Final
Triune Mine
Okanogan County, Washington
Removal Preliminary Assessment/
Site Inspection

March 2014

Prepared for:

U.S. DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
Spokane District Office
1103 N Fancher Rd.
Spokane, WA 99212

Prepared by:

ECOLOGY AND ENVIRONMENT, INC.
720 3rd Avenue
Seattle, Washington 98104-1816

This page intentionally left blank.

Executive Summary

The United States Department of the Interior Bureau of Land Management (BLM) tasked Ecology and Environment, Inc. (E & E) to perform a Removal Preliminary Assessment/Site Inspection (Removal PA/SI) at the Triune Mine site (the Site) to support the BLM's effort to assess and address potential threats to human health and the welfare of the environment per its delegated authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), consistent with the National Contingency Plan (NCP) per 40 Code of Federal Regulations (CFR) 300.410. The Triune Mine consists of an abandoned gold, silver, copper, and molybdenum mine and ore processing facility near Oroville, Okanogan County, Washington. Historical mining activities included underground and surface mining and milling.

The overall goal of the Removal PA/SI is to address any hazardous substance releases at the Triune Mine via the removal process. Specific objectives of the Removal PA/SI are to:

- Confirm whether a release of a hazardous substance has occurred or if the threat of a release exists;
- Identify contaminants of potential concern (COPCs);
- Identify potential targets that may be impacted by the Site and the pathways by which they may be impacted;
- Evaluate if and how the Site poses a threat to human health or the environment; and
- Assess whether additional characterization is required and/or whether a removal action or remediation is warranted at the Site.

Field sampling and other project activities were performed to meet the project objectives. Removal PA/SI results indicate that a release of metal COPCs has occurred, and that the COPCs may pose a threat to human (nearby residents, recreational users, and workers) and ecological targets by direct contact and ingestion. A removal action is recommended to limit direct contact with and migration of source materials. Potential removal actions could include waste consolidation/containment and/or excavation of contaminated material from the bed of the stream that flows across the site.

This page intentionally left blank.

Table of Contents

Section **Page**

Executive Summary i

1 Introduction 1-1
1.1 Purpose and Objectives 1-1

2 Site Description 2-1
2.1 Mine History and Description 2-1
2.2 Location and Topography 2-2
2.3 Climate 2-2
2.4 Geology and Soils 2-2
2.4.1 Geology 2-2
2.4.2 Soils 2-3
2.5 Hydrology and Hydrogeology 2-4
2.6 Vegetation and Wildlife 2-5
2.6.1 Vegetation 2-5
2.6.2 Wildlife 2-5
2.7 Cultural Resources 2-5
2.8 Land Use and Population 2-5
2.9 Previous Investigations 2-6
2.9.1 1995 Okanogan County Health District Initial Investigation 2-6
2.9.2 2009 Okanogan County Public Health Sampling 2-6
2.9.3 2010 Washington Department of Ecology Site Hazard Assessment 2-6

3 Field Activities and Laboratory Analysis 3-1
3.1 Sampling Locations and Methodologies 3-1
3.1.1 Soil Sampling and Mine Waste Delineation 3-2
3.1.2 Sediment Sampling 3-4
3.1.3 Surface Water Sampling 3-4
3.2 Laboratory Analysis 3-5
3.3 Quality Assurance and Quality Control 3-5

4 Removal Site Evaluation Results 4-1
4.1 Background Concentrations 4-1
4.1.1 Surface Soil 4-1
4.1.2 Sediment 4-2
4.1.3 Surface Water 4-2
4.2 Comparison to Risk Based Screening Levels 4-2
4.2.1 Soil 4-2

4.2.2 Sediment 4-4
4.2.3 Surface Water 4-5
4.3 Source Area Delineation 4-5
4.4 Additional Field Screening – Crescent Claim 4-6

5 Summary and Conclusions 5-1

6 Recommendations 6-1

7 References 7-1

Appendices

A SAP Deviation Documentation Forms

B Data Validation Memoranda

C XRF Field Screening Data

List of Tables

Table

2-1 Triune Mine Key Site Features

2-2 Listed and Proposed Endangered and Threatened Species and Critical Habitat, Candidate Species, and Species of Concern for Okanogan County

2-3 Sample Results of 1995 Okanogan County Health District Initial Investigation

2-4 Soil Sample Results of 2009 Okanogan County Public Health Sampling

2-5 Surface Water Sample Results of 2009 Okanogan County Public Health Sampling

3-1 Sample Collection Summary

4-1 Surface Soil Background Sample Results and Values

4-2 Sediment Background Sample Results and Values

4-3 Surface Water Background Sample Results and Values

4-4 Soil Sample Results and Comparison to Background and Screening Levels

4-5 Sediment Sample Results and Comparison to Background and Screening Levels

4-6 Surface Water Sample Results and Comparison to Background and Screening Levels

4-7 Source Feature Volume Estimates

This page intentionally left blank.

List of Figures

Figure

1-1 Location Map

2-1 Plan of Operations

2-2 Site Features

3-1 Sample Location Map Overview

3-2 Sample Locations, Northern Portion

3-3 Sample Locations, Central Portion

3-4 Sample Locations, Southern Portion

4-1 Source Delineation, Northern Portion

4-2 Source Delineation, Central Portion

4-3 Source Delineation, Southern Portion

This page intentionally left blank.

List of Acronyms and Abbreviations

°F	degrees Fahrenheit
BLM	Bureau of Land Management
CCC	criteria continuous concentration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	centimeter
CMC	criteria maximum concentration
COPC	contaminant of primary concern
CSL	Cleanup Screening Level
DOI	(U.S.) Department of the Interior
E & E	Ecology and Environment, Inc.
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
gpm	gallon(s) per minute
GPS	geographic positioning system
MDL	method detection limit
MTCA	Model Toxics Control Act
NCP	National Contingency Plan
NRCS	Natural Resources Conservation Service
OCHD	Okanogan County Health District
OCPH	Okanogan County Public Health
ohms/cm	ohms per centimeter
PEL	Probable Effects Level
PGL	practical quantitation limit
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control

Removal PA/SI	Removal Preliminary Assessment/Site Inspection
SAP	Sampling and Analysis Plan
SCO	Sediment Cleanup Objective
Site, the	Triune Mine site
SMS	Washington State Sediment Management Standards
SU	standard unit
TAL	target analyte list
TEL	Threshold Effects Level
TR	Target Cancer Risk
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WDOE	Washington Department of Ecology
WRCC	Western Regional Climate Center
WSDNR	Washington State Department of Natural Resources
XRF	X-ray fluorescence spectrometer

1 Introduction

The United States Department of the Interior Bureau of Land Management (BLM) tasked Ecology and Environment, Inc. (E & E) under Order Number L12PB00842 and BLM National Environmental Support Blanket Purchase Agreement Number L09PA00500 to perform a Removal Preliminary Assessment/Site Inspection (Removal PA/SI) at the Triune Mine site (the Site) to support the BLM's effort to assess and address potential threats to human health and the welfare of the environment per its delegated authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), consistent with the National Contingency Plan (NCP) per 40 Code of Federal Regulations (CFR) 300.410.

The Triune Mine consists of an abandoned gold, silver, copper, and molybdenum mine and ore processing facility located on public lands managed by the BLM near Oroville, Okanogan County, Washington. Historical mining activities included underground and surface mining. The Triune Mine operated beginning at an unknown time prior to 1900 and continued until 1939. For the purposes of the Removal PA/SI, the Triune Mine comprises the Triune and Security lode claims. Exploration, mining, and ore processing activities also occurred on other adjacent claims. The Triune Mine and other adjacent mine claims are shown on Figure 1-1.

1.1 Purpose and Objectives

The overall goal of the Removal PA/SI is to address any hazardous substance releases at the Triune Mine via the removal process. Specific objectives of the Removal PA/SI are to:

- Confirm whether a release of a hazardous substance has occurred or if the threat of a release exists;
- Identify contaminants of potential concern (COPCs);
- Identify potential targets that may be impacted by the Site and the pathways by which they may be impacted;
- Evaluate if and how the Site poses a threat to human health or the environment; and
- Assess whether additional characterization is required and/or whether a removal action or remediation is warranted at the Site.

This page intentionally left blank.

2 Site Description

2.1 Mine History and Description

The Triune Mine (also referred to as the Tribune Mine) is an abandoned gold, silver, copper, and molybdenum mine that operated for an unknown period of time until 1939. There are currently active claims at the Triune Mine. The mine produced ore from at least four quartz veins ranging from stringers to 10 feet thick within a metasedimentary argillite host rock. Underground workings consist of a 140-foot shaft with an adit at a lower level and more than 2,000 feet of drifts (Huntting 1956).

The description of mine features below is based on information provided in the Okanogan County Health District (OCHD) Initial Investigation Report (OCHD 1996), the BLM Plan of Operations (BLM 1996), and observations made by E & E during the site reconnaissance completed on October 30, 2012, as part of the Removal PA/SI at the Site. The BLM Plan of Operations is presented on Figure 2-1. Key mine features are shown in Figure 2-2, listed in Table 2-1, and described below.

The Site has numerous underground mine openings and surface workings. Underground mine openings include shafts, adits, and/or stopes. Surface workings include a north-trending pit approximately 20 to 30 feet wide, approximately 200 feet long, and up to approximately 10 to 20 feet deep. At the base of the pit are several mine openings that appear to be stopes or adits. A shaft is located near the opening of one of these adits. A north-trending depression that also appears to be a pit, or possibly a collapsed adit, is located to the south. Water was present within this depression during the October 30, 2012, site reconnaissance. No flow was evident at that time. Multiple smaller pits, trenches, and surface cuts are also located at the Site.

The Site includes the dilapidated remains of a mill, located on the Triune Claim immediately south of an unnamed stream that bisects the Site. The mill remains include several pieces of concrete foundation, broken timbers, and a small pit. Tailings are likely present near the mill area and within the unnamed stream.

Remnants of other former buildings are located throughout the Site. A flat bench north of the unnamed stream on the Triune Claim is referred to as the “camp area.” Dirt roads in generally good condition are located throughout the Triune Mine and adjacent claims. A trash dump containing wood and metal debris is located on the Triune Claim south of the large pit.

Waste rock is present in discrete piles near the openings of several of the shafts and adits, as well as in piles within and adjacent to the pit and surface

explorations. Waste rock also is distributed at other areas of the Site, including locations within and on the flanks of the pit. Waste rock also is present in the Triune Mill area and the bench adjacent to TC Adit 3. Rock material in the camp area appears to be locally derived graded soil, but may also include waste rock (see Figure 2-2). Some of these materials are located adjacent to or near the unnamed stream and therefore potentially subject to erosion.

Adits, shafts, trenches, surface cuts, and associated waste rock, as well as structures, occur on claims and other property adjacent to the site. Mill tailings are located near the boundary between the Spokane Claim and the Crescent Claim.

2.2 Location and Topography

The Site is located on lands administered by the BLM 1 mile west of Wannacut Lake and 6 miles southwest of the town of Oroville, Washington. The legal description of the Site is T39N R26E Sec 10, 11. The site location is presented on Figure 1-1.

The Site is located near the eastern edge of the physiographic region referred to as the Northern Cascades, which are located west of the Okanogan Highlands and northeast of the Columbia Basin. This area is characterized by a transition from the jagged, glaciated mountains of the North Cascades to the rounded mountains and deeply dissected valleys of the Okanogan Highlands. Elevations range from 950 feet near Oroville to 7,829 feet at the summit of Mt. Chopaka. The average elevations of mountains in this area range from 3,500 to 4,000 feet (Umpleby 1911; WSDNR 2012a).

The Site is located on the east flank of a generally north-trending ridge between Wannacut Lake and Palmer Lake. Elevation at the Site ranges from approximately 2,000 to 2,400 feet above sea level (USGS 1982).

2.3 Climate

The nearest meteorological station is located in Oroville, Washington, approximately 6 miles northeast of the Site. Average annual total precipitation at the Oroville Station for the period 1909 to 1960 is 11.36 inches and occurs primarily from November through January and in May and June. An average of 22.8 inches of total snowfall occurs in Oroville per year. Average maximum and minimum daily temperatures were 61.2 degrees Fahrenheit (°F) and 38.4°F, respectively (WRCC 2012a, 2012b).

2.4 Geology and Soils

2.4.1 Geology

The Site is located west of the Pasayten Fault Zone along the eastern edge of the Northern Cascades province. The eastern portion of the Northern Cascades is typified by tectonostratigraphic terranes that were later intruded by plutonic activity and metamorphosed, leading to complex suites of rocks (WSDNR 2012b). The Pasayten Fault Zone forms the Okanogan River Valley, located 4 miles east and 1,000 feet below the Site, separating the Site from the Okanogan Batholith to the east.

The Site is underlain by the metasedimentary argillite of the Spectacle Formation (Umpleby 1911). The Site is located just above the contact of the Spectacle Formation and the Whiskey Mountain Granodiorite (Fox and Reinhart 1968), which is a plutonic stock of Triassic age that is contemporaneous with the Colville Batholith (Waters and Krauskoph 1941). Mine workings at the Triune Mine follow quartz veins cutting through the metasedimentary argillite that were emplaced as a result of contact metamorphism associated with the Whiskey Mountain Granodiorite.

2.4.2 Soils

Soils at the Site are divided into three series (NRCS 2012). Soils present at the steeper, forest mosaic hillsides found primarily in the southern portion of the Triune Claim are mapped as a complex of Donovan Series soils and rock outcrops. The Donovan Series is found on slopes of 20 to 40 percent and consists of "moderately deep to a densic contact, well drained soils formed in mixed volcanic ash over glacial till." (NRCS 2009) They are on toeslopes, footslopes, and backslopes of foothills and mountains. Slope ranges from 0 to 65 percent. These soils tend to occur in locations that have a mean annual soil temperature of about 47°F and an average annual precipitation of about 17 inches (NRCS 2009).

Soils underlying the open hillslope north of the unnamed stream in the northern portion of both the Triune and Security claims are mapped as a complex of Lithic Haploxerepts and Vallan Series soils. This complex occurs on slopes of 15 to 45 percent. A Lithic Haploxerept is a soil that exhibits at least one of the following:

1. "Cracks within 125 cm of the mineral soil surface that are 5 mm or more wide through a thickness of 30 cm or more for some time in normal years and slickensides or wedge-shaped peds in a layer 15 cm or more thick that has its upper boundary within 125 cm of the mineral soil surface" (NRCS 2010); or
2. "A linear extensibility of 6.0 cm or more between the mineral soil surface and either a depth of 100 cm or a densic, lithic, or paralithic contact, whichever is shallower" (NRCS 2010).

The Vallan Series soil consists of shallow, well-drained soils formed in colluvium and residuum from rhyodacite and andesite with a minor component of glacial till. The upper part also has an admixture of volcanic ash and loess. These soils are on summits, shoulders, and backslopes of glacially scoured foothills and mountains. Slopes are 5 to 65 percent. These soils tend to occur in locations that have a mean annual soil temperature of about 43°F and an average annual precipitation of about 17 inches (NRCS 2005).

Soils underlying the unnamed stream and the lower reaches of the hillside in the Security Claim are a Koepke ashy silt loam. Koepke ashy silt loam is found on slopes of 15 to 25 percent and consists of deep to a densic contact, well-drained soils that formed in volcanic ash over glacial till. The Koepke soils are on footslopes and backslopes of glaciated hills and mountains. Slope ranges from 0 to 45 percent (NRCS 2007).

2.5 Hydrology and Hydrogeology

Average total annual precipitation as measured at Oroville, Washington, 6 miles northeast of the Site, is 11.36 inches (WRCC 2012a, 2012b). An unnamed stream flows eastward through the Triune and Security claims. The unnamed stream originates at the headwaters of two tributaries approximately 1 mile west of the Site. The stream is mapped as intermittent from its headwaters downstream to approximately the northern boundary of the Mariposa Claim. From that point, the stream is mapped as perennial for a total distance of approximately 0.5 mile, through the Triune and Security Claims, and a distance of approximately 800 feet east of the eastern boundary of the Security Claim. The stream is mapped as intermittent from that point downstream to Spring Lake (USGS 1982). Spring Lake drains via an intermittent stream that flows southeastward approximately 1,500 feet into Wannacut Lake (USGS 1982).

During the June 2013 field event, E & E staff observed the course of the unnamed stream through the site and to its terminus. As the unnamed stream exits the small, steep drainage course through the Triune Claim, it flows onto a widening alluvial fan in the Security Claim. This alluvial fan is initially steep and narrow but widens and turns southward just east of the Security Claim. As the alluvial fan reduces in grade and opens into a broader plain, the stream becomes intermittent and trends to the southeast; within a distance of less than 1,000 feet, all trace of the surface stream is lost. From the beginning of the alluvial fan in the Security Claim to the disappearance of the surface trace, the surface flow of the unnamed stream is evidently infiltrating into the subsurface. Flow of water likely continues via groundwater toward Spring Lake and beyond.

Spring Lake is mapped as a freshwater forested/shrub wetland, 1.51 acres in area. Other nearby mapped wetlands, generally located between the Site and Wannacut Lake, include four freshwater forested/shrub wetlands ranging from 0.18 to 9.75 acres and seven freshwater emergent wetlands ranging from 0.13 to 26.79 acres (USFWS 2012a).

The adit located in the Triune Claim near the border with the Security Claim (TC Adit 1) discharges surface water. On September 7, 1995, OCHD personnel noted drainage estimated at 0.5 to 1.0 gallon per minute (gpm) from the adit (referred to as Adit #1 in the Initial Investigation report [OCHD 1996]). At that time, the adit drainage was observed to “flow across the main access road into a small pond situated in a small creek drainage” (OCHD 1996). On that date, the drainage had a measured water conductivity of 1,100 ohms per centimeter (ohms/cm) and a pH estimated with litmus paper at 6.5 standard units (SUs). The location of these measurements along the drainage path is unknown. Water was collected from this drainage and analyzed for total metals, with no surface water results noted as being above applicable screening levels at the time of the study. During the October 30, 2012, site reconnaissance, the adit discharge was visually estimated to be less than 1 gpm.

During the 1995 site visit, a groundwater seep was observed in the northern portion of the Triune Claim draining southward from a surface cut to the unnamed stream (OCHD 1996). OCHD personnel reported that the seep appeared to be exiting “a collapsed surface works entry” (OCHD 1996). On September 7, 1995,

this drainage was estimated to have a discharge of 1.0 gpm and had a measured conductivity of approximately 840 ohms/cm and a pH estimated at 6.5 to 7.0 SUs via litmus paper (OCHD 1996). This feature appears to correspond to the water observed in the base of the depression south of the Triune Claim pit during the October 30, 2012, site reconnaissance. During that site reconnaissance, no flow was visually discernible.

No groundwater wells are located on this site. Twelve domestic and irrigation wells are located within the Township 39 North, Range 26 East, Section 11 (WDOE 2012). Section 11 makes up the northwest quadrant of the Wannacut Lake drainage basin. A portion of the Triune Claim lies within Section 10, in which there are no wells (WDOE 2012).

2.6 Vegetation and Wildlife

2.6.1 Vegetation

Vegetation at the Site is characterized by open forests of ponderosa and western white pine (WSDNR 2012c), grass meadows, and a riparian corridor along the unnamed stream. A site-specific vegetation survey has not been performed. Table 2-2 presents plant species that are listed and candidate endangered and threatened and species of concern in Okanogan County, Washington, provided by the United States Fish and Wildlife Service (USFWS) (2012b).

2.6.2 Wildlife

A site-specific wildlife survey has not been performed at the Site. Table 2-2 presents listed and candidate endangered and threatened species, species of concern, and designated critical habitat for animal species in Okanogan County, Washington, provided by the USFWS (2012b).

2.7 Cultural Resources

The BLM completed a cultural resources survey of the Site in the spring of 2013.

2.8 Land Use and Population

The Site is not presently occupied. Evidence of recent mining exploration activities and livestock grazing were observed during the October 30, 2012, site reconnaissance and June 2013 field event. The site is located in close proximity to Wannacut Lake, and is thus likely used for recreation by visitors. Several residences exist east of the Site within approximately 1,000 feet of the Security Claim boundary. E & E field staff and a BLM observer visited the residence directly east of the Security Claim (adjacent to the unnamed stream) to request property access and confirmed that the residence was occupied. The occupancy and use of the other residences within 1,000 feet of the site are not known. The area of the Site is rural in nature and, as such, the Site and nearby Wannacut Lake area are not located in a Census-designated place. These areas are located in the Oroville County Census Division block 3. The nearest Census-designated place is the town of Oroville, located 6 miles to the northeast, with a total population of 1,686 people (U.S. Census Bureau 2010). There are 12 water well records for nearby domestic and irrigation wells, located within Section 11, Township 39 North, Range 26 East, and no wells located within Section 10 (WDOE 2012).

2.9 Previous Investigations

This section summarizes the results of previous investigation activities at the Site.

2.9.1 1995 Okanogan County Health District Initial Investigation

The OCHD conducted an Initial Investigation of the Triune Mine under the state of Washington's Toxics Cleanup Program administered by the Washington Department of Ecology (WDOE). Personnel from the OCHD documented physical site conditions and sampled surface water discharging from a mine adit and soil from a tailings/waste pile. Results were reported in the *Washington Department of Ecology Toxics Cleanup Program Initial Investigation Report – Data Collection* (OCHD 1996). Sample results from this investigation are summarized in Table 2-3. This investigation found the surface water concentrations at the site to be below the Model Toxics Control Act (MTCA) Method A cleanup level. Lead and mercury concentrations in the soil both exceeded the respective cleanup levels (OCHD 1996).

2.9.2 2009 Okanogan County Public Health Sampling

Okanogan County Public Health (OCPH) conducted surface soil and surface water sampling at the Site on November 18, 2009. OCPH personnel located all of the features described in the 1995 investigation report, with the most notable change being the absence of any standing water in the adit or surface workings. They collected surface soil samples from five waste rock piles located around the Site and surface water samples from two locations that appear to be located within the unnamed stream. Soil sample results from this sampling event are summarized in Table 2-4, and surface water results are summarized in Table 2-5. Soil from the waste rock piles exceeded the MTCA Method A cleanup levels for arsenic at three locations, cadmium in five locations, lead in four locations, and mercury in one location. Surface water exceeded the MTCA Method A cleanup levels for cadmium and lead at one location (OCPH 2009).

2.9.3 2010 Washington Department of Ecology Site Hazard Assessment

The WDOE completed a site hazard assessment of the Triune and Security mine claims based upon the results from the 2009 OCPH report (OCPH 2009). The WDOE assigned a score of 1 to the Site, a score that, under the guidelines of the MTCA, represents the greatest potential threat to human health and the environment (WDOE 2010).

3 Field Activities and Laboratory Analysis

E & E developed a Sampling and Analysis Plan (SAP) for the Triune Mine prior to conducting field sampling (E & E 2013). The SAP includes the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP). The FSP describes the methods to be used to gather data for the Removal PA/SI, the procedures used to collect samples in the field, and the procedures used to validate the data derived from those samples. The FSP also specifies collection of other information, including visual observations and field screening, estimation of waste material volumes, and global positioning system (GPS) surveying. The QAPP specifies a framework for data collection procedures and measurements to be designed in a way that is scientifically sound and that produces products of known, acceptable and documented quality, and additionally provides assurance that sampling activities are conducted in accordance with the requirements of this project.

E & E conducted the Removal PA/SI field activities from June 18 through 21, 2013. With few exceptions, the Removal PA/SI field activities were conducted in accordance with the approved SAP. Deviations from the SAP were made in consultation with the BLM Project Inspector during the field sampling event and are documented in SAP Deviation Documentation Forms (see Appendix A).

Field activities performed to meet the Removal PA/SI objectives include:

- Collection of soil samples from waste rock, tailings, and potentially contaminated soil to assess site sources;
- Collection of surface water and sediment samples to assess whether contaminants associated with site source materials have migrated into the unnamed stream; and
- Estimation of the approximate lateral extent and volumes of waste rock, tailings, and contaminated soil using visual observations and X-ray fluorescence spectrometer (XRF) field screening results.

3.1 Sampling Locations and Methodologies

Samples were collected as described below. Planned locations for soil, sediment, and surface water sampling presented in the SAP were chosen based upon information from previous investigations and a site reconnaissance visit conducted on October 30, 2012. Samples collected for laboratory analysis are

listed in Table 3-1. Actual sample locations are illustrated in Figures 3-1 through 3-4.

3.1.1 Soil Sampling and Mine Waste Delineation

Soil sampling and analysis and field screening were performed to meet the following Removal PA/SI objectives:

- Identify COPCs;
- Determine concentrations of COPCs in waste rock, tailings, and soil;
- Estimate the areal extent of waste rock, tailings, and contaminated soil;
- Evaluate potential risk to human health and the environment posed by waste rock, tailings, and contaminated soil; and
- Evaluate background soil conditions near the Site.

Surface soils were characterized using a combination of visual observations, XRF field screening, and fixed laboratory analyses to evaluate the presence and areal extent of tailings, waste rock, and contaminated soil at the Site, as well as concentrations of total metals in the soil materials. Existing information on mine waste disposal and natural processes was verified and supplemented in the field using a combination of visual observations and field screening for total metals using an XRF. Visual inspection and XRF field screening also was performed at locations where soil samples were collected for laboratory analysis. The following subsections further summarize soil characterization activities.

3.1.1.1 Soil Sampling

Soil samples were collected for laboratory analysis for total metals. Soil samples were collected from mine waste materials (e.g., waste rock and mill tailings), potentially impacted soil, and background soil. Each site surface soil sample collected comprised a five-point composite sample. Composite sampling was performed rather than grab sampling to provide more representative concentrations of COPCs in the sampled features. The location of each composite point was determined in the field. In general, each composite sample consisted of subsamples located near the center of the subject feature and four additional subsamples arrayed in the four cardinal directions from the central sample. Each background soil sample comprised a grab sample. Background soil sample locations were selected in the field at locations expected to have generally similar geological characteristics as site soils.

All background samples and composite subsamples were collected from 0 to 0.5 feet below ground surface. Large rocks, cobbles, and organic detritus were removed from the subsampling sites prior to sample collection. The lateral coordinates of the subsample locations were recorded using GPS instrumentation. Samples collected for laboratory analysis are listed in Table 3-1. Sample locations are illustrated in Figures 3-1 through 3-4.

XRF field screening and visual observation were performed at each composite soil sample point. This was generally done prior to mine waste delineation so that

information on physical characteristics (e.g., lithological characteristics) and total metals concentrations of the source materials could potentially be used to refine the delineation. XRF screening of each composite soil subsample was performed before compositing with the other subsamples to provide an estimate of the heterogeneity of metals concentrations within the area of the composite soil sample. XRF screening also was performed on composited soil samples to provide a field estimate of total metals concentrations in the material submitted for laboratory total metals analysis.

For each subsample, sample material was placed into a clean disposable re-sealable plastic bag. The bag was sealed, and the material was homogenized by working the material manually within the sealed bag. This material was subsequently field screened with a rented Innov-X XRF analyzer by testing the soil material directly through the bag to provide an estimate of total metals concentrations in the subsample. XRF field screening was performed in accordance with the XRF standard operating procedure. The XRF readings of key metals (arsenic, cadmium, lead, and mercury) were recorded in the field logbook. XRF concentrations of these and other metals analyzed also were recorded digitally by the XRF units.

Subsample material was then transferred from the plastic bag into a composite sample bag. The composite sample material was homogenized by working the material manually within the sealed bag. This composite sample was subsequently field screened with an XRF by testing the soil material directly through the bag to provide an estimate of total metals concentrations of the composite sample.

Following field screening, composite surface soil samples were placed into the appropriate pre-cleaned sample containers provided by the analytical laboratory. Samples were analyzed for total target analyte list (TAL) metals plus mercury and molybdenum.

3.1.1.2 Source Material Delineation

Suspected and/or previously documented piles and other deposits of waste rock and tailings were inspected visually by the field team to determine the lateral extent of the piles and deposits. Visual observations included topography, grain size, lithological and mineralogical characteristics, and differences in vegetative cover. The waste rock and tailings were expected to be located in piles and benches near adits, shafts, and surface mine works, and areas near the mill, respectively. The mill area is contiguous with the TC Adit 3 area. Both waste rock and tailings were expected to be present in this general area. Visual observations of the lateral extent of mine waste were further tested by XRF field screening. Waste rock associated with the bench at TC Adit 3 was generally identifiable and discernible based on visual observations of topography; however, areas of tailings and contaminated soil were not readily identified and/or delineated.At each XRF screening location, vegetation and organic detritus were removed to expose underlying soil, tailings, and/or waste rock. Observations of the soil at each XRF screening location were recorded in the field logbook. The XRF readings of key metals (arsenic, cadmium, lead, and mercury) were recorded in the field logbook. XRF concentrations of these and other metals analyzed also were recorded digitally by the XRF units.

The lateral coordinates of the field screening location were recorded using GPS instrumentation.

3.1.1.3 Additional Field Delineation – Crescent Claim

Mill tailings are present on the Spokane Claim. Some of these tailings are located near the boundary between the Spokane Claim and the Crescent Claim. E & E performed field screening to assess the potential presence of tailings on the Crescent Claim. The tailings were visually discernible from the adjacent native soils. E & E visually estimated the location of the easternmost occurrence of possible tailings on the Crescent Claim and performed XRF field screening of the suspected tailings to estimate total metals concentrations. The lateral coordinates of field screening locations were surveyed with GPS instrumentation.

3.1.2 Sediment Sampling

Sediment sampling was performed to meet the following Removal PA/SI objectives:

- Assess whether COPCs have migrated into the unnamed stream sediment and off site;
- Evaluate potential risk to human health and the environment posed by sediment; and
- Evaluate background sediment conditions near the Site.

Sediment samples are listed in Table 3-1. Sample locations were determined in the field based on field conditions in consultation with the BLM. Sample locations are illustrated in Figures 3-1 through 3-4.

For locations where both a surface water sample and a sediment sample were collected, the sediment sample was collected following the surface water sample. Sediment samples were collected from the most downstream locations first, with sampling progressing upstream to avoid disturbing sediments that could affect downstream locations.

Sediment samples were collected from the top 10 centimeters (cm) (4 inches) of the bed sediments. Organic debris was removed from the sampling location prior to sample collection. Sediments were placed into a dedicated plastic bowl using a dedicated plastic scoop. The collected sediment was thoroughly homogenized, and placed into pre-cleaned sample containers provided by the analytical laboratory.

Sediment samples were analyzed at the laboratory for total United States Environmental Protection Agency (EPA) TAL metals, plus mercury and molybdenum.

3.1.3 Surface Water Sampling

Surface water sampling was performed to meet the following Removal PA/SI objectives:

- Assess whether COPCs have migrated into surface water in the unnamed stream and off site;

- Evaluate potential risk to human health and the environment posed by contaminated surface water; and
- Evaluate background surface water conditions near the Site.

Surface water samples are listed in Table 3-1. Sample locations were determined in the field based on field conditions in consultation with the BLM. Sample locations are illustrated in Figures 3-1 through 3-4.

At each surface water and sediment sampling location, the surface water sample was collected prior to the sediment sample. Sampling proceeded upstream to avoid disturbing sediments that could impact turbidity and contaminant concentrations in downstream locations.

Samples were collected using a battery-operated peristaltic pump outfitted with dedicated silicone tubing. The water sample was collected from a single location within the middle of the stream channel at the mid-depth water level. Dissolved metals aliquots were collected following collection of the total metals aliquots using a dedicated in-line 0.45-micrometer filter. Following sample collection at each location, field parameters for pH, temperature, specific conductance, oxidation-reduction potential, dissolved oxygen, and turbidity were measured using a water quality meter and recorded in the field logbook. Precipitation was above normal on June 20, 2013, the day surface water sampling was performed. On that date, rainfall of 0.54 inches was recorded at the nearest weather station (Omak Airport, 34 miles south), setting a day-of-year record for that station (Weather Underground 2013).

Surface water samples were analyzed at the laboratory for total and dissolved TAL metals plus mercury and molybdenum.

3.2 Laboratory Analysis

At the conclusion of sampling activities, samples were submitted to E & E's subcontracted analytical laboratory, TestAmerica Seattle, for analysis of total TAL metals, plus mercury and molybdenum, in soils, sediments, and surface waters; and for dissolved TAL metals, plus mercury and molybdenum, in surface waters.

3.3 Quality Assurance and Quality Control

Project QA (quality assurance)/QC (quality control) procedures were followed as specified in the QAPP (E & E 2013). QA/QC procedures included validation of laboratory analytical results. The laboratory data were validated by an E & E chemist in accordance with the National Functional Guidelines for Inorganic Data Review (EPA 2010), in conjunction with the QA/QC requirements specified in each specific analytical method and any project-specific QC defined in the QAPP. Based on the data validation, the data are considered usable for the data use objectives specified in the SAP (E & E 2013). Data validation memoranda are provided in Appendix B. Daily standardization data for the field XRF unit are provided in Appendix C.

This page intentionally left blank.

4 Removal Site Evaluation Results

This section presents sample and field screening results and comparison of sample results to estimated background concentrations and risk-based screening levels.

The analytical summary tables present all detected metals, but the report text addresses only detected metals that exceed the selected screening criteria. Aluminum, calcium, iron, magnesium, potassium, and sodium are common earth crust elements. Laboratory results for these metals are provided in Tables 4-1 through 4-6, but not evaluated in this report.

4.1 Background Concentrations

The Triune Mine site is located in an area that is mineralized and therefore is expected to exhibit metals concentrations that are elevated relative to non-mineralized areas. Natural background (i.e., pre-mining) soil, sediment, and surface water conditions at the Triune Mine are thus expected to reflect naturally elevated concentrations of associated metals. Background samples were collected to provide an estimate of local background metals concentrations in surface soil, sediment, and surface water. Results of background samples are presented in Tables 4-1 through 4-3. Tables 4-1 through 4-3 also provide recommended background value used for comparison to site samples and details regarding how each recommended background value was derived.

Ten background soil samples were collected for laboratory analysis. Recommended soil background values consist of the lower of the 90th percentile value or four times the 50th percentile value of the background sample results for each analyte. To calculate these values, if the result for a given analyte for a given sample was nondetect, a value of one half the method detection limit (MDL) was used in the calculation. If an analyte was detected at a value below the practical quantitation limit (PQL), the MDL value was used in the calculation.

One sediment sample and one surface water background sample were collected for laboratory analysis. For these media, for a given analyte, the recommended background value is the sample result for results greater than the PQL, and the MDL for analytes detected below the PQL.

The following sections compare Site sample concentrations to the recommended background values.

4.1.1 Surface Soil

Concentrations of metals in source samples (tailings, waste rock, and potentially contaminated soil) were compared to the recommended soil background values to assess whether the metals concentrations in the source samples are more likely

attributable to the source materials or to naturally occurring mineralization. The following elements were detected in one or more source samples at concentrations greater than or equal to three times the recommended background value: antimony, arsenic, cadmium, copper, lead, mercury, molybdenum, selenium, silver, thallium, vanadium, and zinc. Comparison of soil sample results to recommended background values are summarized in Table 4-4. Appendix C presents XRF field screening results (not used in this evaluation).

4.1.2 Sediment

Concentrations of metals in sediment samples were compared to the recommended sediment background values to assess whether the metals concentrations in sediment samples collected within and downstream of the Site are more likely attributable to a release(s) from Site sources or to either naturally occurring mineralization or other non-Site sources located upgradient of the Site. The following elements met one of the following conditions: 1) the element was detected in one or more sediment samples at concentrations greater than or equal to three times the recommended background value; or, 2) if the element was not detected in the background sediment sample, it was detected in the one or more downstream sediment samples: antimony, beryllium, cadmium, lead, mercury, molybdenum, silver, and zinc. Results of comparison of sediment sample results to recommended background values are summarized in Table 4-5.

4.1.3 Surface Water

Concentrations of metals in surface water samples were compared to the recommended surface water background values to assess whether the metals concentrations in surface water samples collected within and downstream of the Site are more likely attributable to a release(s) from Site sources or to either naturally occurring mineralization or other non-Site sources located upgradient of the Site. The following elements met one of the following conditions: 1) the element was detected in one or more surface water samples at concentrations greater than or equal to three times the recommended background value; or, 2) if the element was not detected in the background surface water sample, it was detected in the one or more downstream surface water samples: : antimony (total), cadmium (total and dissolved), copper (total and dissolved), lead (total), manganese (total and dissolved), molybdenum (total and dissolved), and zinc (total and dissolved). Results of comparison of surface water sample results to recommended background values are summarized in Table 4-6.

4.2 Comparison to Risk Based Screening Levels

Sample results for soil, sediment, and surface water were compared to risk-based screening levels to identify COPCs and provide information on potential risk to human health or the environment.

4.2.1 Soil

Soil sample metals concentrations were compared to the following risk-based screening levels:

- EPA Removal Management Levels (RMLs) for Soil:

- Resident, Target Cancer Risk (TR) = 10^{-4}, Target hazard quotient (THQ) = 1;
- Resident, TR = 10^{-4} and THQ = 3;
- Industrial, TR = 10^{-4} and THQ = 1;
- Industrial, TR = 10^{-4} and THQ = 3;

- EPA Regional Screening Levels (RSLs) for Soil:
  - Resident, TR = 10^{-6}, THQ = 1;
  - Composite Worker, TR = 10^{-6}, THQ = 1;
  - Outdoor Worker, TR = 10^{-6}, THQ = 1;
  - Soil to Ground Water, TR = 10^{-6}, THQ = 1
- Washington State MTCA Method A Soil Cleanup Levels:
  - Unrestricted Land Use
  - Industrial Land Use.

EPA RMLs are chemical-specific risk-based screening levels for individual contaminants in soil that the BLM may use to support a decision to undertake a removal or other action based on potential risk to human health. They are not necessarily health protective concentrations for chronic exposure. Exceedance of an RML by itself does not imply that adverse health effects will occur. RMLs may be used to help identify areas, contaminants, and conditions where a removal action may be appropriate. Sites where contaminant concentrations fall below RMLs are not necessarily "clean" and may warrant further action or study under CERCLA and the NCP. Sites with contaminant concentrations above the RMLs may not necessarily warrant a removal action, depending upon factors such as background concentrations and site-specific exposure scenarios or other considerations. This is the primary screening criteria under which the samples were evaluated.

EPA RSLs are, like RMLs, chemical-specific risk-based screening levels for individual contaminants in soil that the BLM may use to support a decision to undertake a removal or other action based on potential risk to human health. RSLs are more conservative risk-based levels for individual analytes than RMLs. RSLs may be used as guidelines to determine whether levels of contamination found at a site may warrant further investigation or site cleanup. The RSLs are considered to be protective for humans (including sensitive populations) over a lifetime for a given scenario. RSLs may be used to help identify areas, contaminants, and conditions that require further federal attention at a particular site. RSLs for soil to groundwater are typically the most conservative soil screening levels considered for most analytes.

MTCA Method A soil cleanup levels are based upon default criteria that can be applied to sites with a limited number of hazardous substances present, to routine

cleanups, and where Method A values exist for all contaminants of concern. For the purpose of identifying COPCs at the Triune Mine, any analyte in any soil sample exceeding any of the selected soil screening levels is considered a COPC. On this basis, the following metals are considered COPCs at the Site: antimony; arsenic; barium; cadmium; cobalt; copper; lead; manganese; mercury; molybdenum; selenium; silver; thallium; vanadium; and zinc. Concentrations of all of these COPCs except barium, cobalt, or manganese significantly exceed the recommended background concentrations. Results of comparison of soil sample results to screening levels are summarized in Table 4-4.

Of the COPCs, arsenic, lead, molybdenum, thallium, and vanadium were detected in at least one sample at a concentration above one or more RML. The samples with metal concentrations greater than RMLs are from waste rock associated with the pit (samples 13-TC-Pit1-SS1 and 13-TC-Pit1-SS2), TC Shaft 4 (sample 13-TC-Shaft4-SS1), and TC Adit 4 (sample 13-TC-Adit4-SS-1), and the mill area (sample 13-TC-Mill-SS2).

4.2.2 Sediment

Sediment sample metals concentrations were compared to the Threshold Effects Levels (TELs) and Probable Effects Levels (PELs) compiled in the National Oceanic and Atmospheric Administration Screening Quick Reference Tables (Buchman 2008) and the Washington State Sediment Management Standards (Chapter 173-204 WAC), Sediment Cleanup Objectives (SCOs) and Cleanup Screening Levels (CSLs) The SCOs establish a no adverse effects level, including no acute or chronic adverse effects, to the benthic community. Chemical concentrations at or below the SCOs correspond to sediment quality that results in no adverse effects to the benthic community. The CSLs establish a minor adverse effects level, including acute or chronic effects, to the benthic community. Chemical concentrations at or below the CSL but greater than the SCO correspond to sediment quality that results in minor adverse effects to the benthic community. The freshwater chemical and biological cleanup screening levels establish minor adverse effects as the level above which station clusters of potential concern are defined and may be defined as potential cleanup sites for benthic community toxicity, and at or below which station clusters of low concern are defined, per the procedures identified in WAC 173-204-510 and 173-204-520.

Cadmium, lead, mercury, and silver were detected in one or more sediment samples above one or more of the selected screening levels. In each of these samples, the analyte concentration significantly exceeded the recommended background value.

Cadmium was detected above the more conservative TEL value in all of the downstream sediment samples but was not detected above the PEL or SMS SCO or CSL in any of these samples. Lead was detected above the TEL in samples 13-Stream3-SD1, 13-Stream2-SD1, and 13-Stream1-SD1, and above the PEL in 13-Stream1-SD1. Lead was not detected above the SMS SCO or CSL in any of the samples. Mercury was detected above the TEL in samples 13-Stream3-SD1, 13-Stream2-SD1, and 13-Stream1-SD1, and above the PEL and SMS SCO in 13-Stream1-SD1. Mercury was not detected above the SMS CSL in any samples. Silver was detected above the SMS SCO but below the CSL in sample 13-

Stream1-SD1. Results of comparison of sediment sample results to screening levels are summarized in Table 4-5.

4.2.3 Surface Water

Surface water sample metals concentrations were compared to the following risk-based surface water screening levels for aquatic life:

- National Toxics Rule; Surface Water; Fresh Water; Aquatic Life; 40 CFR 131; criteria maximum concentration (CMC) (acute) and criteria continuous concentration (CCC) (chronic);
- Water Quality Standards for Surface Waters of the State of Washington; Chapter 173-201A Washington Administrative Code; Table 240(3); Acute and Chronic; and
- National Recommended Water Quality Criteria; Fresh Water; Aquatic Life Criteria; CMC (acute) and CCC (chronic).

The CMC is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect. The CCC is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.

In addition, even though there is no known use of water from the unnamed stream for drinking water supply, the surface water results also were compared to the following drinking water standards:

- National Primary Drinking Water Regulations Maximum Contaminant Levels;
- EPA RML, Tapwater, TR = 10^{-4} and THQ = 3; and
- EPA RML, Tapwater, TR=10^{-4} and THQ = 1.

None of the concentrations for any analytes in any of the surface water samples exceeded any of the selected surface water screening levels. However, the concentration of molybdenum in adit drainage sample13-TC-Adit3-SW1 exceeded the EPA RMLs for tapwater.

4.3 Source Area Delineation

The approximate lateral extent of the mine waste features as identified by visual observation and delineated by XRF field screening are illustrated in Figures 4-1 through 4-3. The locations of the mine waste feature boundaries, and thus the delineation field screening locations, were informed by visual observations of the topography, soil type, lithology type, and vegetation. XRF field screening data were used to delineate mine waste features by observing a decrease in the concentration of COPC metals along transects of delineation screening locations collected across the suspected mine waste feature boundary. The soil materials in the mill and TC Adit 3 area were not readily identified throughout the entire area as tailings, waste rock, or contaminated soil because of vegetative cover, lack of

clear topographic indications, and lack of a definitive decrease in concentrations of COPC metals along some of the transects. The lack of a definitive extent in this area may be due to mixing of waste materials with largely unimpacted soils. The estimated overall extent of source materials in this area is depicted in Figure 4-2. This area is generalized and likely includes soils with relatively low COPC concentrations along with source materials with elevated COPC concentrations. XRF field screening results are provided in Appendix C.

Total volumes of waste rock were estimated based on field measurements of feature dimensions and slope angles, and a field estimation of feature shapes. The estimated total volume of materials in the mill and TC Adit 3 area likely includes soils with relatively low COPC concentrations along with source materials with elevated COPC concentrations. Results of the volume estimates are presented in Table 4-7.

4.4 Additional Field Screening – Crescent Claim

The approximate eastern lateral extent of the mill tailings associated with the Spokane Claim as delineated by field screening are illustrated in Figure 4-3. XRF field screening results are provided in Appendix C. No samples of tailings were collected for laboratory analysis. Based on XRF results, several COPCs (including arsenic and lead) may be present in the tailings at concentrations exceeding one or more soil screening level.

5 Summary and Conclusions

The following metals were identified as COPCs in source materials (waste rock, tailings, and contaminated soil) at the site: antimony; arsenic; barium; cadmium; cobalt; copper; lead; manganese; mercury; molybdenum; selenium; silver; thallium; vanadium; and zinc. Concentrations of the COPCs except barium, cobalt, or manganese significantly exceed the recommended soil background concentrations. Source materials with COPC concentrations exceeding risk-based screening levels may present a threat to human health and ecological receptors via direct contact and ingestion. Concentrations of arsenic, lead, molybdenum, thallium, and vanadium exceeded EPA soil RMLs and/or MTCA Method A soil cleanup levels in one or more samples of waste rock from the area of the pit, TC Shaft 4, and TC Adit 4. Concentrations of lead exceeded EPA soil RMLs and MTCA Method A soil cleanup levels in one sample from the mill area.

The source materials near the mill and bench area near TC Adit 3 are subject to erosion by the unnamed stream. Based on the locally steep topography along the stream in the mill and bench area, erosion will likely continue to occur under present conditions. Source materials that are exposed at the surface here and elsewhere at the site are subject to migration via runoff. Sediment samples collected in the unnamed stream indicate that erosion and downstream transport of site-related contamination likely has occurred in the past. Concentrations of the following COPCs were detected at significantly higher concentrations in downstream sediment samples than in the recommended background sample, suggesting that their presence in the stream sediment is attributable to site sources: antimony, cadmium, lead, mercury, molybdenum, silver, and zinc. Of these COPCs, cadmium, lead, mercury, and silver were detected in one or more sediment samples at concentrations exceeding one or more sediment screening level.

The unnamed stream appears to be a losing stream, fully infiltrating into the subsurface, a short distance downstream of the site for at least part of the year. Under such conditions, stream sediment transport would be limited to the most downstream extent of stream flow at any given time. The highest COPC concentrations in the sediment samples were generally detected in the most downstream sediment sample collected (13-Stream1-SD1). This could be due to historical sediment transport via the unnamed stream or alternatively, to another source(s), including other mine waste sources in the area. The downstream extent of sediment with COPC concentrations exceeding screening levels is not known.

Concentrations of the following COPCs were detected at significantly higher concentrations in unnamed stream surface water samples than in the recommended background sample, suggesting that their presence in the surface

water is attributable to site source waste materials (waste rock, tailings, and/or contaminated soil) and/or drainage from TC Adit 3 or the pit: cadmium (total); lead (total); and molybdenum (total and dissolved). However, none of the detected concentrations in any of the surface water samples, including the sample of discharge from TC Adit 3 (13-TC-Adit3-SW1) exceed the surface water screening levels. The sample of discharge from TC Adit 3 (13-TC-Adit3-SW1) exceeded EPA RMLs for tapwater.

6 Recommendations

In order to limit direct contact with and migration of source materials at the site, a removal action is recommended. It is recommended that such a removal action address the waste rock located in various places throughout the Triune Claim as well as the contaminated materials in the mill area. Potential removal actions could include waste consolidation/containment and/or excavation of contaminated material from the stream bed or other measures to limit stream erosion of mine wastes in the mill area and possibly the bench near TC Adit 3.

It is recommended that the following additional information be gathered to inform the development of a potential removal action or remedial action.

- Extent and quantities of materials (tailings, waste rock, potentially contaminated soil) exceeding screening levels in the mill and TC Adit 3 area;
- The downstream extent of sediment contamination in the unnamed stream; and
- The possible influence of other mines (e.g., mine and mill tailings on Spokane Claim) on COPC concentrations in the sediment in the unnamed stream.

In addition, sampling drinking water wells near the site may be warranted. Groundwater was not sampled as part of the removal PA/SI. Based on mapped hydrography (USGS 1982) and observations made during the October 2012 site reconnaissance and June 2013 sampling event, the unnamed stream is a losing stream over much of its length downstream of the site for at least some of the time. As such, COPCs detected in surface water may be expected to occur in groundwater flowing downgradient of the site. Groundwater also could be impacted by flow through source materials or mine workings and migrate off site.

In addition to the potential chemical threats to human health and ecological receptors, several physical hazards associated with mine openings at the site were identified. Although fences have been erected around some of the openings, all openings observed at the site had relatively easy access, and a few had evidence of recent human use or exploration. Installation of restrictive barriers in the mine openings is recommended to limit physical access to these features.

This page intentionally left blank.

7 References

Buchman, M.F., 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration, 34 pages.

Bureau of Land Management (BLM). 1996. Wenatchee Resource Area, Plan of Operations, Project Area WMP-130-95-001 W.

Ecology and Environment, Inc. (E & E). 2013. Final Work Plan, Sampling and Analysis Plan, Triune Mine, February 2013.

Fox, Kenneth F. and C. Dean Reinhart. 1968. Geologic Map of the Loomis Quadrangle, Okanogan County, Washington.

Huntting, Marshall T. 1956. Inventory of Washington Minerals, Part II, Metallic Minerals. Washington Division of Mines and Geology Bulletin No. 37.

Natural Resources Conservation Service (NRCS). 2005. Vallan Series Soil Description. https://soilseries.sc.egov.usda.gov/OSD_Docs/V/VALLAN.html. Accessed November 29, 2012.

_____. 2007. Koepke Series Soil Description. https://soilseries.sc.egov.usda.gov/OSD_Docs/K/KOEPKE.html. Accessed November 21, 2012.

_____. 2009. Donovan Series Soil Description. https://soilseries.sc.egov.usda.gov/OSD_Docs/D/DONAVAN.html. Accessed November 21, 2012.

_____. 2010. Keys to Soil Taxonomy, Eleventh Edition. United States Department of Agriculture.

_____. 2012. Web Soil Survey. http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. United States Department of Agriculture. Accessed November 21, 2012.

Okanogan County Health District (OCHD). 1996. Washington Department of Ecology Toxics Cleanup Program, Initial Investigation Report – Data Collection, Triune (Tribune) Mine, December 16, 1996.

Okanogan County Public Health (OCPH). 2009. Results of November 18, 2009 sampling at Triune Mine by Okanogan County Public Health. Provided by BLM, September 5, 2012.

U.S. Census Bureau. 2010. 2010 Census – Census Block Map (Index): Oroville CCD, WA, and 2010 Census – Census Block Map: Oroville CCD, WA. http://www2.census.gov/geo/maps/dc10map/GUBlock/st53_wa/cousub/cs5304792480_oroville/DC10BLK_CS5304792480_000.pdf and http://www2.census.gov/geo/maps/dc10map/GUBlock/st53_wa/cousub/cs5304792480_oroville/DC10BLK_CS5304792480_003.pdf. Accessed November 21, 2012.

Umpleby, Joseph. 1911. Bulletin No. 5 Part II Geology and Ore Deposits of the Oroville-Nighthawk Mining District. Washington Geological Survey. July 1, 1911.

United States Environmental Protection Agency (U.S. EPA). 2000. Data Quality Objectives Process for Hazardous Waste Site Investigations, EPA QA/G-4HW, January.

United States Fish and Wildlife Service (USFWS). 2012a. National Wetland Inventory data. http://www.fws.gov/wetlands/Wetlands-Mapper.html. Accessed December 17, 2012.

_____. 2012b. Listed and Proposed Endangered and Threatened Species and Critical Habitat; Candidate Species; and Species of Concern in Okanogan County, as prepared by the U.S. Fish and Wildlife Service, Central Washington Field Office, revised March 15, 2012.

United States Geological Survey (USGS). 1982. Bullfrog Mtn. Quadrangle, Washington, Okanogan County, 7.5 Minute Series topographic map.

Washington Department of Ecology (WDOE). 2010. Results of Draft Site Hazard Assessment of Triune Mine Site, Facility Site ID No. 1856824. Provided by BLM, September 5, 2012.

_____. 2012. Water Well Database. http://apps.ecy.wa.gov/welllog/MapSearch/viewer.htm?&FASTSTART=YES&SESSIONID=760104251 Accessed December 16, 2012.

Washington State Department of Natural Resources (WSDNR). 2012a. Geology of Washington – Okanogan Highlands. http://www.dnr.wa.gov/researchscience/topics/geologyofwashington/pages/okanogan.aspx. WSDNR. Accessed November 27, 2012.

_____. 2012b. Geology of Washington – Northern Cascades. http://www.dnr.wa.gov/ResearchScience/Topics/GeologyofWashington/Pages/ncascade.aspx. WSDNR. Accessed November 27, 2012.

_____. 2012c. http://www.dnr.wa.gov/ResearchScience/Topics/ForestResearch/Pages/lm_tree_seed_zones.aspx Accessed December 16, 2012.

Waters, A. C. and Konrad Krauskoph. 1941. Geological Society of America Bulletin, Volume 52, Number 9, pp. 1370-1371.

Weather Underground. 2013. Weather record for Omak, WA Airport (KOMK). http://www.wunderground.com/history/airport/KOMK/2013/6/20/DailyHistory.html?req_city=NA&req_state=NA&req_statename=NA&MR=1. Accessed December 16, 2013.

Western Regional Climate Center. 2012a. OROVILLE 1 S, WASHINGTON (456187), Period of Record Monthly Climate Summary. Period of Record: 5/1/1960 to 2/28/1970. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wa6187. Accessed November 14, 2012.

_____. 2012b. OROVILLE 3 NW, WASHINGTON (456188), Period of Record Monthly Climate Summary. Period of Record: 2/3/1909 to 5/3/1960. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wa6188. Accessed November 28, 2012.

This page intentionally left blank.

Tables

This page intentionally left blank.

Table 2-1 Triune Mine Key Site Features

Area	Feature	Description
Triune Claim	TC Adit 1	Small adit (<10 ft.) with small waste rock pile.
	TC Adit 2	Small adit (<10 ft.) with small waste rock pile.
	TC Adit 4	Adit with waste rock pile approximately 40 ft. x 40 ft. x 20 ft. high.
	TC Shaft 1	Shaft.
	TC Shaft 2	Shaft with small waste rock pile.
	TC Shaft 3	Shaft with small waste rock pile.
	TC Shaft 4	Shaft with waste rock pile approximately 30 ft. x 30 ft. x 20 ft. high.
	TC Shaft 5	Shaft with small waste rock pile.
	TC Shaft 6	Shaft with waste rock pile approximately 50 ft. x 50 ft. x 30 ft. high.
	Pit with Multiple Stopes/Adits/Shafts	North-trending surface workings area approximately 20 to 30 ft. wide, approximately 200 ft. long, and up to approximately 10 to 20 ft. deep. At the base of the pit are stopes, shafts, and/or adits. Waste rock is distributed within and on the flanks of the pit.
	Pit or Collapsed Adit	A north-trending depression that appears to be a pit or collapsed adit. The depression intersects the unnamed stream. On October 30, 2012, water was ponded within the depression. No flow was visually observed.
	Pits, trenches, and cuts	Multiple exploratory pits, trenches, and cuts with associated waste rock are located within the claim.
	Triune Mill	The former stamp mill. The former mill building is destroyed; remains include several timbers and pieces of concrete foundation located on a bench adjacent to the unnamed stream. The bench is cut out of a steep slope. South of the former mill building is a 20-foot deep shaft with small associated waste rock pile. A 6-foot deep pit is associated with the mill building. The remains of a 10-foot diameter wood stave tank lies in the bed of the unnamed stream in this area.
	Former structures	Multiple buildings in various stages of disrepair are located within the claim.
	Camp Area	A flat bench that appears to be constructed of waste rock.
	Trash Dump	A trash dump containing wood and metal debris is located in the area between the pit and pit/collapsed adit.
Security Claim	SC Adit 1	Adit
	SC Shaft 1	Shaft
	Bench adjacent to TC Adit 3	Large bench that appears to be constructed of waste rock, possible with some tailings. Drainage from TC Adit 3 flows northeastward across bench. Spring emerges near toe of eastern edge of bench.
	Adit Drainage	Surface water drainage from TC Adit 3. On October 30, 2012, flow near adit portal visually estimated at <0.1 cfs. Flow percolated into subsurface on bench before apparently emerging at spring.
	Spring	Spring that emerges near toe of eastern edge of bench. Flow is apparently associated with TC Adit 3 drainage, which was observed to percolate into bench on October 30, 2012.
	Pits, trenches, and cuts	Several exploratory pits and cuts with associated waste rock are located within the claim.
	Former structures	Multiple buildings in various stages of disrepair are located within the claim.
Spokane Claim	Adits	Three adits and associated waste rock are located near the north end of the Spokane Claim.
	Shaft	A shaft is located near the north end of the Spokane Claim.
	Mill	A former mill is located near the north end of the Spokane Claim. Associated tailings are distributed near the eastern border of the claim.
Mariposa Claim	Adits	Four adits, including three adits near the north end of the claim and one adit near the center of the claim, and associated waste rock, are located in the claim.
	Cut	A cut is located in the northern part of the claim.
Outside Claim Boundaries	Exploration workings north of Mariposa Claim	A small cut, a 10 ft. shaft, and an 8 ft. adit with small waste rock dump are located north of the unnamed stream.
General Area	Unnamed Stream	Stream that flows generally eastward through portions of the Mariposa, Triune, and Security Claims. Flow is mapped as locally intermittent or perennial. On October 30, 2012, flow was visually estimated at 0.5 cfs near the Triune Claim Pit or Collapsed Adit. Further downstream, between the Mill area and the Bench associated with TC Adit 3, the flow was entirely subsurface. Flow re-emerged at the surface adjacent to the Bench.

Key:
cfs = Cubic feet per second.
ft. = Feet.

Table 2-2 Listed and Proposed Endangered and Threatened Species and Critical Habitat, Candidate Species, and Species of Concern for Okanogan County

Listed Animal Species
Bull trout (Salvelinus confluentus)
Canada lynx (Lynx canadensis)
Gray wolf (Canis lupus) [west of U.S. 97 and State Highway 17]
Grizzly bear (Ursus arctos horribilis)
Northern spotted owl (Strix occidentalis caurina)
Listed Plant Species
Spiranthes diluvialis (Ute ladies'-tresses)
Designated Critical Habitat
Critical habitat for the bull trout
Critical habitat for the Canada lynx
Critical habitat for the northern spotted owl
Candidate Animal Species
Fisher (Martes pennanti) - West Coast DPS (west of the Okanogan River)
Greater sage grouse (Centrocercus urophasianus)
North American wolverine (Gulo gulo luteus) – contiguous U.S. DPS
Yellow-billed cuckoo (Coccyzus americanus)
Candidate Plant Species
Pinus albicaulis (whitebark pine)
Animal Species of Concern
Bald eagle (Haliaeetus leucocephalus)
Black swift (Cypseloides niger)
Burrowing owl (Athene cunicularia)
California floater (Anodonta californiensis)
Columbian sharp-tailed grouse (Tympanuchus phasianellus columbianus)
Fisher (Martes pennanti), east of the Okanogan River
Giant Columbia spire snail (Fluminicola columbiana)
Loggerhead shrike (Lanius ludovicianus)
Long-eared myotis (Myotis evotis)
Northern goshawk (Accipiter gentilis)
Olive-sided flycatcher (Contopus cooperi)
Pacific lamprey (Lampetra tridentata)
Pallid Townsend's big-eared bat (Corynorhinus townsendii pallescens)
Peregrine falcon (Falco peregrinus)
Pygmy whitefish (Prosopium coulteri)
Redband trout (Oncorhynchus mykiss)
River lamprey (Lampetra ayresi)
Sagebrush lizard (Sceloporus graciosus)
Western brook lamprey (Lampetra richardsoni)
Western gray squirrel (Sciurus griseus griseus)
Westslope cutthroat trout (Oncorhynchus clarki lewisi)
Plant Species of Concern
Botrychium ascendens (triangular-lobed moonwort)
Botrychium crenulatum (crenulate moonwort)
Botrychium paradoxum (two-spiked moonwort)
Botrychium pedunculosum (stalked moonwort)

Source: USFWS 2012.

Table 2-3 Sample Results of 1995 Okanogan County Health District Initial Investigation

Analyte	Surface Water Concentrations (ug/L)	Method Detection Limit (ug/L)	Cleanup Level (ug/L)	Soil Concentrations (mg/kg)	Method Detection Limit (mg/kg)	Cleanup Level (mg/kg)
Arsenic	4.9	3.0	5.0	6.08	--	20
Cadmium	2.4	1.7	5.0	1.79	0.1	2.0
Chromium	< MDL	4.7	50.0	< MDL	0.1	2000
Lead	1.4	2.0	15.0	**807**	0.5	250
Mercury	< MDL	0.3	2.0	**8.11**	--	2.0
Selenium	8.2	6.0	--	< MDL	--	--
Silver	< MDL	4.7	--	< MDL	1.0	--
Copper	< MDL	20.0	--	44.7	--	--
Zinc	< MDL	20.0	--	86.9	--	--
Nickel	25.4	10.0	--	< MDL	--	--
Antimony	< MDL	5.0	--	< MDL	--	--
Beryllium	< MDL	0.2	--	< MDL	--	--

Key:
MDL = Method detection limit
mg/kg = Milligrams per kilogram
ug/L = Micrograms per liter

Data Source: Okanogan County Health District (OCHD). 1996. Washington Department of Ecology Toxics Cleanup Program, Initial Investigation Report – Data Collection, Triune (Tribune) Mine, December 16, 1996.

Table 2-4 Soil Sample Results of 2009 Okanogan County Public Health Sampling

Analyte	TR001 Waste Rock Concentrations (mg/kg)	TR002 Waste Rock Concentrations (mg/kg)	TR003 Waste Rock Concentrations (mg/kg)	TR004 Waste Rock Concentrations (mg/kg)	TR005 Waste Rock Concentrations (mg/kg)	Method Detection Limit (mg/kg)	Cleanup Level (mg/kg)
Arsenic	11.80	**205.50**	**45.40**	5.70	**96.00**		20
Barium	258	95.5	122	116	81		--
Cadmium	**2.44**	**26.8**	**21.8**	**7.45**	**19.2**		2.0
Chromium	5.65	11.7	6.75	4.78	14.2		2000
Lead	159	**5550**	**580**	**393**	**3990**		250
Mercury	0.68	0.07	0.08	0.71	**4.93**		2.0
Selenium	<MDL	<MDL	<MDL	<MDL	<MDL	2.5	--
Silver	1.40	7.00	2.76	2.90	9.80		--

Key:
MDL = Method detection limit
mg/kg = Milligrams per kilogram

Data Source: Okanogan County Public Health (OCPH). 2009. Results of November 18, 2009 sampling at Triune Mine by Okanogan County Public Health. Provided by BLM, September 5, 2012.

Table 2-5 Surface Water Sample Results of 2009 Okanogan County Public Health Sampling

Analyte	TR004 Surface Water Concentrations (ug/L)	TR006 Surface Water Concentrations (ug/L)	Method Detection Limit (ug/L)	Cleanup Level (ug/L)
Arsenic	5.0	< MDL	2.0	5.0
Barium	68	17		--
Cadmium	**17.4**	< MDL	0.3	5.0
Chromium	5.4	< MDL	4.7	50.0
Lead	**27.4**	2		15.0
Mercury	< MDL	< MDL	0.3	2.0
Selenium	< MDL	< MDL	5.0	--
Silver	< MDL	< MDL	4.7	--

Key:
MDL = Method detection limit
ug/L = Micrograms per liter

Data Source: Okanogan County Public Health (OCPH). 2009. Results of November 18, 2009 sampling at Triune Mine by Okanogan County Public Health. Provided by BLM, September 5, 2012.

Table 3-1 Sample Collection Summary

Medium	Sample Identification	Date collected	Time Collected	Description
Soil	13-TC-pit1-SS1	6/18/2013	10:40	Waste rock associated with Pit with Multiple Stopes/Adits/Shafts
	13-TC-pit2-SS1	6/18/2013	12:50	Waste rock associated with Pit
	13-TC-mill-SS1	6/18/2013	18:10	Soil in area of Triune Mill (possible contaminated soil and tailings)
	13-TC-mill-SS2	6/18/2013	19:40	Soil in area of Triune Mill (possible contaminated soil and tailings)
	13-TC-camp-SS1	6/18/2013	16:00	Soil in area of Camp
	13-TC-shaft4-SS1	6/19/2013	14:10	Waste rock associated with TC Shaft 4
	13-TC-adit4-SS1	6/19/2013	15:55	Waste rock associated with TC Adit 4
	13-TC-shaft5-SS1	6/19/2013	18:00	Waste rock associated with TC Shaft 5
	13-SC-bench-SS1	6/19/2013	11:30	Soil on Bench adjacent to TC Adit 3 (possible contaminated soil, waste rock, and tailings)
	13-SC-bench-SS2	6/19/2013	11:35	Soil on Bench adjacent to TC Adit 3 (possible contaminated soil, waste rock, and tailings)
	13-Bkd-SS1	6/20/2013	14:20	Background soil
	13-Bkd-SS2	6/20/2013	14:45	Background soil
	13-Bkd-SS3	6/20/2013	15:10	Background soil
	13-Bkd-SS4	6/20/2013	15:20	Background soil
	13-Bkd-SS5	6/20/2013	15:30	Background soil
	13-Bkd-SS6	6/20/2013	15:45	Background soil
	13-Bkd-SS7	6/20/2013	16:00	Background soil
	13-Bkd-SS8	6/20/2013	16:10	Background soil
	13-Bkd-SS9	6/20/2013	16:35	Background soil
	13-Bkd-SS10	6/20/2013	17:00	Background soil
	13-SC-outwash-SS1	6/21/2013	10:00	Opportunity sample collected in area near unnamed stream downstream of Mill
	13-Bkd-SS11	6/20/2013	17:20	Field duplicate of 13-Bkd-SS4
	13-SC-bench-SS3	6/19/2013	11:40	Field duplicate of 13-SC-bench-SS2
Sediment	13-stream1-SD1	6/20/2013	9:37	Sediment from Unnamed Stream, near Spring Lake
	13-stream2-SD1	6/20/2013	10:00	Sediment from Unnamed Stream, downstream of Security Claim boundary
	13-stream3-SD1	6/20/2013	11:25	Sediment from Unnamed Stream, downstream of Bench adjacent to TC Adit 3
	13-stream4-SD1	6/20/2013	12:40	Sediment from Unnamed Stream near Camp area and upstream of Mill area
	13-streamBkd-SD1	6/20/2013	13:15	Sediment from Unnamed Stream, background location
	13-stream7-SD1	6/20/2013	12:45	Field duplicate of 13-stream4-SD1
Surface Water	13-stream1-SW1	6/20/2013	9:25	Surface water from Unnamed Stream, near Spring Lake
	13-stream3-SW1	6/20/2013	11:15	Surface water from Unnamed Stream downstream of Bench adjacent to TC Adit 3
	13-TC-adit3-SW1	6/20/2013	11:45	Surface water, drainage from TC Adit 3
	13-stream4-SW1	6/20/2013	12:30	Surface water from Unnamed Stream near Camp area and upstream of Mill area
	13-streamBkd-SW1	6/20/2013	13:13	Surface water from Unnamed Stream, background location
	13-stream7-SW1	6/20/2013	12:35	Field duplicate of 13-stream4-SW1

Table 4-1 Surface Soil Background Sample Results and Values

Analyte	Analytical Method	Units	Recommended Background Comparison Value	Background Value Basis	13 BKD SS1		13 BKD SS2		13 BKD SS3		13 BKD SS4		13 BKD SS5		13 BKD SS6		13 BKD SS7		13 BKD SS8		13 BKD SS9		13 BKD SS10		13 BKD SS11 (duplicate of 13 Bkd SS4)	
Aluminum	SW846 6010B	mg/kg	15500	90th Percentile Value	9600		11000		14000		14000		9900		20000		15000		14000		9000		15000		12000	
Antimony	SW846 6020	mg/kg	0.597	90th Percentile Value	0.4		0.47		0.43		0.4		0.37		0.44		0.42		1.2		0.47		0.53		0.34	
Arsenic	SW846 6020	mg/kg	16.3	90th Percentile Value	12		19		7.6		10		10		12		11		15		16		10		9.6	
Barium	SW846 6020	mg/kg	210	90th Percentile Value	130		120		210		180		120		180		180		150		130		210		160	
Beryllium	SW846 6020	mg/kg	0.658	90th Percentile Value	0.38		0.43		0.58		0.54		0.4		0.65		0.73		0.59		0.33		0.56		0.45	
Cadmium	SW846 6020	mg/kg	0.459	90th Percentile Value	0.26		0.25		0.72		0.34		0.2		0.33		0.43		0.39		0.3		0.35		0.3	
Calcium	SW846 6010B	mg/kg	5540	90th Percentile Value	4000		4200		3600		3200		4600		3000		2700		3100		1400		4500		2700	
Chromium	SW846 6020	mg/kg	42.4	90th Percentile Value	19		23		18		28		100		21		24		24		23		36		24	
Cobalt	SW846 6020	mg/kg	21.3	90th Percentile Value	9.5		11		12		12		21		24		18		20		9.1		12		11	
Copper	SW846 6020	mg/kg	54.8	90th Percentile Value	28	J	44	J	27	J	27	J	30	J	53	J	43	J	71	J	33	J	36	J	25	J
Iron	SW846 6010B	mg/kg	28200	90th Percentile Value	19000		24000		23000		22000		21000		28000		27000		30000		16000		26000		20000	
Lead	SW846 6020	mg/kg	14.6	90th Percentile Value	13		9.5		20		10		6		10		14		13		7.1		8.4		9	
Magnesium	SW846 6010B	mg/kg	5630	90th Percentile Value	3900	J	5100	J	3900	J	4800	J	5900	J	4200	J	4200	J	3800	J	4300	J	5600	J	4000	J
Manganese	SW846 6020	mg/kg	722	90th Percentile Value	410		470		610		540		430		830		710		640		400		620		490	
Mercury	SW846 7471A	mg/kg	0.0184	90th Percentile Value	0.018		0.0086	J	0.014	J	0.012	J	0.013	J	0.022		0.017	J	0.014	J	0.017		0.011	J	0.0092	J
Molybdenum	SW846 6010B	mg/kg	2.5	90th Percentile Value	1.6		2.5		1.3		1.9		2.3		3.9		2.9		7.1		3.4		1.3		1.7	
Nickel	SW846 6020	mg/kg	47	90th Percentile Value	16		20		19		25		65		43		31		45		24		26		21	
Potassium	SW846 6010B	mg/kg	2510	90th Percentile Value	1800		2300		1800		2300		2400		1100		1700		1500		2200		3500		2100	
Selenium	SW846 6020	mg/kg	0.84	4 X 50th Percentile Value	0.54	J	0.72	J	0.7	J	0.56	J	0.56	J	0.91		0.88		1		0.62	J	0.67		0.55	J
Silver	SW846 6020	mg/kg	0.05	4 X 50th Percentile Value	0.17		0.16	J	0.12	J	0.085	J	0.13	J	0.12	J	0.071	J	0.24		0.14	J	0.14	J	0.084	J
Sodium	SW846 6010B	mg/kg	17	90th Percentile Value	52	J	52	J	48	J	57	J	52	J	65	J	53	J	50	J	68	J	79	J	43	J
Thallium	SW846 6020	mg/kg	0.131	90th Percentile Value	0.11	U	0.14	U	0.14	U	0.14	U	0.11	U	0.15	J	0.15	J	0.13	U	0.13	U	0.12	U	0.14	U
Vanadium	SW846 6020	mg/kg	43.2	90th Percentile Value	35		40		32		39		35		38		45		32		29		43		36	
Zinc	SW846 6020	mg/kg	80.1	90th Percentile Value	47	J	61	J	80	J	60	J	44	J	75	J	81	J	79	J	49	J	72	J	54	J
Percent Solids	ASTM D 2216	%	--	--	86		86		82		85		79		74		82		85		80		83		85	
Percent Moisture	ASTM D 2216	%	--	--	14		14		18		15		21		26		18		15		20		17		15	

Key

%	Percent
J	Result is an estimated value.
mg/kg	Millgrams per kilogram
U	Analyte was analyzed for but not detected. Value provided is method detection limit.

This page intentionally left blank.

Table 4-2 Sediment Background Sample Results and Values

Analyte	Lab Method	Units	Recommended Background Comparison Value	Background Value Basis	13 StreamBKD SD1	
Aluminum	SW846 6010B	mg/kg	4400	Single detected result	4400	
Antimony	SW846 6020	mg/kg	0.087	Detected below PQL; background value = MDL	0.3	J
Arsenic	SW846 6020	mg/kg	5.5	Single detected result	5.5	
Barium	SW846 6020	mg/kg	110	Single detected result	110	
Beryllium	SW846 6020	mg/kg	0.046	Detected below PQL; Background value = MDL	0.14	J
Cadmium	SW846 6020	mg/kg	0.017	Detected below PQL; Background value = MDL	0.29	J
Calcium	SW846 6010B	mg/kg	220000	Single detected result	220000	
Chromium	SW846 6020	mg/kg	9.3	Single detected result	9.3	
Cobalt	SW846 6020	mg/kg	3.6	Single detected result	3.6	
Copper	SW846 6020	mg/kg	28	Single detected result	28	
Iron	SW846 6010B	mg/kg	6900	Single detected result	6900	J
Lead	SW846 6020	mg/kg	3.8	Single detected result	3.8	J
Magnesium	SW846 6010B	mg/kg	2800	Single detected result	2800	J
Manganese	SW846 6020	mg/kg	180	Single detected result	180	J
Mercury	SW846 7471A	mg/kg	Nondetect	Nondetect	0.01	U
Molybdenum	SW846 6020	mg/kg	0.16	Detected below PQL; Background value = MDL	0.71	J
Nickel	SW846 6020	mg/kg	9.8	Single detected result	9.8	
Potassium	SW846 6010B	mg/kg	770	Single detected result	770	J
Selenium	SW846 6020	mg/kg	1.7	Single detected result	1.7	
Silver	SW846 6020	mg/kg	0.025	Detected below PQL; Background value = MDL	0.099	J
Sodium	SW846 6010B	mg/kg	33	Detected below PQL; Background value = MDL	160	J
Thallium	SW846 6020	mg/kg	Nondetect	Nondetect	0.27	U
Vanadium	SW846 6020	mg/kg	12	Single detected result	12	
Zinc	SW846 6020	mg/kg	32	Single detected result	32	
Percent Solids	ASTM D 2216	%	--	--	45	
Percent Moisture	ASTM D 2216	%	--	--	55	

Key

%	Percent
J	Result is an estimated value.
MDL	Method detection limit
mg/kg	Millgrams per kilogram
PQL	Practical quantitation limit
U	Analyte was analyzed for but not detected. Value provided is method detection limit.

Table 4-3 Surface Water Background Sample Results and Values

Analyte	Lab Method	Units	Recommended Background Comparison Value	Background Value Basis	13 StreamBKD SW1	
Total Metals						
Aluminum, Total	SW846 6010B	µg/L	Nondetect	Nondetect	310	U
Antimony, Total	SW846 6020	µg/L	Nondetect	Nondetect	0.4	U
Arsenic, Total	SW846 6020	µg/L	Nondetect	Nondetect	3.8	U
Barium, Total	SW846 6020	µg/L	36	Single detected result	36	
Beryllium, Total	SW846 6020	µg/L	Nondetect	Nondetect	0.51	U
Cadmium, Total	SW846 6020	µg/L	Nondetect	Nondetect	0.14	U
Calcium, Total	SW846 6010B	µg/L	98000	Single detected result	98000	
Chromium, Total	SW846 6020	µg/L	Nondetect	Nondetect	1.4	U
Cobalt, Total	SW846 6020	µg/L	Nondetect	Nondetect	0.16	U
Copper, Total	SW846 6020	µg/L	0.55	Detected below PQL; Background value = MDL	0.88	J
Iron, Total	SW846 6010B	µg/L	Nondetect	Nondetect	83	U
Lead, Total	SW846 6020	µg/L	Nondetect	Nondetect	0.17	U
Magnesium, Total	SW846 6010B	µg/L	19000	Single detected result	19000	
Manganese, Total	SW846 6020	µg/L	0.95	Detected below PQL; Background value = MDL	1.7	J
Mercury, Total	SW846 7470A	µg/L	Nondetect	Nondetect	0.041	U
Molybdenum, Total	SW846 6020	µg/L	10	Single detected result	10	
Nickel, Total	SW846 6020	µg/L	Nondetect	Nondetect	2	U
Potassium, Total	SW846 6010B	µg/L	410	Detected below PQL; Background value = MDL	2000	J
Selenium, Total	SW846 6020	µg/L	Nondetect	Nondetect	3.6	U
Silver, Total	SW846 6020	µg/L	Nondetect	Nondetect	0.15	U
Sodium, Total	SW846 6010B	µg/L	12000	Single detected result	12000	
Thallium, Total	SW846 6020	µg/L	Nondetect	Nondetect	1.4	U
Vanadium, Total	SW846 6020	µg/L	Nondetect	Nondetect	4.9	U
Zinc, Total	SW846 6020	µg/L	Nondetect	Nondetect	4.4	U
Dissolved Metals						
Aluminum, Dissolved	SW846 6010B	µg/L	Nondetect	Nondetect	310	U
Antimony, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	0.4	U
Arsenic, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	3.8	U
Barium, Dissolved	SW846 6020	µg/L	35	Single detected result	35	
Beryllium, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	0.51	U
Cadmium, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	0.14	U
Calcium, Dissolved	SW846 6010B	µg/L	97000	Single detected result	97000	
Chromium, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	1.4	U
Cobalt, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	0.16	U
Copper, Dissolved	SW846 6020	µg/L	0.55	Detected below PQL; Background value = MDL	0.75	J
Iron, Dissolved	SW846 6010B	µg/L	Nondetect	Nondetect	83	U
Lead, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	0.17	U
Magnesium, Dissolved	SW846 6010B	µg/L	18000	Single detected result	18000	
Manganese, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	0.95	U
Mercury, Dissolved	SW846 7470A	µg/L	Nondetect	Nondetect	0.041	U
Molybdenum, Dissolved	SW846 6020	µg/L	9.8	Single detected result	9.8	
Nickel, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	2	U
Potassium, Dissolved	SW846 6010B	µg/L	410	Detected below PQL; Background value = MDL	1900	J
Selenium, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	3.6	U
Silver, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	0.15	U
Sodium, Dissolved	SW846 6010B	µg/L	12000	Single detected result	12000	
Thallium, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	1.4	U
Vanadium, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	4.9	U
Zinc, Dissolved	SW846 6020	µg/L	Nondetect	Nondetect	4.4	U

Key

µg/L	Micrograms per liter
J	Result is an estimated value.
MDL	Method detection limit
PQL	Practical quantitation limit
U	Analyte was analyzed for but not detected. Value provided is method detection limit.

Table 4-4 Soil Sample Results and Comparison to Background and Screening Levels

Analyte	Analytical Method	Units	Recommended Background Comparison Value	EPA RSL for Soil: Resident; TR=10-6, THQ=1	EPA RSL for Soil: Composite Worker; TR=10-6, THQ=1	EPA RSL for Soil: Outdoor Worker; TR=10-6, THQ=1	EPA RSL for Soil to Ground Water; TR=10-6, THQ=1	EPA RML for Soil; Resident; TR=10-4 and THQ=1	EPA RML for Soil; Resident; TR=10-4 and THQ=3	EPA RML for Soil; Industrial; TR=10-4 and THQ=3	EPA RML for Soil; Industrial; TR=10-4 and THQ=1	MTCA Method A Soil; Unrestricted Land Use	MTCA Method A Soil; Industrial Land Use	13-TC-Pit1-SS1		13-TC-Pit2-SS1		13-TC-Camp-SS1		13-TC-Mill-SS1		13-TC-Mill-SS2	
Aluminum	SW846 6010B	mg/kg	15500	77400	988000	1100000	23300	77000	230000	3000000	990000			4000		6400		7300		8300		6300	
Antimony	SW846 6020	mg/kg	0.597	31.3	409	454	0.271	31	94	1200	410			1.6		**2.9**		0.44		**1.8**		**1.8**	
Arsenic	SW846 6020	mg/kg	16.3	0.614	2.39	2.65	0.0013	34	61	240	240	20	20	**70**		**58**		13		9.7		14	
Barium	SW846 6020	mg/kg	210	15300	191000	213000	118	15000	46000	570000	190000			130		79		140		110		110	
Beryllium	SW846 6020	mg/kg	0.658	156	2010	2230	12.7	160	470	6000	2000			0.36		0.28		0.25		0.48		0.32	
Cadmium	SW846 6020	mg/kg	0.459	70	798	886	0.52	70	210	2400	800	2	2	**14**		**19**		**1.9**		**1.5**		**14**	
Calcium	SW846 6010B	mg/kg	5540											4500		2700		**35000**		5400		14000	
Chromium	SW846 6020	mg/kg	42.4	117000	1530000	1700000	28000000	120000	350000	4600000	1500000	2000	2000	8.1		11		17		17		12	
Cobalt	SW846 6020	mg/kg	21.3	23.4	304	338	0.212	23	70	910	300			4.4	J	8.6		8.8		6.7		7	
Copper	SW846 6020	mg/kg	54.8	3130	40900	45400	21.9	3100	9400	120000	41000			120		**530**	J	47	J	34	J	93	J
Iron	SW846 6010B	mg/kg	28200	54800	715000	795000	274	55000	160000	2100000	720000			22000		25000		17000		18000		14000	
Lead	SW846 6020	mg/kg	14.6	400	800	800		400	400	800	800	250	1000	**1500**		**760**		**140**		**170**		**1300**	
Magnesium	SW846 6010B	mg/kg	5630											1200	J	1900	J	3800		2900	J	2100	J
Manganese	SW846 6020	mg/kg	722	1830	22700	25200	21	1800	5500	68000	23000			440		200	J	550		470		650	
Mercury	SW846 7471A	mg/kg	0.0184	10.2	42.6	47.4	0.0327	10	30	130	43	2	2	**0.37**		**0.46**		**0.17**		**1.5**		**9.6**	
Molybdenum	SW846 6010B/6020	mg/kg	2.5	391	5110	5680	1.57	390	1200	15000	5100			**110**		**200**		3.6		**26**		**35**	
Nickel	SW846 6020	mg/kg	47	1550	19700	21900	19.7	1500	4600	59000	20000			7		6.2		16		14		11	
Potassium	SW846 6010B	mg/kg	2510											1100		940		1800		1200		1200	
Selenium	SW846 6020	mg/kg	0.84	391	5110	5680	0.404	390	1200	15000	5100			2		**13**		0.86		1.2		1.5	
Silver	SW846 6020	mg/kg	0.05	391	5110	5680	0.605	390	1200	15000	5100			**3.2**		**0.18**	J	**0.49**		**0.86**		**3.7**	
Sodium	SW846 6010B	mg/kg	17											**97**		**93**	J	**72**	J	**76**	J	**53**	J
Thallium	SW846 6020	mg/kg	0.131	0.782	10.2		0.0111	0.78	2.3	31	10			0.13	U	**16**		0.11	U	0.15	J	0.13	U
Vanadium	SW846 6020	mg/kg	43.2	393	5110		62.9	390	1200	15000	5100			9.2		**750**	J	27		25		17	
Zinc	SW846 6020	mg/kg	80.1	23500	307000	341000	291	23000	70000	920000	310000			**520**	J	**6100**		130	J	110	J	**370**	J
Percent Solids	ASTM D 2216	%	--	--	--	--	--	--	--	--	--	--	--	94		95		88		86		90	
Percent Moisture	ASTM D 2216	%	--	--	--	--	--	--	--	--	--	--	--	5.8		5.2		12		14		9.7	

Key	
%	Percent
EPA	United States Environmental Protection Agency
J	Result is an estimated value.
mg/kg	Millgrams per kilogram
MTCA	Model Toxics Control Act
RSL	Regional Screening Level
THQ	Target hazard quotient (unitless)
TR	Target cancer risk (unitless)
U	Analyte was analyzed for but not detected. Value provided is method detection limit.
UJ	Analyte was analyzed for but not detected. The reported value is an estimated value of the sample detection limit.
Bolded	Value is greater than or equal to three times the recommended background comparison value.
Gray shaded	Value is greater than at least one risk-based screening value.
Orange shaded =	Sample result is greater than screening level value for EPA RML for Soil; Resident; TR=10-4 and THQ=1.

Table 4-4 Soil Sample Results and Comparison to Background and Screening Levels

Analyte	Analytical Method	Units	Recommended Background Comparison Value	EPA RSL for Soil: Resident; TR=10-6, THQ=1	EPA RSL for Soil: Composite Worker; TR=10-6, THQ=1	EPA RSL for Soil: Outdoor Worker; TR=10-6, THQ=1	EPA RSL for Soil to Ground Water; TR=10-6, THQ=1	EPA RML for Soil; Resident; TR=10-4 and THQ=1	EPA RML for Soil; Resident; TR=10-4 and THQ=3	EPA RML for Soil; Industrial; TR=10-4 and THQ=3	EPA RML for Soil; Industrial; TR=10-4 and THQ=1	MTCA Method A Soil; Unrestricted Land Use	MTCA Method A Soil; Industrial Land Use	13-SC-Bench-SS1		13-SC-Bench-SS2		13-SC-Bench-SS3 (duplicate of 13-SC-Bench-SS2)		13-SC-outwash-SS1		13-TC-Shaft4-SS1		13-TC-Adit4-SS-1		13-TC-Shaft5-SS1	
Aluminum	SW846 6010B	mg/kg	15500	77400	988000	1100000	23300	77000	230000	3000000	990000			13000		21000		18000		2100	J	990		4000		1500	
Antimony	SW846 6020	mg/kg	0.597	31.3	409	454	0.271	31	94	1200	410			**3.4**		0.84		1.1		**3.3**		**2.9**		1.2		1.1	
Arsenic	SW846 6020	mg/kg	16.3	0.614	2.39	2.65	0.0013	34	61	240	240	20	20	10		3.2		3.7		12		47		48		5.5	
Barium	SW846 6020	mg/kg	210	15300	191000	213000	118	15000	46000	570000	190000			53		78		86		90		43		66		92	
Beryllium	SW846 6020	mg/kg	0.658	156	2010	2230	12.7	160	470	6000	2000			0.28		0.26		0.23		0.11	U	0.53		0.4		0.19	
Cadmium	SW846 6020	mg/kg	0.459	70	798	886	0.52	70	210	2400	800	2	2	**1.7**		**1.7**		**2**		**1.6**		**16**		**12**		**3**	
Calcium	SW846 6010B	mg/kg	5540											3000		1100		830		2900	J	3000		2400		**21000**	
Chromium	SW846 6020	mg/kg	42.4	117000	1530000	1700000	28000000	120000	350000	4600000	1500000	2000	2000	6.4		0.6		0.62		4.3	J	0.76		2		0.94	
Cobalt	SW846 6020	mg/kg	21.3	23.4	304	338	0.212	23	70	910	300			3.6		3.1		2.2		2.2		4.3		5.4		4.3	
Copper	SW846 6020	mg/kg	54.8	3130	40900	45400	21.9	3100	9400	120000	41000			31	J	17	J	19	J	32		120	J	**170**	J	60	J
Iron	SW846 6010B	mg/kg	28200	54800	715000	795000	274	55000	160000	2100000	720000			16000		9900	J	6800		4300	J	24000		18000		24000	
Lead	SW846 6020	mg/kg	14.6	400	800	800		400	400	800	800	250	1000	**190**		**140**		**110**		**150**	B	**2800**		**1800**		**180**	
Magnesium	SW846 6010B	mg/kg	5630											1100	J	350	J	300	J	1900	J	150	J	470	J	670	J
Manganese	SW846 6020	mg/kg	722	1830	22700	25200	21	1800	5500	68000	23000			200		540		480		150		550		730		840	
Mercury	SW846 7471A	mg/kg	0.0184	10.2	42.6	47.4	0.0327	10	30	130	43	2	2	**2.1**		**1**		**1.1**		**2.6**	J	**0.24**		**0.3**		**0.28**	
Molybdenum	SW846 6010B/6020	mg/kg	2.5	391	5110	5680	1.57	390	1200	15000	5100			**37**		**60**		**44**		3.7		**1200**		**240**		**200**	
Nickel	SW846 6020	mg/kg	47	1550	19700	21900	19.7	1500	4600	59000	20000			5.5		0.97		0.87		6.7		1.2		3		1.2	
Potassium	SW846 6010B	mg/kg	2510											1600		750	J	500	J	730	J	510		620		370	
Selenium	SW846 6020	mg/kg	0.84	391	5110	5680	0.404	390	1200	15000	5100			**3.3**		1.2		0.89		0.74	J	2.5		2.5		1.3	
Silver	SW846 6020	mg/kg	0.05	391	5110	5680	0.605	390	1200	15000	5100			**3.1**		**1.6**	J	**2.7**	J	**4.4**		**16**		**5.2**		**0.74**	
Sodium	SW846 6010B	mg/kg	17											**110**		33	J	14	UJ	**160**	J	18	J	**65**	J	12	J
Thallium	SW846 6020	mg/kg	0.131	0.782	10.2		0.0111	0.78	2.3	31	10			0.24	J	0.11	U	0.12	U	0.16	U	0.13	J	0.11	J	0.1	U
Vanadium	SW846 6020	mg/kg	43.2	393	5110		62.9	390	1200	15000	5100			8.7		1.3		1.1		6.1		1.2		4.7		2.2	
Zinc	SW846 6020	mg/kg	80.1	23500	307000	341000	291	23000	70000	920000	310000			110	J	63	J	72	J	81	J	**810**	J	**770**	J	120	J
Percent Solids	ASTM D 2216	%	--	--	--	--	--	--	--	--	--	--	--	85		96		96		74		96		94		96	
Percent Moisture	ASTM D 2216	%	--	--	--	--	--	--	--	--	--	--	--	15		4.4		4		26		3.9		5.7		4	

Key	
%	Percent
EPA	United States Environmental Protection Agency
J	Result is an estimated value.
mg/kg	Millgrams per kilogram
MTCA	Model Toxics Control Act
RSL	Regional Screening Level
THQ	Target hazard quotient (unitless)
TR	Target cancer risk (unitless)
U	Analyte was analyzed for but not detected. Value provided is method detection limit.
UJ	Analyte was analyzed for but not detected. The reported value is an estimated value of the sample detection limit.
Bolded	Value is greater than or equal to three times the recommended background comparison value.
Gray shaded	Value is greater than at least one risk-based screening value.
Orange shaded =	Sample result is greater than screening level value for EPA RML for Soil; Resident; TR=10-4 and THQ=1.

Table 4-5 Sediment Sample Results and Comparison to Background and Screening Levels

Analyte	Analytical Method	Units	Recommended Background Comparison Value	TEL	PEL	SMS Sediment Cleanup Objective	SMS Cleanup Screening Level	13-Stream4-SD1		13-Stream7-SD1 (duplicate of 13-Stream4-SD1)		13-Stream3-SD1		13-Stream2-SD1		13-Stream1-SD1	
Aluminum	SW846 6010B	mg/kg	4400					3700		3200		2700		3100		3200	
Antimony	SW846 6020	mg/kg	0.087					**0.34**	**J**	**0.28**	**J**	0.22	J	**0.28**	**J**	**0.29**	**J**
Arsenic	SW846 6020	mg/kg	5.5	5.9	17	14	120	5.2		4.3		4.6		4.7		5.8	
Barium	SW846 6020	mg/kg	110					98		81		91		110		79	
Beryllium	SW846 6020	mg/kg	0.046					**0.14**	**J**	0.12	J	0.082	J	0.089	J	0.13	J
Cadmium	SW846 6020	mg/kg	0.017	0.596	3.53	2.1	5.4	**0.84**		**0.69**		**1.6**		**1.9**		**2**	
Calcium	SW846 6010B	mg/kg	220000					200000		170000		250000		260000		190000	
Chromium	SW846 6020	mg/kg	9.3	37.3	90	72	88	8.1		6.9		7.2		6.4		6.8	
Cobalt	SW846 6020	mg/kg	3.6					3.3		2.7		2.4		2.7		2.8	
Copper	SW846 6020	mg/kg	28	35.7	197	400	1200	24		21		13		18		29	
Iron	SW846 6010B	mg/kg	6900					6900	J	5800	J	6000	J	6000	J	6200	J
Lead	SW846 6020	mg/kg	3.8	35	91.3	360	> 1300	**12**	**J**	8.8	J	**56**	**J**	**56**	**J**	**210**	**J**
Magnesium	SW846 6010B	mg/kg	2800					2600	J	2200	J	2600	J	2700	J	2200	J
Manganese	SW846 6020	mg/kg	180					150	J	120	J	130	J	150	J	150	J
Mercury	SW846 7471A	mg/kg	Nondetect	0.174	0.486	0.66	0.8	**0.018**	**J**	0.012	UJ	**0.3**		**0.25**		**0.75**	
Molybdenum	SW846 6020	mg/kg	0.16					**1.8**		**1.4**		**1.5**		**1.3**		**2.3**	
Nickel	SW846 6020	mg/kg	9.8	18	36	26	110	8.7		7.3		6.3		7		7	
Potassium	SW846 6010B	mg/kg	770					650	J	580	J	610	J	680	J	600	J
Selenium	SW846 6020	mg/kg	1.7			11	> 20	1.8		1.4	J	0.64	J	0.92	J	1.1	
Silver	SW846 6020	mg/kg	0.025			0.57	1.7	**0.095**	**J**	0.071	J	**0.19**	**J**	**0.17**	**J**	**0.6**	
Sodium	SW846 6010B	mg/kg	33					**160**	**J**	**140**	**J**	**130**		**140**	**J**	**130**	**J**
Thallium	SW846 6020	mg/kg	Nondetect					0.26	U	0.29	U	0.17	U	0.22	U	0.2	U
Vanadium	SW846 6020	mg/kg	12					13		11		9.8		9.2		11	
Zinc	SW846 6020	mg/kg	32	123	315	3200	> 4200	39		33		76		**99**		87	
Percent Solids	ASTM D 2216	%						38		40		56		46		48	
Percent Moisture	ASTM D 2216	%						62		60		44		54		52	

Key

%	Percent
J	Result is an estimated value.
mg/kg	Milligrams per kilogram
PEL	Probable Effects Level
TEL	Threshold Effects Level
U	Analyte was analyzed for but not detected. Value provided is method detection limit.
Bolded	Value is greater than or equal to three times the recommended background comparison value. If the analyte was not detected in the background sample but was detected in the site sample, the sample result is bolded.
Gray shaded	Value is greater than at least one risk-based screening value.

This page intentionally left blank.

Table 4-6 Surface Water Sample Results and Comparison to Background and Screening Levels

Analyte	Analytical Method	Units	Recommended Background Comparison Value	Hardness Dependent Aquatic Life Criterion	National Toxics Rule; Surface Water; Fresh Water; Aquatic Life; 40 CFR 131; CMC (acute)	National Toxics Rule; Surface Water; Fresh Water; Aquatic Life; 40 CFR 131; CCC (chronic)	Water Quality Standards for Surface Waters of the State of Washington; Chapter 173-201A WAC; Table 240(3); Acute	Water Quality Standards for Surface Waters of the State of Washington; Chapter 173-201A WAC; Table 240(3); Chronic	National Recommended Water Quality Criteris; Fresh Water; Aquatic Life Criteria; CMC (acute)	National Recommended Water Quality Criteris; Fresh Water; Aquatic Life Criteria; CCC (chronic)	National Primary Drinking Water Regulations Maximum Contaminant Level	EPA RML, Tapwater, TR=10-4 and THQ=3	EPA RML, Tapwater, TR=10-4 and THQ=1	13-Stream4-SW1		13-Stream7-SW1 (duplicae of 13-Stream4-SW-1)		13-TC-Adit3-SW1		13-Stream3-SW1		13-Stream1-SW1	
Total Metals																							
Aluminum, Total	SW846 6010B	µg/L	Nondetect									47000	16000	310	U	310	U	310	U	310	U	310	U
Antimony, Total	SW846 6020	µg/L	Nondetect								6	18	6.0	0.4	U	0.4	U	**0.56**	**J**	0.4	U	0.4	U
Arsenic, Total	SW846 6020	µg/L	Nondetect								10	4.5	4.5	3.8	U	3.8	U	3.8	U	3.8	U	3.8	U
Barium, Total	SW846 6020	µg/L	36								2000	8600	2900	36		36		24		38		34	
Beryllium, Total	SW846 6020	µg/L	Nondetect								4	48	16	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
Cadmium, Total	SW846 6020	µg/L	Nondetect								5			0.14	U	0.14	U	**0.99**	**J**	0.14	U	**0.15**	**J**
Calcium, Total	SW846 6010B	µg/L	98000											100000		98000		150000		100000		96000	
Chromium, Total	SW846 6020	µg/L	Nondetect								100	47000	16000	1.4	U	1.4	U	1.4	U	1.4	U	1.4	U
Cobalt, Total	SW846 6020	µg/L	Nondetect									14	4.7	0.16	U	0.16	U	0.16	U	0.16	U	0.16	U
Copper, Total	SW846 6020	µg/L	0.55								1300	1900	620	0.95	J	0.86	J	1.2	J	**1.9**	**J**	0.93	J
Iron, Total	SW846 6010B	µg/L	Nondetect									33000	11000	83	U	83	U	**230**	**J**	**220**	**J**	83	U
Lead, Total	SW846 6020	µg/L	Nondetect								15			**0.17**	**J**	0.17	U	**1.9**	**J**	**2.5**		**1**	**J**
Magnesium, Total	SW846 6010B	µg/L	19000											19000		19000		16000		18000		18000	
Manganese, Total	SW846 6020	µg/L	0.95									970	320	2.6		2.2		**17**		**8**		1.9	J
Mercury, Total	SW846 7470A	µg/L	Nondetect								2	1.9	0.63	0.041	U	0.041	U	0.041	U	0.041	U	0.041	U
Molybdenum, Total	SW846 6020	µg/L	10									230	78	15		14		**610**		18		**30**	
Nickel, Total	SW846 6020	µg/L	Nondetect									910	300	2	U	2	U	2	U	2	U	2	U
Potassium, Total	SW846 6010B	µg/L	410											**2100**	**J**	**2000**	**J**	**2200**	**J**	**2400**	**J**	**2400**	**J**
Selenium, Total	SW846 6020	µg/L	Nondetect								50	230	78	3.6	U	3.6	U	3.6	U	3.6	U	3.6	U
Silver, Total	SW846 6020	µg/L	Nondetect									210	71	0.15	U	0.15	U	0.15	U	0.15	U	0.15	U
Sodium, Total	SW846 6010B	µg/L	12000											12000		12000		9700		12000		12000	
Thallium, Total	SW846 6020	µg/L	Nondetect								2	0.47	0.16	1.4	U	1.4	U	1.4	U	1.4	U	1.4	U
Vanadium, Total	SW846 6020	µg/L	Nondetect									190	63	4.9	U	4.9	U	4.9	U	4.9	U	4.9	U
Zinc, Total	SW846 6020	µg/L	Nondetect									14000	4700	4.4	U	4.4	U	**31**		**7**		4.4	U
Dissolved Metals																							
Aluminum, Dissolved	SW846 6010B	µg/L	Nondetect						7.5E+02	8.7E+01		47000	16000	310	U	310	U	310	U	310	U	310	U
Antimony, Dissolved	SW846 6020	µg/L	Nondetect								6	18	6.0	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Arsenic, Dissolved	SW846 6020	µg/L	Nondetect		3.6E+02	1.9E+02	3.6E+02	1.9E+02	3.4E+02	1.5E+02	10	4.5	4.5	3.8	U	3.8	U	3.8	U	3.8	U	3.8	U
Barium, Dissolved	SW846 6020	µg/L	35								2000	8600	2900	35		36		20		34		33	
Beryllium, Dissolved	SW846 6020	µg/L	Nondetect								4	48	16	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
Cadmium, Dissolved	SW846 6020	µg/L	Nondetect	H	1.3E+01	2.4E+00	1.3E+01	2.4E+00	6.1E+00	5.4E-01	5			0.14	U	0.14	U	**0.2**	**J**	0.14	U	0.14	U
Calcium, Dissolved	SW846 6010B	µg/L	97000											97000		99000		150000		95000		92000	
Chromium, Dissolved	SW846 6020	µg/L	Nondetect	H	1.4E+03	4.5E+02	1.4E+03	4.5E+02	1.5E+03	1.9E+02	100	47000	16000	1.4	U	1.4	U	1.4	U	1.4	U	1.4	U
Cobalt, Dissolved	SW846 6020	µg/L	Nondetect									14	4.7	0.16	U	0.16	U	0.16	U	0.16	U	0.16	U
Copper, Dissolved	SW846 6020	µg/L	0.55	H	5.0E+01	3.0E+01	5.0E+01	3.0E+01	3.9E+01	2.4E+01	1300	1900	620	0.63	J	0.76	J	0.55	U	0.83	J	**4**	**J**
Iron, Dissolved	SW846 6010B	µg/L	Nondetect									33000	11000	83	U	83	U	83	U	83	U	83	U
Lead, Dissolved	SW846 6020	µg/L	Nondetect	H	2.2E+02	8.5E+00	2.2E+02	8.5E+00	2.2E+02	8.5E+00	15			0.17	U	0.17	U	0.17	U	0.17	U	0.17	U
Magnesium, Dissolved	SW846 6010B	µg/L	18000											18000		18000		16000		18000		18000	
Manganese, Dissolved	SW846 6020	µg/L	Nondetect									970	320	**1.1**	**J**	**1.2**	**J**	**8.1**		**1.4**	**J**	**1.4**	**J**
Mercury, Dissolved	SW846 7470A	µg/L	Nondetect		2.1E+00	1.2E-02	2.1E+00	1.2E-02	1.4E+00	7.7E-01	2	1.9	0.63	0.041	U	0.041	U	0.041	U	0.041	U	0.041	U
Molybdenum, Dissolved	SW846 6020	µg/L	9.8									230	78	15		14		**580**		18		**30**	
Nickel, Dissolved	SW846 6020	µg/L	Nondetect	H	3.7E+03	4.1E+02	3.7E+03	4.1E+02	1.2E+03	1.4E+02		910	300	2	U	2	U	2	U	2	U	2	U
Potassium, Dissolved	SW846 6010B	µg/L	410											**2000**	**J**	**2000**	**J**	**2000**	**J**	**2300**	**J**	**2300**	**J**
Selenium, Dissolved	SW846 6020	µg/L	Nondetect		2.0E+01	5.0E+00	2.0E+01	5.0E+00			50	230	78	3.6	U	3.6	U	3.6	U	3.6	U	3.6	U
Silver, Dissolved	SW846 6020	µg/L	Nondetect	H	2.5E+01		2.5E+01	NA	2.3E+01			210	71	0.15	U	0.15	U	0.15	U	0.15	U	0.15	U
Sodium, Dissolved	SW846 6010B	µg/L	12000											12000		12000		9700		11000		12000	
Thallium, Dissolved	SW846 6020	µg/L	Nondetect								2	0.47	0.16	1.4	U	1.4	U	1.4	U	1.4	U	1.4	U
Vanadium, Dissolved	SW846 6020	µg/L	Nondetect									190	63	4.9	U	4.9	U	4.9	U	4.9	U	4.9	U
Zinc, Dissolved	SW846 6020	µg/L	Nondetect	H	3.0E+02	2.7E+02	3.0E+02	2.7E+02	3.1E+02	3.1E+02		14000	4700	4.4	U	4.4	U	**6**	**J**	4.4	U	4.4	U

Table 4-6 Surface Water Sample Results and Comparison to Background and Screening Levels

Analyte	Analytical Method	Units	Recommended Background Comparison Value	Hardness Dependent Aquatic Life Criterion	National Toxics Rule; Surface Water; Fresh Water; Aquatic Life; 40 CFR 131; CMC (acute)	National Toxics Rule; Surface Water; Fresh Water; Aquatic Life; 40 CFR 131; CCC (chronic)	Water Quality Standards for Surface Waters of the State of Washington; Chapter 173-201A WAC; Table 240(3); Acute	Water Quality Standards for Surface Waters of the State of Washington; Chapter 173-201A WAC; Table 240(3); Chronic	National Recommended Water Quality Criteris; Fresh Water; Aquatic Life Criteria; CMC (acute)	National Recommended Water Quality Criteris; Fresh Water; Aquatic Life Criteria; CCC (chronic)	National Primary Drinking Water Regulations Maximum Contaminant Level	EPA RML, Tapwater, TR=10-4 and THQ=3	EPA RML, Tapwater, TR=10-4 and THQ=1	13-Stream4-SW1		13-Stream7-SW1 (duplicae of 13-Stream4-SW-1)		13-TC-Adit3-SW1		13-Stream3-SW1		13-Stream1-SW1	
Field Water Quality Parameters																							
pH	Field Test	pH Units												7.95				7.37		8.05		7.3	
Conductivity	Field Test	mS/cm												0.663				0.779		0.614		0.703	
Turbidity	Field Test	NTU												27				7		39		3	
Dissolved Oxygen	Field Test	mg/L												11.48				9.85		11.74		10.58	
Temperature	Field Test	degrees C												10				9.5		10.1		10.8	
ORP	Field Test	mV												95				11		156		232	

Key

%	Percent
µg/L	Micrograms per liter
CCC	Criteria Continuous Concentration
CFR	Code of Federal Regulations
CMC	Criteria Maximum Concentration
degrees C	Degrees Celsius
EPA	United States Environmental Protection Agency
H	Hardness dependent surface water quality criteria for aqua
J	Result is an estimated value.
mg/L	Milligrams per liter
mS/cm	MilliSiemens per centimeter
mV	Millivolts
NTU	Nephelometric Turbidity Units
ORP	
RML	Removal Management Level
THQ	Target hazard quotient (unitless)
TR	Target cancer risk (unitless)
U	Analyte was analyzed for but not detected. Value provided is method detection limit.
WAC	Washington Administrative Code
Bolded	Value is greater than or equal to three times the recommended background comparison value. If the analyte was not detected in the background sample but was detected in the site sample, the sample result is bolded.
Gray shaded	Value is greater than at least one risk-based screening value.

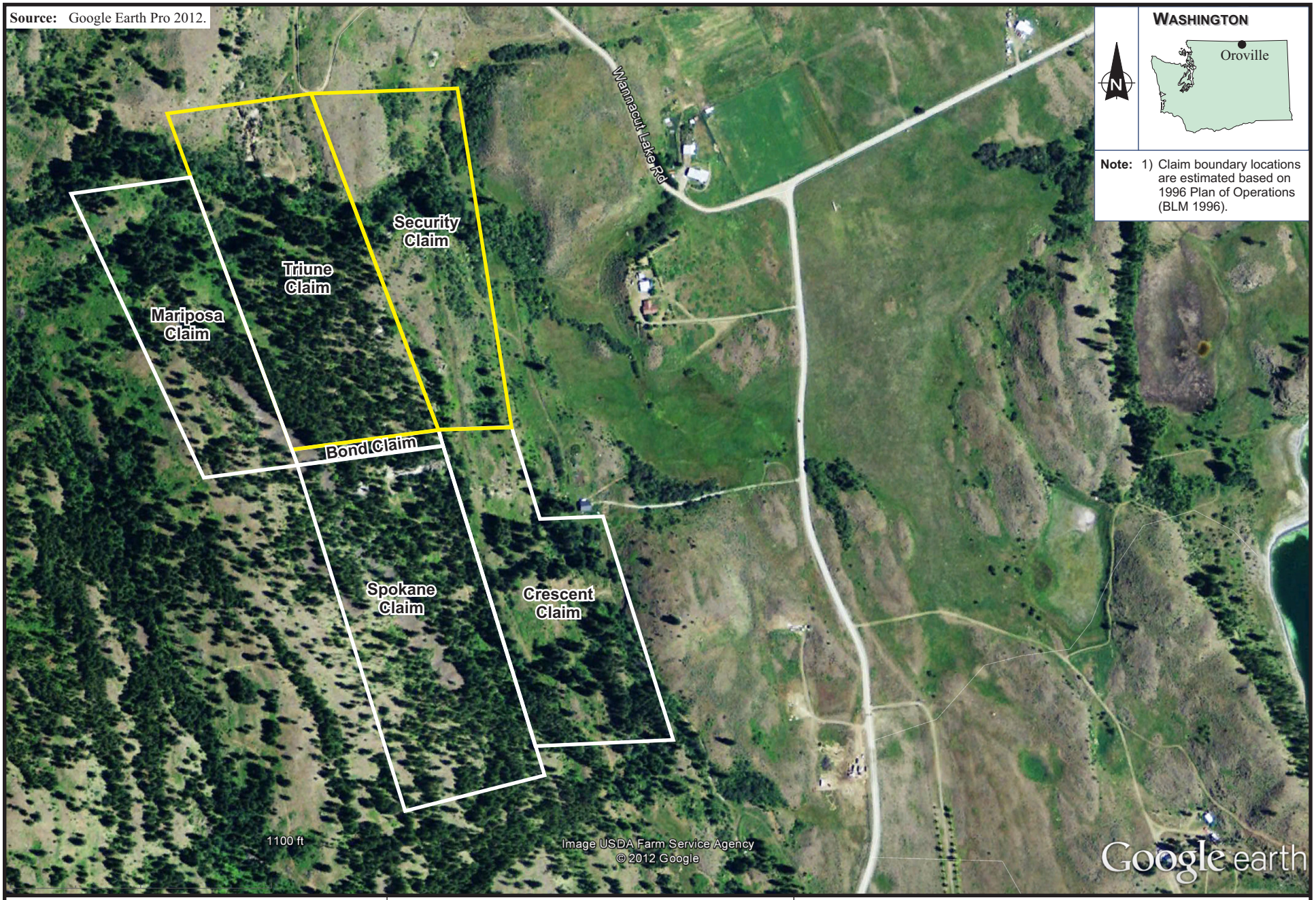
Table 4-7 Source Feature Volume Estimates

Feature	Estimated Volume (Cubic Yards)
BLM shaft1	149
TC-pit	1,248
TC-shaft2	32
TC-camp	1,649
TC-mill	554
SC-bench	5,294
TC-shaft4	435
TC-adit4	302
TC-shaft5	844
SC-pit1	81
TC-shaft6	125

This page intentionally left blank.

Figures

This page intentionally left blank.



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

TRIUNE MINE
Okanogan County, Washington

0 275 550
Approximate Scale in Feet

Figure 1-1
LOCATION MAP

Date:	Drawn by:	
12/27/12	AES	10:004077-0001-02-01\fig 1-1

This page intentionally left blank.

Source: BLM Plan of Operations, Area WMP-130-001 W, 1996.

BLM - WENATCHEE RESOURCE AREA
PLAN OF OPERATIONS PROJECT AREA
WMP-130-95-001 W

William "Hank" Lovitt - Operator
Bond, Crescent, Mariposa, Security, and Tribune
Unpatented Mining Claims
Okanogan County, Washington
Sections 10 & 11, T 39 N, R 26 E, W.M.

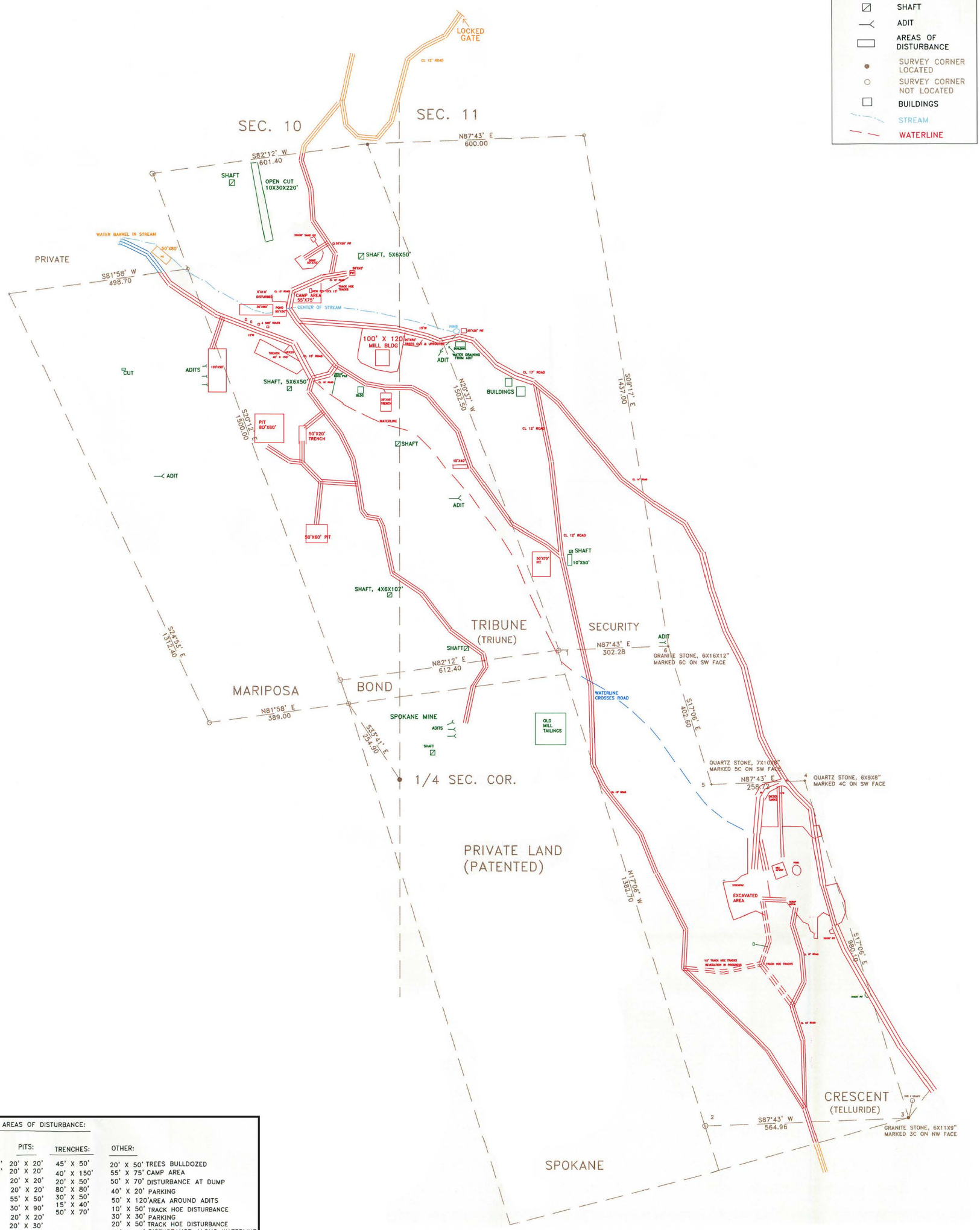
COLOR CODE

NEW DISTURBANCE

OLD DISTURBANCE

LEGEND

- SURVEYED ROADS WITH CENTERLINE
- SHAFT
- ADIT
- AREAS OF DISTURBANCE
- SURVEY CORNER LOCATED
- SURVEY CORNER NOT LOCATED
- BUILDINGS
- STREAM
- WATERLINE



AREAS OF DISTURBANCE:

ROADS:		PITS:	TRENCHES:	OTHER:
10' X 1775'	12' X 3670'	20' X 20'	45' X 50'	20' X 50' TREES BULLDOZED
12' X 520'	12' X 3600'	20' X 20'	40' X 150'	55' X 75' CAMP AREA
15' X 200'	14' X 430'	20' X 20'	20' X 50'	50' X 70' DISTURBANCE AT DUMP
15' X 240'	15' X 735'	20' X 20'	80' X 80'	40' X 20' PARKING
16' X 260'	16' X 70'	55' X 50'	30' X 50'	50' X 120' AREA AROUND ADITS
18' X 490'	17' X 300'	30' X 90'	15' X 40'	10' X 50' TRACK HOE DISTURBANCE
20' X 200'	18' X 520'	20' X 20'	50' X 70'	30' X 30' PARKING
30' X 30'		20' X 30'		20' X 50' TRACK HOE DISTURBANCE
		10' X 15'		30' X 50' DISTURBANCE ALONG WATERLINE
		5' X 5'		10' X 250' DISTURBANCE ALONG WATERLINE
		5' X 5'		20' X 40' ROCK PILE
		5' X 5'		100' X 120' AREA AROUND OLD MILL
		5' X 5'		30' X 90'
		10' X 15'		50' X 118'
		5' X 10'		110' X 135' MILL SITE
				125' X 100'
				100' X 70'
				110' X 30'
				40' X 80'

TOTAL ACRES DISTURBED = 6.47

BASE MAP DRAWN BY D. GROODY 08/18/1995 FROM ORIGINAL SURVEY OF 1900
REVISED 08/24/95, 08/25/95, 08/31/95, 09/01/95 D. GROODY FILE NAME: SEP1.DWG
FIELD WORK CONDUCTED ON AUGUST 23 & 30, 1995 BY BRENT CUNDERLA & DIANE GROODY
DRAWING REVISED 11/19/96 J. WHITE FILE NAME CRESJLW

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

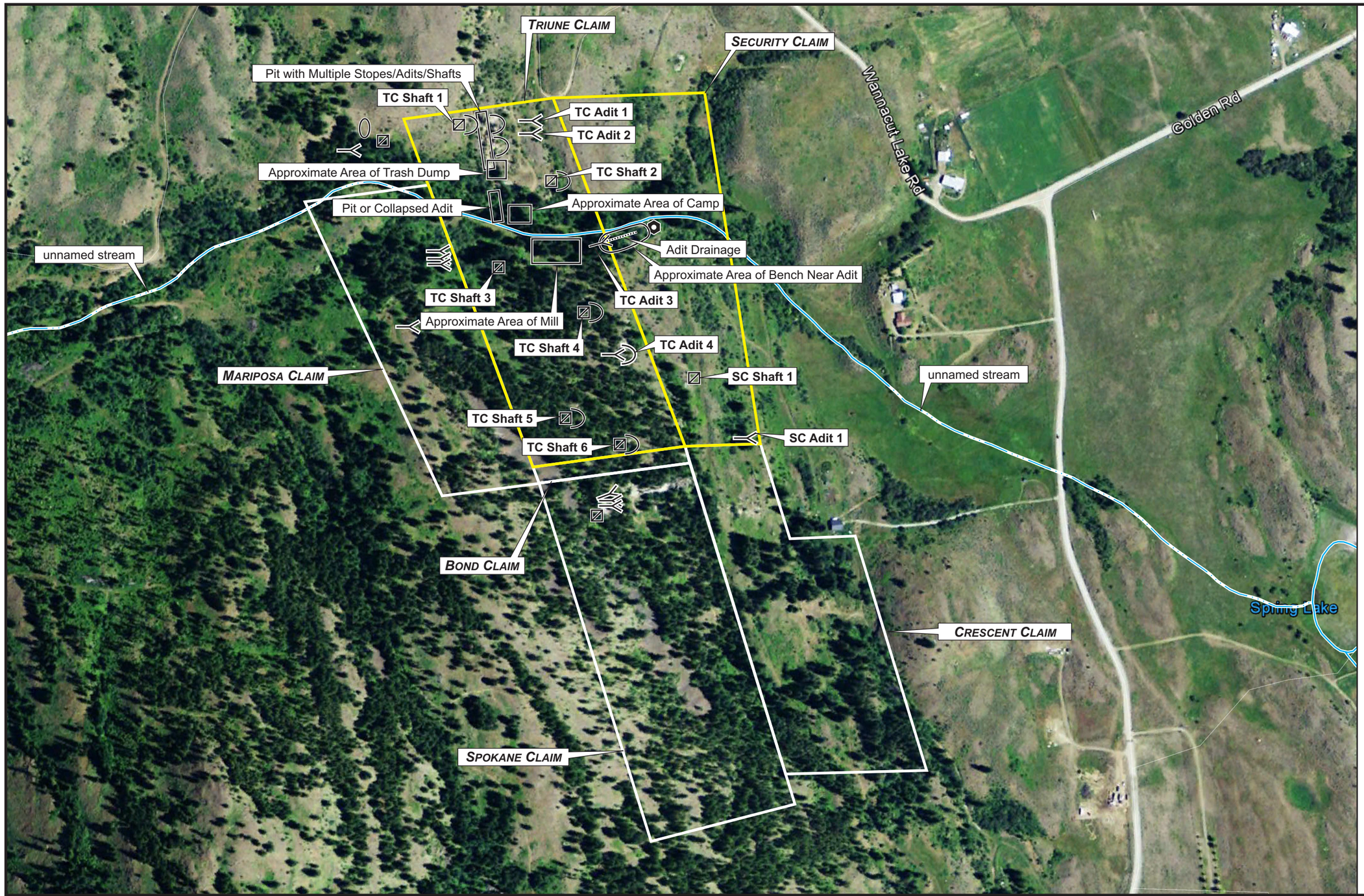
TRIUNE MINE
Okanogan County, Washington

0 200 400
Approximate Scale in Feet

Figure 2-1
PLAN OF OPERATIONS

Date:	Drawn by:	
12/18/12	AES	10:004077-0001-02-01\fig 2-1

This page intentionally left blank.



Legend

- Adit
- Adit with Waste Rock Pile
- Shaft
- Shaft with Waste Rock Pile
- Spring
- Pit or Cut

Note:

1) Claim boundary locations are estimated based on 1996 Plan of Operations (BLM 1996).
2) Stream location data from USGS, 1982.

Source: Google Earth Pro 2012.

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

N

0 300 600
Approximate Scale in Feet

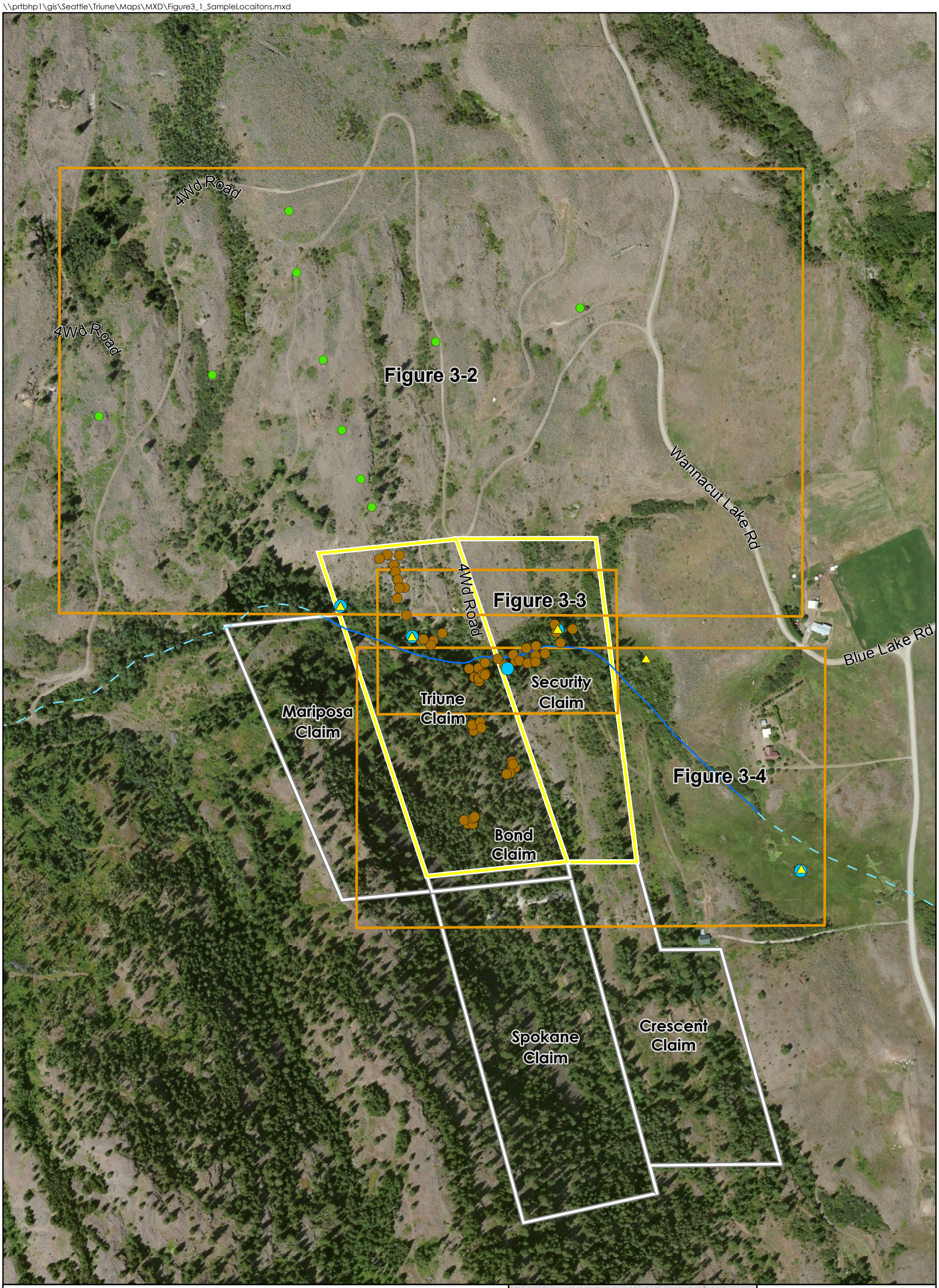
TRIUNE MINE
Okanogan County, Washington

Figure 2-2
SITE FEATURES

Date:	Drawn by:	
12/27/12	AES	10:004077-0001-02-01\fig 2-2

This page intentionally left blank.

\\prtbhp1\gis\Seattle\Triune\Maps\MXD\Figure3_1_SampleLocaitons.mxd



Sample Types

- Surface Water Sample Location
- Sediment Sample Location
- Surface Soil Subsample Location
- Background Surface Soil Sample Location
- Unnamed Stream - Perennial
- Unnamed Stream - Intermittent
- Figure Extents

- Other Claims
- Triune and Security Claims

Stream location data from USGS, 1982

N

0 500 1,000
Feet

Figure 3-1
Sample Locations
Map Overview

Triune Mine

ecology and environment, inc.
International Specialists in the Environment

This page intentionally left blank.

\\prtbhp1\gis\Seattle\Triune\Maps\MXD\Figure3_2_SampleLocations_Northern.mxd

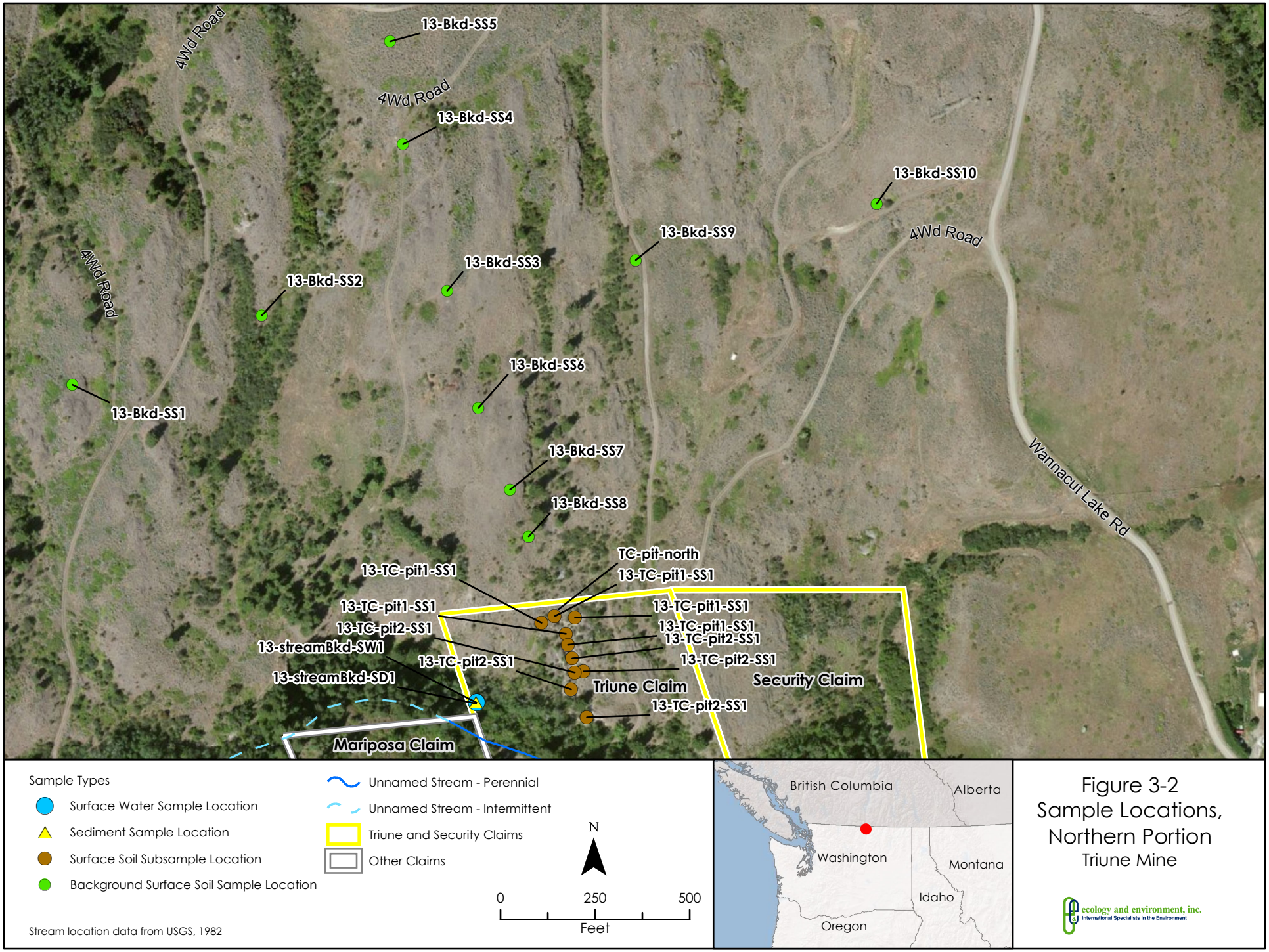


Figure 3-2
Sample Locations,
Northern Portion
Triune Mine

ecology and environment, inc.
International Specialists in the Environment

\\prtbhp1\gis\Seattle\Triune\Maps\MXD\Figure3_3_SampleLocations_Central.mxd

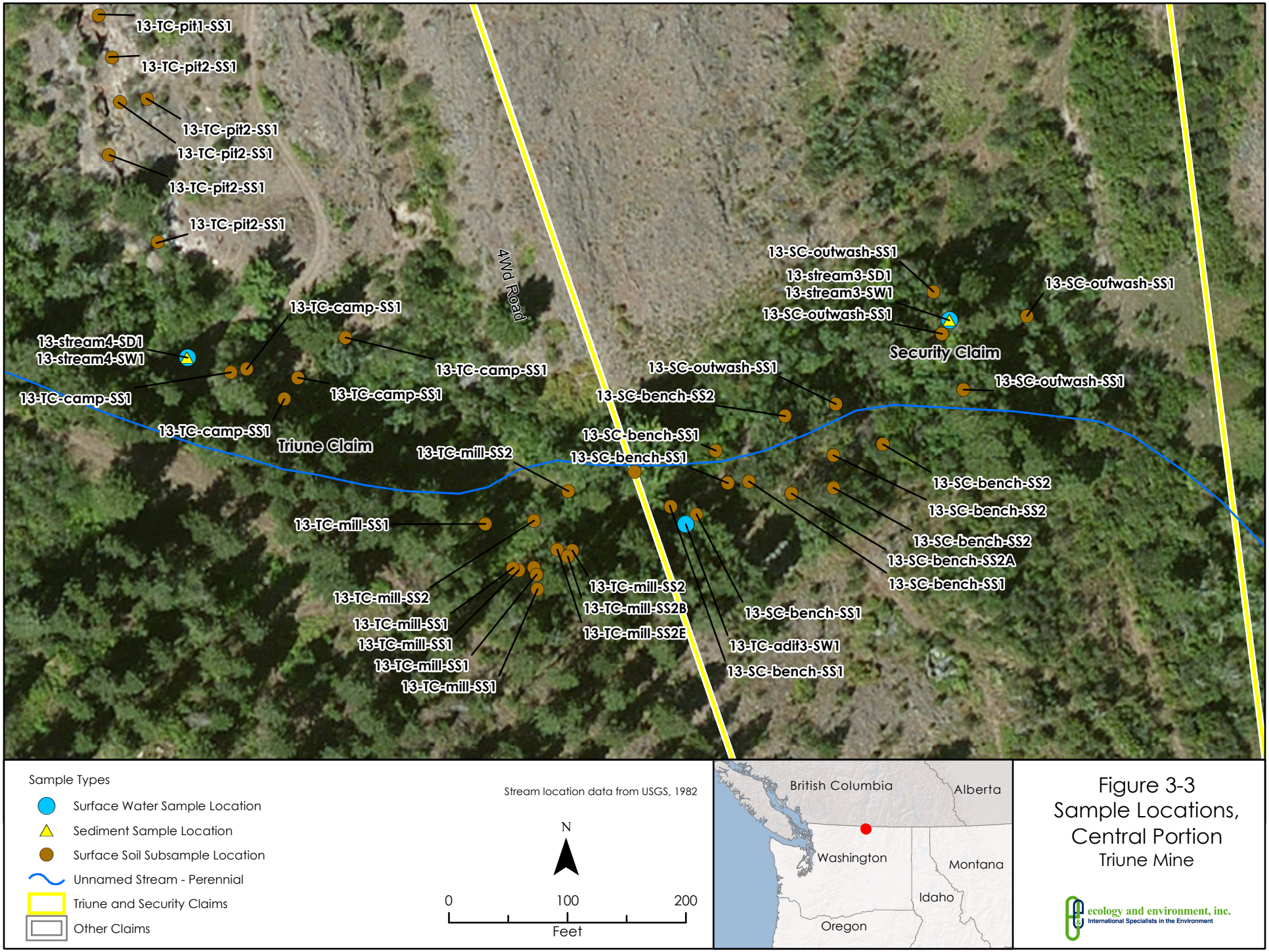


Figure 3-3
Sample Locations,
Central Portion
Triune Mine

\\prtbhp1\gis\Seattle\Triune\Maps\MXD\Figure3_4_SampleLocations_Southern.mxd

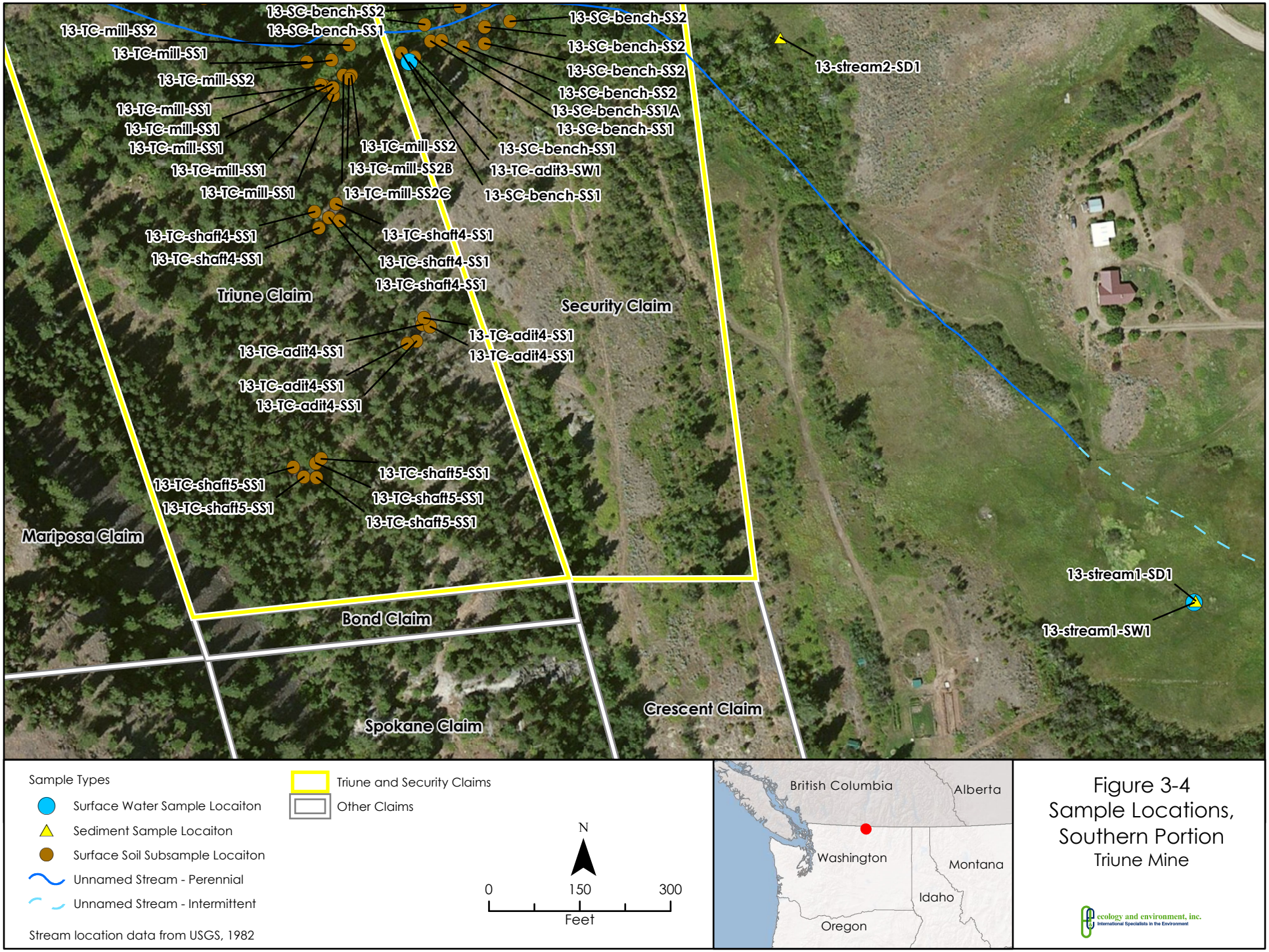


Figure 3-4
Sample Locations,
Southern Portion
Triune Mine

ecology and environment, inc.
International Specialists in the Environment

\\prtbhp1\gis\Seattle\Triune\Maps\MXD\Figure4_1_SourceDelineation_Northern.mxd

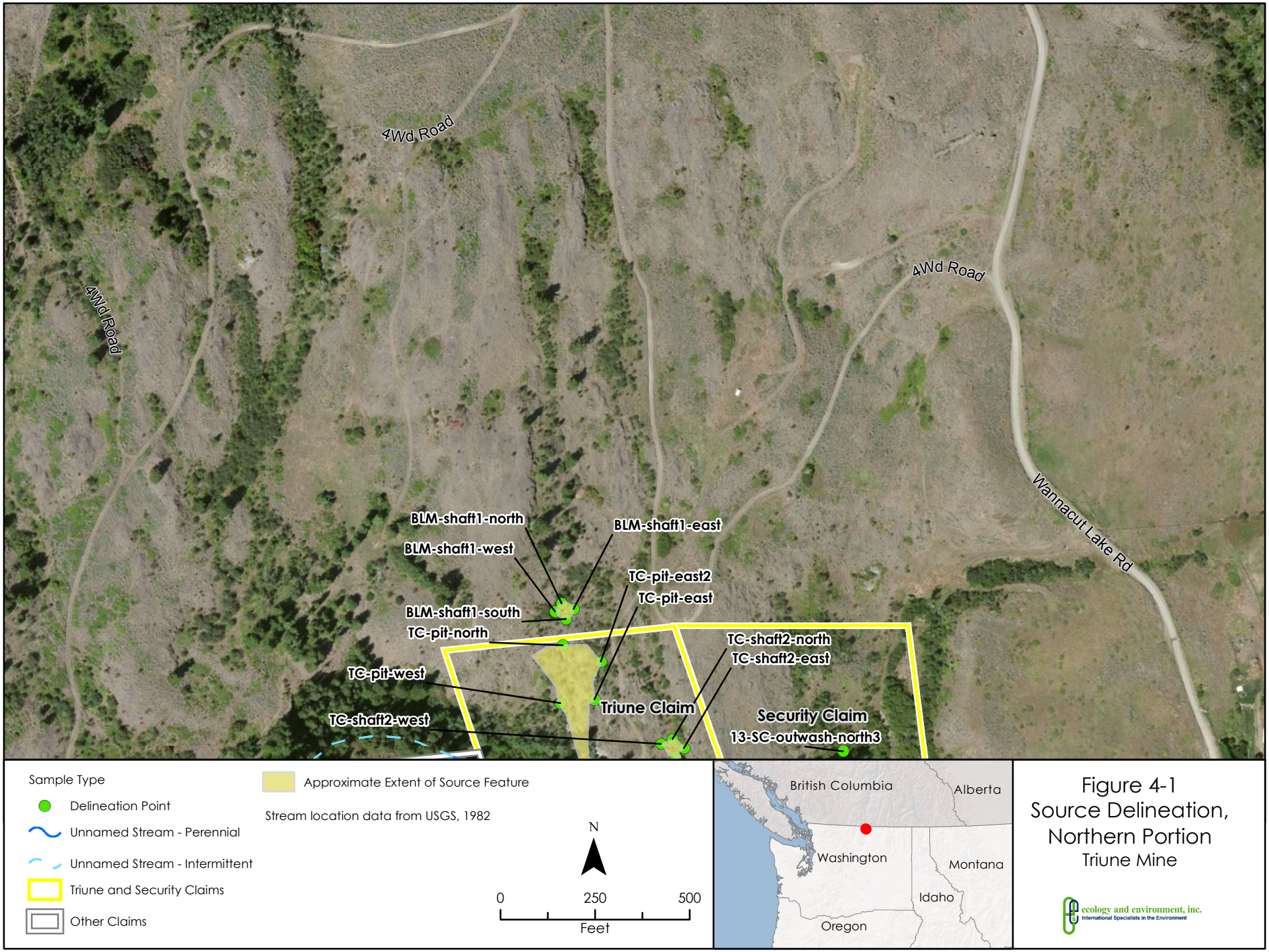


Figure 4-1
Source Delineation,
Northern Portion
Triune Mine

ecology and environment, inc.
International Specialists in the Environment

\\prtbhp1\gis\Seattle\Triune\Maps\MXD\Figure4_2_SourceDelineation_Central.mxd

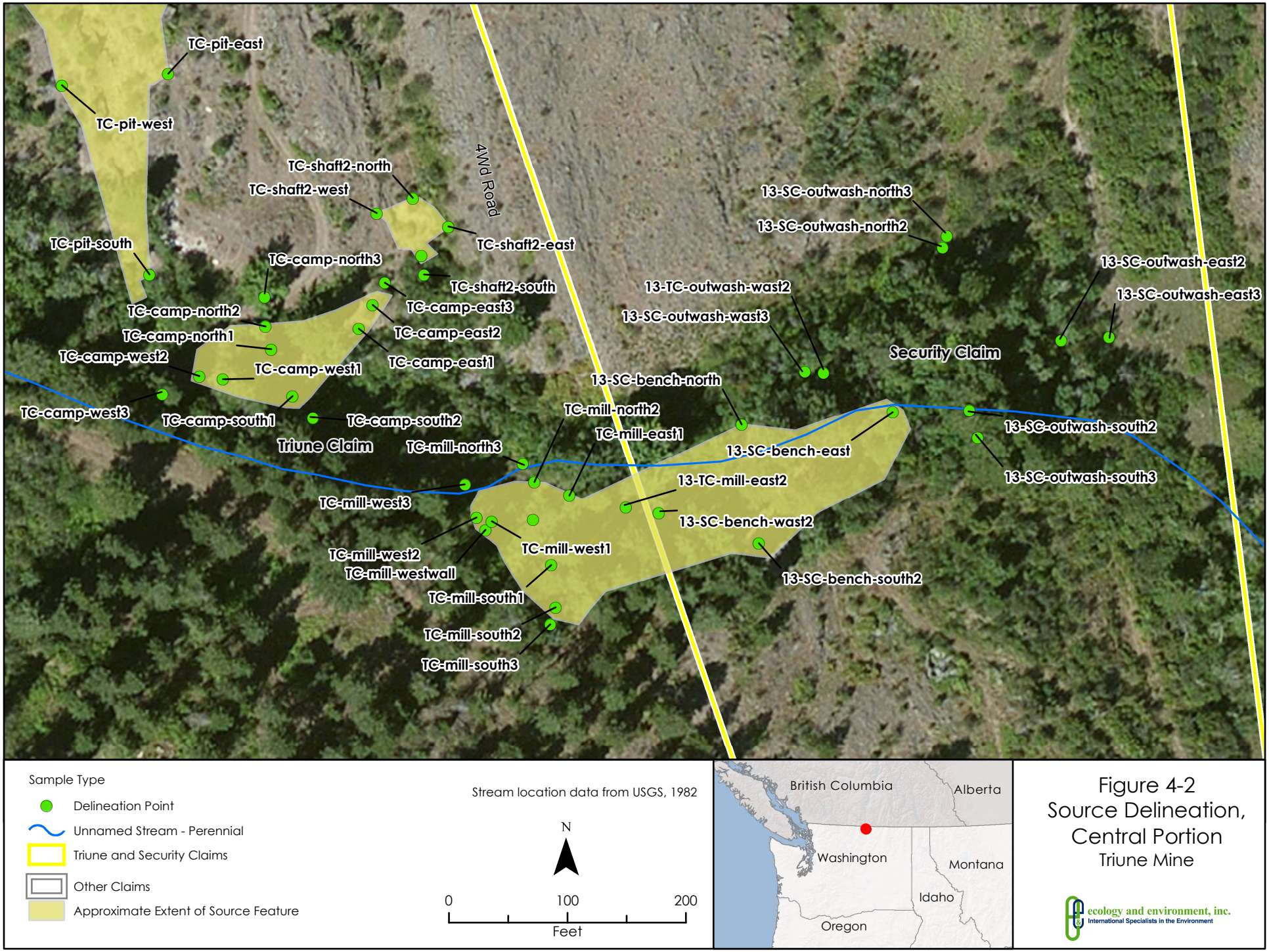


Figure 4-2
Source Delineation,
Central Portion
Triune Mine

ecology and environment, inc.
International Specialists in the Environment

\\prtbhp1\gis\Seattle\Triune\Maps\MXD\Figure4_3_SourceDelineation_Southern.mxd

Figure 4-3
Source Delineation,
Southern Portion
Triune Mine

ecology and environment, inc.
International Specialists in the Environment

A SAP Deviation Documentation Forms

This page intentionally left blank.

Triune Mine Removal SI

SAP Deviation Documentation

Date: 6/21/20103	Name: Jonathan Reeve

Description of Problem:

The XRF was found to be non-functional this morning at approximately 7:30 during routine daily calibration. Attempts to address the failure by the E & E field team alone and with the technical support via phone of Field Environmental (the rental company providing the Innov-X XRF unit) were unsuccessful. The hardware technician diagnosed the problem as likely being a connection failure between the HP iPAQ PDA and the XRF instrument that is not field-serviceable. The earliest Field Environmental can get a unit sent to us is Monday morning, 6/24/13.

Location of Problem:

Triune Mine site meeting point.

Description of Deviation to Address Problem:

After discussion of the issue with the BLM representative (Elizabeth Earp) and the project manager (Mark Longtine), the decision was made to implement the following plan:

1. Have Field Environmental send the replacement unit to E & E's Seattle office.
2. At waste rock delineation sites in which there exists a distinct visual boundary between waste rock and natural soils, collect a two-sample transect across the visual boundary and place those samples in marked plastic bags for later analysis.
3. At sites or individual delineation quadrants in which there does not exist a clear visual delineation of the potentially contaminated soil, collect a three-sample transect across the suspected boundary location, using judgment to site sample locations relative to site features. These samples will also be placed in marked plastic bags for later analysis.
4. Collect quadrant GPS location of clearly defined visual boundaries where appropriate; collect GPS location of "middle" sample location in three-sample transect where boundary is visually indeterminate.
5. Collect planned in-situ screening locations of tailings located on the Crescent Claim in marked plastic bags for later analysis.
6. Using replacement XRF unit in Seattle office on 6/24/13 or later, analyze all samples collected as a result of the above plan for metals and report results on the field forms.

Triune Mine Removal SI

SAP Deviation Documentation

Date: 6/21/20103	**Name: Jonathan Reeve**
Other Means Considered but Rejected to Address Problem: 1. Attempt to receive unit earlier at field site and have field team stay past planned demobilization to conduct in-situ sampling. Rejected due to logistics and poor local shipping record. 2. Not collect XRF data of mine features for the purpose of delineation and rely solely upon visual identification of features. Rejected due to client request.	

Triune Mine Removal SI

SAP Deviation Documentation

Date: 6/21/20103	Name: Jonathan Reeve

Description of Problem:

New site feature discovered that was not addressed in SAP. Feature is a possible outwash plain of mill tailings or other mining activity waste material in the unnamed creek east of the site feature SC-Bench. Due to the unique hydrology of the valley, the unnamed creek infiltrates to groundwater shortly after leaving the Security Claim to the east. However, between the east end of the SC-Bench feature and the east end of the Security Claim, the creek descends a steep moderate grade that then lessens to a shallow grade as it widens into an alluvial cone. In this area there is strong visual evidence of significant transport of sediment associated with the mine into the area. Due to the stream infiltrating downward into the alluvial cone, the eastward, downstream extent of this outwash sediment is limited.

Location of Problem: Security Claim of the Triune Mine site.

Description of Deviation to Address Problem:

This feature will be delineated using a Waste Material Delineation Form and a three-point XRF transect for each quadrant. The feature will also be sampled using a composite sample analysis and a Surface Soil Data Collection Form. The four quadrant samples that make up the five point surface sample composite will double as the inner locations of the XRF transect for the waste material delineation. A composite surface soil sample will be collected and sent to the laboratory for analysis.

Other Means Considered but Rejected to Address Problem:

1. No collection of surface soil sample.
2. No delineation of outwash feature.

This page intentionally left blank.

B Data Validation Memoranda

This page intentionally left blank.

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

Laboratory: TestAmerica	**Lab Project Number: 580-39053-1**
Sampling Dates: 6/18, 6/19, & 6/20/13	**Sample Matrix: Soil/Sediment/Water**
Analytical Method: TAL (Total & Dissolved)	**Data Reviewer: M. Song**

Metals + Mo by EPA 6010B/6020/7470A/7471A

REVIEW AND APPROVAL:

Data Reviewer: Mindy Song **Date: _____**
Technical QA Reviewer: _____ **Date: _____**
Project Manager: Mark Longtine **Date: _____**

SAMPLE IDENTIFICATION:

Sample No.	Sample I.D.	Lab ID
1	13-Stream1-SW1	580-39053-1
2	13-Stream3-SW1	580-39053-2
3	13-TC-Adit3-SW1	580-39053-3
4	13-Stream4-SW1	580-39053-4
5	13-Stream7-SW1	580-39053-5
6	13-StreamBKD-SW1	580-39053-6
7	13-Stream1-SD1	580-39053-7
8	13-Stream2-SD1	580-39053-8
9	13-Stream3-SD1	580-39053-9
10	13-Stream4-SD1	580-39053-10
11	13-Stream7-SD1	580-39053-11
12	13-StreamBKD-SD1	580-39053-12
13	13-TC-Pit1-SS1	580-39053-13
14	13-TC-Pit2-SS1	580-39053-14
15	13-TC-Camp-SS1	580-39053-15
16	13-TC-Mill-SS1	580-39053-16
17	13-SC-Bench-SS1	580-39053-17
18	13-SC-Bench-SS2	580-39053-18
19	13-TC-Shaft4-SS1	580-39053-19
20	13-TC-Adit4-SS-1	580-39053-20

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

Sample No.	Sample I.D.	Lab ID
21	13-TC-Shaft5-SS-1	580-39053-21
22	13-TC-Mill-SS2	580-39053-22
23	13-SC-Bench-SS3	580-39053-23
24	13-BKD-SS1	580-39053-24
25	13-BKD-SS2	580-39053-25
26	13-BKD-SS3	580-39053-26
27	13-BKD-SS4	580-39053-27
28	13-BKD-SS5	580-39053-28
29	13-BKD-SS6	580-39053-29
30	13-BKD-SS7	580-39053-30
31	13-BKD-SS8	580-39053-31
32	13-BKD-SS9	580-39053-32
33	13-BKD-SS10	580-39053-33
34	13-BKD-SS11	580-39053-34

DATA PACKAGE COMPLETENESS CHECKLIST:

Checklist Code:

- **X** Included: no problems
- ***** Included: problems noted in review
- **O** Not Included and/or Not Available
- **NR** Not Required
- **RS** Provided As Re-submission

Case Narrative:

- **X** Case Narrative present

Quality Control Summary Package:

- **X** Data Summary sheets
- **X** Initial and Continuing Calibration results
- **X** CRDL Standard results
- ***** Preparation Blank and Calibration Blank results
- **X** ICP Interference Check Sample results
- ***** Matrix Spike recoveries
- ***** Matrix Duplicate results
- **X** Laboratory Control Sample recoveries
- **NR** Method of Standard Additions results
- **X** ICP Serial Dilution results
- **X** Instrument Detection Limits
- **X** ICP Interelement Correction Factors
- **X** ICP Linear Ranges

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

__X__ Preparation Log
__X__ Analysis Run Log

Raw QC Data Package Section

__X__ Chain-of-Custody Records
__X__ Instrument Printouts
__X__ Sample Preparation Notebook Pages
__X__ Logbook and Worksheet Pages
__X__ Percent Solids Determination

DATA VALIDATION SUMMARY

The data were validated in accordance with the National Functional Guidelines for Inorganic Data Review (EPA 2010), National Functional Guidelines for Organic Data Review (EPA 2008), Guidelines for Data Reporting , Data Reduction in conjunction with the QA/QC requirements specified in each specific analytical method and any project-specific QC defined in the QAPP.

Indicate with a YES or NO whether each item is acceptable without qualification:

1	**Holding Times**	**YES**
2	**Initial and Continuing Calibrations**	**YES**
3	**Laboratory Control Sample**	**YES**
4	**Matrix Spike**	**NO**
5	**Blanks and Background Samples**	**YES**
6	**Duplicate Analyses**	**NO**
7	**Interference Check Samples and Serial Dilution Analysis**	**YES**
8	**Post Digestion Spike and Standard Addition Analysis**	**N/A**
9	**Analyte Quantitation**	**YES**
10	**Overall Assessment of Data**	**YES**
11	**Usability of Data**	**NO**

Comments: N/A: Not Applicable.
Four field duplicate samples were collected, as required by the Sampling and Analysis Plan (SAP). No rinsate samples were required because dedicated sampling equipment was used.

EPA SW-846 Method 6010B (ICP) was used to analyze Al, Fe, Mg, K, Na, and Ca.
EPA SW-846 Method 6020 (ICP/MS) was used to analyze As, Sb, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Tl, V, and Zn .
EPA SW-846 Method 7471A & 7470A (CVAA) were used to analyze Hg.

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

1. HOLDING TIMES

__X__ Acceptable
_____ Acceptable with qualification
_____ Unacceptable

Samples were extracted and analyzed within required holding times except as noted under Comments. In addition, no problems were identified with regard to sample preservation or custody unless specified. For those samples analyzed outside holding time requirements, the detected results have been qualified as estimated (J), and the nondetected results have been qualified either as estimated (UJ) or rejected (R) based on the reviewer's judgement.

All Sample Matrices:
Mercury: 28 days (from collection) for analysis.
Hexavalent chromium: 24 hours (from collection) for analysis.
All other metals: 180 days (from collection) for analysis.

Comments: All samples met the required method holding times. The temperatures of two coolers at receipt were 2.1°C and 2.3°C.

2. INITIAL AND CONTINUING CALIBRATION VERIFICATION

__X__ Acceptable
_____ Acceptable with qualification
_____ Unacceptable

Unless flagged below, an initial calibration verification (ICV) and a calibration blank were analyzed at the beginning of the run, and a continuing calibration verification (CCV) and a calibration blank were analyzed after every ten samples, and at the end of the run. ICV and CCV recoveries were within a range of 80-120% for mercury and tin, and 90-110% for all other metals. For analytes which exceeded these control limits, associated detected results are qualified as estimated (J). In cases where the recovery was below 65% or above 135% (for mercury and tin) or below 75% or above 125% (for all other metals), all associated data are rejected (R).

Comments: All recoveries of metals in initial and continuing calibration verifications were within the control limits.

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

3. LABORATORY CONTROL SAMPLE

___X__ Acceptable
_____ Acceptable with qualification
_____ Unacceptable
_____ No Laboratory Control Samples Analyzed

Laboratory control sample recoveries are used for a qualitative indication of accuracy (bias) independent of matrix effects. LCS recovery limits should either be specified in the Sampling and Analysis Plan or can be established by the laboratory. For analytes which exceeded these control limits, associated detected results are qualified as estimated (J). In cases where the recovery was below 30%, all associated nondetected results are rejected (R) and detected results are qualified as estimated (J).

Comments: The LCS percent recoveries in water, sediment, and soil matrix were within the control limits.

4. MATRIX SPIKE

_____ Acceptable
___X___ Acceptable with qualification
_____ Unacceptable
_____ No Matrix Spikes Analyzed

Matrix spike recoveries are used for a qualitative indication of accuracy (bias) due to matrix effects. Unless flagged below, one laboratory control sample was analyzed at a rate of one per batch or one per 20 samples. Recoveries were within a range of 75-125%. For analytes which exceeded these control limits, associated detected results are qualified as estimated (J). In cases where the recovery was below 30%, all associated nondetected results are rejected (R) and detected results are qualified as estimated (J).

Comments: Water sample 13-Stream1-SW1 was used for MS/MSD analysis and the recoveries of Ca were outside of control limits. Qualification was not necessary because the amount of calcium present in the parent sample was greater than four times the amount spiked.

Sediment sample 13-Stream1-SD1 was used for MS/MSD analysis and the recoveries of Al, Ca, Fe, Mg, K, Pb, and Mn were outside of control limits. Qualification was not required for Al and Ca because the amount of Al and Ca present in the parent sample was greater than 4X the amount spiked. The detected Fe, Mg, K, Pb, and Mn results in sediment samples were qualified as estimated (J).

Soil sample 13-TC-Shaft5-SS-1 was used for MS/MSD analysis and the recoveries of Al, Ca, Fe, Mg, Cu, Pb, Mn, Mo, and Zn were outside of control limits. Qualification was not required for Al, Ca, Fe, Pb, and Mn because the amount of these metals present in the parent sample was greater than four times the amount spiked. The detected Mg, Cu, Mo, and Zn results in soil samples were qualified as estimated (J).

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

5. BLANKS AND BACKGROUND SAMPLES

__X__ Acceptable
_____ Detection Limits Adjusted

The following blanks were analyzed:
__X__ Method (preparation) Blanks
_____ Field Blanks
_____ Calibration Blanks
_____ Rinsate Blanks
_____ Background Samples

Preparation (method) blanks were prepared for each batch of samples extracted. A preparation blank was analyzed after every continuing calibration standard, prior to sample analysis unless noted below. Any compound detected in the sample and also detected in any associated blank, must be qualified as non-detect (U) when the sample concentration is less than 5x the blank concentration.

Comments: A trace amount of copper (0.107 mg/kg) was detected in the method blank. Finding does not require qualification since the associated sample concentration was more than 5x the blank concentration.

6. DUPLICATE ANALYSES

_____ Acceptable
__X__ Acceptable with qualification
_____ Unacceptable
_____ No Duplicates Analyzed

Type of duplicates analyzed:
__X__ Field Duplicates
_____ Laboratory Duplicates

Calculate the relative Percent Difference (RPD) between the members of duplicate pairs using the equation indicated below. Qualify the detected results as estimated (J) for any analyte whose RPD in a laboratory duplicate exceeds 20% for water samples or 35% for soil samples.

$$RPD = \frac{2(\text{Value 1} - \text{Value 2})}{\text{Value 1} + \text{Value 2}} \times 100\%$$

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

Analyte, Total (mg/L)	13-Stream4-SW1	13-Stream7-SW1	RPD (%)
Aluminum	<0.31	<0.31	0
Antimony	<0.00040	<0.00040	0
Arsenic	<0.0038	<0.0038	0
Barium	0.036	0.036	0
Beryllium	<0.00051	<0.0051	0
Cadmium	<0.00014	<0.00014	0
Calcium	100	98	2
Chromium	<0.0014	<0.0014	0
Cobalt	<0.00016	<0.00016	0
Copper	0.00095	0.00086	10
Iron	<0.083	<0.083	0
Lead	0.00017	<0.00017	0
Magnesium	19	19	0
Manganese	0.0026	0.0022	17
Nickel	<0.0020	<0.0020	0
Potassium	2.1	2.0	5
Selenium	<0.0036	<0.0036	0
Silver	<0.00015	<0.00015	0
Sodium	12	12	0
Thallium	<0.0014	<0.0014	0
Vanadium	<0.0049	<0.0049	0
Zinc	<0.0044	<0.0044	0
Molybdeum	0.015	0.014	7
Mercury	<0.000041	<0.00041	0

Comments: Sample 13-Stream7-SW1 was a field duplicate of sample 13-Stream4-SW1 and all RPDs were within the control limit (<20%).

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

Analyte, Total (mg/kg)	13-Stream4-SD1	13-Stream7-SD1	RPD (%)
Aluminum	3700	3200	14
Antimony	0.34	0.28	19
Arsenic	5.2	4.3	19
Barium	98	81	19
Beryllium	0.14	0.12	15
Cadmium	0.84	0.69	20
Calcium	200000	170000	16
Chromium	8.1	6.9	16
Cobalt	3.3	2.7	20
Copper	24	21	13
Iron	6900	5800	17
Lead	12	8.8	31
Magnesium	2600	2200	17
Manganese	150	120	22
Nickel	8.7	7.3	8
Potassium	650	580	11
Selenium	1.8	1.4	25
Silver	0.095	0.071	29
Sodium	160	140	13
Thallium	<0.26	<0.29	Not calculated
Vanadium	13	11	17
Zinc	39	33	17
Molybdeum	1.8	1.4	25
Mercury	0.018	<0.012	*

*: RPD>35%

Comments: Sample 13-Stream7-SD1 was a field duplicate of sample 13-Stream4-SD1. All RPDs except Hg were within the control limit. The detected Hg result in 13-Stream4-SD1 was qualified as estimated (J) and the non-detected Hg result in 13-Stream7-SD1 was qualified as estimated (UJ).

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

Analyte, Total (mg/kg)	13-SC-Bench-SS2	13-SC-Bench-SS3	RPD (%)
Aluminum	1100	830	28
Antimony	0.84	1.1	27
Arsenic	3.2	3.7	14
Barium	78	86	10
Beryllium	0.26	0.23	12
Cadmium	1.7	2.0	16
Calcium	21000	18000	15
Chromium	0.60	0.62	3
Cobalt	3.1	2.2	34
Copper	17	19	11
Iron	9900	6800	37*
Lead	140	110	24
Magnesium	350	300	15
Manganese	540	480	12
Nickel	0.97	0.87	11
Potassium	750	500	40*
Selenium	1.2	0.89	30
Silver	1.6	2.7	51*
Sodium	33	<14	*
Thallium	<0.11	<0.12	Not calculated
Vanadium	1.3	1.1	17
Zinc	63	72	13
Molybdeum	67	47	35.1*
Mercury	1.0	1.1	10

*: RPD>35%

Comments: Sample 13-SC-Bench-SS3 was a field duplicate of sample 13-SC-Bench-SS2. The detected Fe, K, Ag, Na, and Mo results in 13-SC-Bench-SS2 and 13-SC-Bench-SS3 were qualified as estimated (J) and the non-detected Na result in 13-SC-Bench-SS3 was qualified as estimated (UJ).

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

Analyte, Total (mg/kg)	13-BKD-SS4	13-BKD-SS11	RPD (%)
Aluminum	14000	12000	8
Antimony	0.40	0.34	16
Arsenic	10	9.6	4
Barium	180	160	12
Beryllium	0.54	0.45	18
Cadmium	0.34	0.30	13
Calcium	3200	2700	17
Chromium	28	24	15
Cobalt	12	11	9
Copper	27	25	8
Iron	22000	20000	10
Lead	10	9.0	17
Magnesium	4800	4000	9
Manganese	540	490	10
Nickel	25	21	17
Potassium	2300	2100	9
Selenium	0.56	0.55	2
Silver	0.085	0.084	1
Sodium	57	43	28
Thallium	<0.14	<0.14	0
Vanadium	39	36	8
Zinc	60	54	11
Molybdeum	2.2	2.0	10
Mercury	0.012	0.0092	26

*: RPD>35%

Comments: Sample 13-BKD-SS11 was a field duplicate of sample 13-BKD-SS4 and all RPDs were within the control limit (<35%).

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

7. INTERFERENCE CHECK SAMPLES AND SERIAL DILUTION ANALYSIS

__X__ Acceptable
_____ Acceptable with qualification
_____ Unacceptable
_____ Not required

Interference Check Samples (ICS) - Unless flagged below, an ICS was analyzed at the beginning and end of each run and at least twice every eight hours. Recoveries were within a range of 80-120%. For analytes which exceeded these control limits, associated detected results are qualified as estimated (J) if the concentrations of Al, Ca, Fe, or Mg are higher in the sample than in the ICS.

Serial Dilution Analysis - Unless flagged below, a serial dilution analysis was performed at a rate of one per 20 samples on a sample having analyte concentrations greater than 50 times the IDL. Percent differences were within a range of 0-10%. For analytes which exceeded these control limits, associated detected results are qualified as estimated (J).

Comments: ICS recoveries were within the control limit.
Serial Dilution: Water sample 13-Stream1-SW1, sediment sample 13-Stream1-SD1, and soil sample 13-TC-Shaft5-SS-1 were used and the percent differences (%D) were within the range.

8. POST DIGESTION SPIKE AND STANDARD ADDITIONS

_____ Acceptable
_____ Acceptable with qualification
_____ Unacceptable
__X__ Not required

Post-digestion spikes - If a furnace AA result was flagged by the laboratory with an E to indicate interference, and the associated post-digestion spike recovery was less than 10%, the associated results are rejected (R).

Method of Standard Additions - If the method of standard additions was required and the correlation coefficient was less than 0.995, the associated results were qualified as estimated (J).
Comments:

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

9. ANALYTE QUANTITATION

Confirm that analyte quantitation was performed correctly using the following formulas:

Water samples:

ug/L = (Instrument printout concentration, mg/L)(1000 ug/mg)(final volume of extract, mL) / (Initial volume of extract, mL)

Soil samples:

mg/kg = (Instrument printout concentration, mg/L)(final volume of extract, mL)(0.001 L/mL) / (weight of sample extracted, g)(0.001 kg/g)(fraction solids)

Comments: Analyte quantitation was acceptable.

Water sample 13-Stream1-SW1
Dissolved Metals:
Ca: (92.28 mg/L) (50 mL/50 mL) =92.28 mg/L.
Lab reported 92 mg/L.
Mg: (18.24 mg/L) (50 mL/50 mL) =18.24 mg/L.
Lab reported 18 mg/L.
Mo: (5.934 ug/L) (5) (50 mL/50 mL) = 29.67 ug/L = 0.02967 mg/L.
Lab reported 0.030 mg/L.

Total Metals:
Ca: (95.70 mg/L) (50 mL/50 mL) =95.70 mg/L.
Lab reported 96 mg/L.
Mg: (18.11 mg/L) (50 mL/50 mL) =18.11 mg/L.
Lab reported 18 mg/L.
Mo: (5.901 ug/L) (5) (50 mL/50 mL) = 29.505 ug/L = 0.029505 mg/L.
Lab reported 0.030 mg/L.

Sediment sample 13-Stream2-SD1
Al: (36.68 mg/L) (0.05L/1.2899 g) (100/45.8) (1000 g/ 1 kg) = 3104.4 mg/kg.
Lab reported 3100 mg/kg.
Ca: (30.74 mg/L) (100) (0.05L/1.2899 g) (100/45.8) (1000 g/ 1 kg) = 260167 mg/kg.
Lab reported 260000 mg/kg.

As: (5.553 ug/L) (10) (0.05L/1.2899 g) (100/45.8) = 4.699765 ug/g = 4.699765 mg/kg.
Lab reported 4.7 mg/kg.
Pb: (65.610 ug/L) (10) (0.05L/1.2899 g) (100/45.8) = 55.5288 ug/g = 55.5288 mg/kg.
Lab reported 56 mg/kg.
Mo: (1.557 ug/L) (10) (0.05L/1.2899 g) (100/45.8) = 1.31776 ug/g = 1.31776 mg/kg.
Lab reported 1.3 mg/kg.

Hg: (0.288 ug/L) (5) (0.05 L/0.6385 g) (100/45.8) = 0.2463 ug/g = 0.2463 mg/kg.

Lab reported 0.25 mg/kg.

Soil sample 13-TC-PIT1-SS1
Al: (83.69 mg/L) (0.05L/1.1020 g) (100/94.2) (1000 g/ 1 kg) = 4030.98 mg/kg.
Lab reported 4000 mg/kg.
Ca: (92.59 mg/L) (0.05L/1.1020 g) (100/94.2) (1000 g/ 1 kg) = 4459.658 mg/kg.
Lab reported 4500 mg/kg.

As: (145.3 ug/L) (10) (0.05L/1.1020 g) (100/94.2) = 69.9847 ug/g = 69.9847 mg/kg.
Lab reported 70 mg/kg.
Pb: (3202 ug/L) (10) (0.05L/1.1020 g) (100/94.2) = 1542.264 ug/g = 1542.264 mg/kg.
Lab reported 1500 mg/kg.
Mo: (238.4 ug/L) (10) (0.05L/1.1020 g) (100/94.2) = 114.8269 ug/g = 114.8269 mg/kg.
Lab reported 110 mg/kg.

Hg: (0.846 ug/L) (5) (0.05 L/0.6062 g) (100/94.2) = 0.37038 ug/g = 0.37038 mg/kg.
Lab reported 0.37 mg/kg.

10. OVERALL ASSESSMENT OF DATA

On the basis of this review, the following determination has been made with regard to the overall data usability for the specified level.

_____ Acceptable
___X___ Acceptable with Qualification
_____ Rejected

Accepted data meet the minimum requirements for the following EPA data category:
_____ ERS Screening
_____ Non-definitive with 10 % Conformation by Definitive Methodology
_____ Definitive, Comprehensive Statistical Error Determination was performed.
___X___ Definitive, Comprehensive Statistical Error Determination was not performed.

Any qualifications to individual sample analysis results are detailed in the appropriate section above or appear under the comments section below. In cases where several QC criteria are out of specification, it may be appropriate to further qualify the data usability. The data reviewer must use professional judgment and express concerns and comments on the data validity for each specific data package.

Comments: Data as reported are valid.

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

11. USABILITY OF DATA

A. These data are considered usable for the data use objectives stated in the *FINAL TRIUNE WORK PLAN SAMPLING AND ANALYSIS PLAN, WASHINGTON, FEBRUARY 2013 (FSP).*

The following data use objective was indicated in the *FSP:*

TO DETERMINE CONCNETRATIONS OF COCS IN SOIL, SEDIMENT, AND SURFACE WATER.
TO DELINEATE THE AREAL EXTENT OF WASTE ROCK, FLOTATION TAILINGS, AND CONTAMINATED SOIL.
TO ASSESS WHETHER MINE CONTAMINANTS HAVE MIGRATED INTO THE UNNAMED STREAM AND OFFSITE.
TO EVALUATE POTENTIAL RISK TO HUMAN HEALTH AND THE ENVIRONMENT POSED BY SURFACE WATER, SOIL, AND SEDIMENT.
TO EVAULATE BACKGROUND CONDITIONS NEAR THE SITE.

THE DATA ARE USABLE FOR THE ABOVE OBJECTIVES.

B. These data meet quality objectives stated in the *QUALITY ASSURANCE PROJECT PLAN TRIUNE MINE, WASHINGTON, FEBRUARY 2013 (QAPP) .*

AS INDICATED IN SECTION 2 OF THE QAPP, THE INVESTIGATION WILL GENERATE BOTH SCREENING AND DEFINITIVE DATA AND TABLE 1-2 OF THE QAPP OUTLINES THE DATA QUALITY INDICATOR GOALS APPLICABLE TO THE DEFINITIVE DATA QUALITY LEVEL. THE DATA IN THIS PACKAGE MEET THESE REQUIREMENTS.

12. DOCUMENTATION OF LABORATORY CORRECTIVE ACTION

Problem: No problems requiring corrective action were found.

Resolution: Not required.

Attached are copies of all data summary sheets, with data qualifiers indicated, and a copy of the chain of custody for the samples.

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

Laboratory: TestAmerica	**Lab Project Number: 580-39227-1**
Sampling Dates: 6/21/2013	**Sample Matrix: Soil**
Analytical Method: TAL Metals + Mo	**Data Reviewer: M. Song**

by EPA 6010B/6020/7471A

REVIEW AND APPROVAL:

Data Reviewer: Mindy Song **Date: _____**
Technical QA Reviewer: _____ **Date: _____**
Project Manager: Mark Longtine **Date: _____**

SAMPLE IDENTIFICATION:

Sample No.	Sample I.D.	Lab ID
1	13-SC-outwash-SS1	580-39227-1
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

DATA PACKAGE COMPLETENESS CHECKLIST:

Checklist Code:

- X Included: no problems
- * Included: problems noted in review
- O Not Included and/or Not Available
- NR Not Required
- RS Provided As Re-submission

Case Narrative:

- X Case Narrative present

Quality Control Summary Package:

- X Data Summary sheets
- X Initial and Continuing Calibration results
- X CRDL Standard results
- * Preparation Blank and Calibration Blank results
- X ICP Interference Check Sample results
- * Matrix Spike recoveries
- * Matrix Duplicate results
- X Laboratory Control Sample recoveries
- NR Method of Standard Additions results
- * ICP Serial Dilution results
- X Instrument Detection Limits
- X ICP Interelement Correction Factors
- X ICP Linear Ranges
- X Preparation Log
- X Analysis Run Log

Raw QC Data Package Section

- X Chain-of-Custody Records
- X Instrument Printouts
- X Sample Preparation Notebook Pages
- X Logbook and Worksheet Pages
- X Percent Solids Determination

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

DATA VALIDATION SUMMARY

The data were validated in accordance with the National Functional Guidelines for Inorganic Data Review (EPA 2010), National Functional Guidelines for Organic Data Review (EPA 2008), Guidelines for Data Reporting , Data Reduction in conjunction with the QA/QC requirements specified in each specific analytical method and any project-specific QC defined in the QAPP.

Indicate with a YES or NO whether each item is acceptable without qualification:

1	**Holding Times**	**NO**
2	**Initial and Continuing Calibrations**	**YES**
3	**Laboratory Control Sample**	**YES**
4	**Matrix Spike**	**NO**
5	**Blanks and Background Samples**	**YES**
6	**Duplicate Analyses**	**YES**
7	**Interference Check Samples and Serial Dilution Analysis**	**NO**
8	**Post Digestion Spike and Standard Addition Analysis**	**N/A**
9	**Analyte Quantitation**	**YES**
10	**Overall Assessment of Data**	**YES**
11	**Usability of Data**	**NO**

Comments: N/A: Not Applicable.
No rinsate samples were required because dedicated sampling equipment was used.

EPA SW-846 Method 6010B (ICP) was used to analyze Al, Fe, Mg, K, Na, and Ca.
EPA SW-846 Method 6020 (ICP/MS) was used to analyze As, Sb, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Tl, V, and Zn .
EPA SW-846 Method 7471A & 7470A (CVAA) were used to analyze Hg.

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

1. HOLDING TIMES

_____ Acceptable
___X___ Acceptable with qualification
_____ Unacceptable

Samples were extracted and analyzed within required holding times except as noted under Comments. In addition, no problems were identified with regard to sample preservation or custody unless specified. For those samples analyzed outside holding time requirements, the detected results have been qualified as estimated (J), and the nondetected results have been qualified either as estimated (UJ) or rejected (R) based on the reviewer's judgement.

All Sample Matrices:
Mercury: 28 days (from collection) for analysis.
Hexavalent chromium: 24 hours (from collection) for analysis.
All other metals: 180 days (from collection) for analysis.

Comments: The sample met the required method holding times but the temperature of a cooler at receipt was 14.5°C. Since the thermal preservation was required for Hg, the detected Hg result was qualified as estimated (J).

2. INITIAL AND CONTINUING CALIBRATION VERIFICATION

___X___ Acceptable
_____ Acceptable with qualification
_____ Unacceptable

Unless flagged below, an initial calibration verification (ICV) and a calibration blank were analyzed at the beginning of the run, and a continuing calibration verification (CCV) and a calibration blank were analyzed after every ten samples, and at the end of the run. ICV and CCV recoveries were within a range of 80-120% for mercury and tin, and 90-110% for all other metals. For analytes which exceeded these control limits, associated detected results are qualified as estimated (J). In cases where the recovery was below 65% or above 135% (for mercury and tin) or below 75% or above 125% (for all other metals), all associated data are rejected (R).

Comments: All recoveries of metals in initial and continuing calibration verifications were within the control limits.

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

3. LABORATORY CONTROL SAMPLE

___X___ Acceptable
_____ Acceptable with qualification
_____ Unacceptable
_____ No Laboratory Control Samples Analyzed

Laboratory control sample recoveries are used for a qualitative indication of accuracy (bias) independent of matrix effects. LCS recovery limits should either be specified in the Sampling and Analysis Plan or can be established by the laboratory. For analytes which exceeded these control limits, associated detected results are qualified as estimated (J). In cases where the recovery was below 30%, all associated nondetected results are rejected (R) and detected results are qualified as estimated (J).

Comments: The LCS percent recoveries were within the control limits.

4. MATRIX SPIKE

_____ Acceptable
___X___ Acceptable with qualification
_____ Unacceptable
_____ No Matrix Spikes Analyzed

Matrix spike recoveries are used for a qualitative indication of accuracy (bias) due to matrix effects. Unless flagged below, one laboratory control sample was analyzed at a rate of one per batch or one per 20 samples. Recoveries were within a range of 75-125%. For analytes which exceeded these control limits, associated detected results are qualified as estimated (J). In cases where the recovery was below 30%, all associated nondetected results are rejected (R) and detected results are qualified as estimated (J).

Comments: Sample 13-SC-outwash-SS1 was used for MS/MSD analysis (ICP metals) and the recoveries of Al, Fe, K, Na, Ca, and Mg were outside of control limits. Qualification was not required for Al because the amount of aluminum present in the parent sample was greater than four times the amount spiked. The detected Fe, K, Na, Ca, and Mg results were qualified as estimated (J). Sample with Lab ID 580-39382-1 was used for MS/MSD analysis (ICP/MS metals) and the recoveries of Cr, Mn, and Zn were outside of control limits. Qualification was not required for Mn because the amount of manganese present in the parent sample was greater than four times the amount spiked. The detected Cr and Zn result were qualified as estimated (J).

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

5. BLANKS AND BACKGROUND SAMPLES

__X__ Acceptable
_____ Detection Limits Adjusted

The following blanks were analyzed:
__X__ Method (preparation) Blanks
_____ Field Blanks
_____ Calibration Blanks
_____ Rinsate Blanks
_____ Background Samples

Preparation (method) blanks were prepared for each batch of samples extracted. A preparation blank was analyzed after every continuing calibration standard, prior to sample analysis unless noted below. Any compound detected in the sample and also detected in any associated blank, must be qualified as non-detect (U) when the sample concentration is less than 5x the blank concentration.

Comments: Trace amount of Fe (4.88 mg/kg), Be (0.0282 mg/kg), and Pb (0.023 mg/kg) were detected in the method blank. These levels were above the method detection limit but below the reporting limit. The detected Be result in 13-SC-outwash-SS1 was qualified as non-detect (U) since the sample concentration was less than 5x the blank concentration.

6. DUPLICATE ANALYSES

__X__ Acceptable
_____ Acceptable with qualification
_____ Unacceptable
_____ No Duplicates Analyzed

Type of duplicates analyzed:
_____ Field Duplicates
__X__ Laboratory Duplicates

Calculate the relative Percent Difference (RPD) between the members of duplicate pairs using the equation indicated below. Qualify the detected results as estimated (J) for any analyte whose RPD in a laboratory duplicate exceeds 20% for water samples or 35% for soil samples.

$$\text{RPD} = \frac{2(\text{Value 1} - \text{Value 2})}{\text{Value 1} + \text{Value 2}} \times 100\%$$

Comments: RPDs of MS & MSD <35%.

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	**Location: Okanogan County, WA**
Project Number: EE-004077-0001-03TTO	

7. INTERFERENCE CHECK SAMPLES AND SERIAL DILUTION ANALYSIS

_____ Acceptable
__X__ Acceptable with qualification
_____ Unacceptable
_____ Not required

Interference Check Samples (ICS) - Unless flagged below, an ICS was analyzed at the beginning and end of each run and at least twice every eight hours. Recoveries were within a range of 80-120%. For analytes which exceeded these control limits, associated detected results are qualified as estimated (J) if the concentrations of Al, Ca, Fe, or Mg are higher in the sample than in the ICS.

Serial Dilution Analysis - Unless flagged below, a serial dilution analysis was performed at a rate of one per 20 samples on a sample having analyte concentrations greater than 50 times the IDL. Percent differences were within a range of 0-10%. For analytes which exceeded these control limits, associated detected results are qualified as estimated (J).

Comments: ICS recoveries were within the control limit.
Serial Dilution: Sample 13SC-outwash-SS1 was used and the percent differences (%D) of Al, Fe, and Na were outside of the required range. The detected Al, Fe, Na results were qualified as estimated (J).

8. POST DIGESTION SPIKE AND STANDARD ADDITIONS

_____ Acceptable
_____ Acceptable with qualification
_____ Unacceptable
__X__ Not required

Post-digestion spikes - If a furnace AA result was flagged by the laboratory with an E to indicate interference, and the associated post-digestion spike recovery was less than 10%, the associated results are rejected (R).

Method of Standard Additions - If the method of standard additions was required and the correlation coefficient was less than 0.995, the associated results were qualified as estimated (J).
Comments:

ANALYTICAL DATA REVIEW SUMMARY

Tier 2 Validation

Site Name: Triune Mine	Location: Okanogan County, WA
Project Number: EE-004077-0001-03TTO	

9. ANALYTE QUANTITATION

Confirm that analyte quantitation was performed correctly using the following formulas:

Water samples:

$$\text{ug/L} = \frac{\text{(Instrument printout concentration, mg/L)(1000 ug/mg)(final volume of extract, mL)}}{\text{(Initial volume of extract, mL)}}$$

Soil samples:

$$\text{mg/kg} = \frac{\text{(Instrument printout concentration, mg/L)(final volume of extract, mL)(0.001 L/mL)}}{\text{(weight of sample extracted, g)(0.001 kg/g)(fraction solids)}}$$

Comments: Analyte quantitation was acceptable.

Sample 13-SC-outwash-SS1
Al: (32.42 mg/L) (0.05L/1.0223 g) (100/74) (1000 g/ 1 kg) = 2142.8 mg/kg.
Lab reported 2100 mg/kg.
Ca: (43.82 mg/L) (0.05L/1.0223 g) (100/74) (1000 g/ 1 kg) = 2896.2 mg/kg.
Lab reported 2900 mg/kg.

As: (18.47 ug/L) (10) (0.05L/1.0763 g) (100/74) = 11.595 ug/g = 11.595 mg/kg.
Lab reported 12 mg/kg.
Pb: (238.2 ug/L) (10) (0.05L/1.0763 g) (100/74) = 149.536 ug/g = 149.536 mg/kg.
Lab reported 150 mg/kg.
Mo: (5.965 ug/L) (10) (0.05L/1.0763 g) (100/74) = 3.745 ug/g = 3.745 mg/kg.
Lab reported 3.7 mg/kg.

Hg: (2.62 ug/L) (10) (0.05 L/0.6908 g) (100/74) = 2.5626 ug/g = 2.5626 mg/kg.
Lab reported 2.6 mg/kg.

10. OVERALL ASSESSMENT OF DATA

On the basis of this review, the following determination has been made with regard to the overall data usability for the specified level.

_____ Acceptable
___X___ Acceptable with Qualification
_____ Rejected

Accepted data meet the minimum requirements for the following EPA data category:
_____ ERS Screening
_____ Non-definitive with 10 % Conformation by Definitive Methodology
_____ Definitive, Comprehensive Statistical Error Determination was performed.
___X___ Definitive, Comprehensive Statistical Error Determination was not performed.

Any qualifications to individual sample analysis results are detailed in the appropriate section above or appear under the comments section below. In cases where several QC

criteria are out of specification, it may be appropriate to further qualify the data usability. The data reviewer must use professional judgment and express concerns and comments on the data validity for each specific data package.

Comments: Data as reported are valid.

11. USABILITY OF DATA

A. These data are considered usable for the data use objectives stated in the *FINAL TRIUNE WORK PLAN SAMPLING AND ANALYSIS PLAN, WASHINGTON, FEBRUARY 2013 (FSP).*

The following data use objective was indicated in the *FSP:*

TO DETERMINE CONCNETRATIONS OF COCS IN SOIL, SEDIMENT, AND SURFACE WATER.
TO DELINEATE THE AREAL EXTENT OF WASTE ROCK, FLOTATION TAILINGS, AND CONTAMINATED SOIL.
TO ASSESS WHETHER MINE CONTAMINANTS HAVE MIGRATED INTO THE UNNAMED STREAM AND OFFSITE.
TO EVALUATE POTENTIAL RISK TO HUMAN HEALTH AND THE ENVIRONMENT POSED BY SURFACE WATER, SOIL, AND SEDIMENT.
TO EVAULATE BACKGROUND CONDITIONS NEAR THE SITE.

THE DATA ARE USABLE FOR THE ABOVE OBJECTIVES.

B. These data meet quality objectives stated in the *QUALITY ASSURANCE PROJECT PLAN TRIUNE MINE, WASHINGTON, FEBRUARY 2013 (QAPP) .*

AS INDICATED IN SECTION 2 OF THE QAPP, THE INVESTIGATION WILL GENERATE BOTH SCREENING AND DEFINITIVE DATA AND TABLE 1-2 OF THE QAPP OUTLINES THE DATA QUALITY INDICATOR GOALS APPLICABLE TO THE DEFINITIVE DATA QUALITY LEVEL. THE DATA IN THIS PACKAGE MEET THESE REQUIREMENTS.

12. DOCUMENTATION OF LABORATORY CORRECTIVE ACTION

Problem: No problems requiring corrective action were found.

Resolution: Not required.

Attached are copies of all data summary sheets, with data qualifiers indicated, and a copy of the chain of custody for the samples.

This page intentionally left blank.

C XRF Field Screening Data

Appendix C

Table 1, Source Delineation XRF Measurements

Reading	Date	Location	Quadrant[1]	Direction	Lateral[2]	Mode	Run time[3]	Ti	Ti +/-	Cr	Cr +/-	Mn	Mn +/-	Fe	Fe +/-	Co	Co +/-	Ni	Ni +/-	Cu	Cu +/-	Zn	Zn +/-	As	As +/-	Se	Se +/-	Rb	Rb +/-	Sr	Sr +/-	Zr	Zr +/-	Mo	Mo +/-	Ag	Ag +/-	Cd	Cd +/-	Sn	Sn +/-	Sb	Sb +/-	I	I +/-	Ba	Ba +/-	W	W +/-	Hg	Hg +/-	Pb	Pb +/-	Th	Th +/-
6	24-Jun-13	TC-pit	Quadrant A	W	inner	Soil	38.23	3737	402	61	44	726	49	36284	428	501	74	2	17	152	12	650	17	36	23	0	3	69	3	247	5	232	6	30	3	48	11	4	14	-17	22	-8	24	NA		510	139	12	7	-10	7	3812	49	2	2
7	24-Jun-13	TC-pit	Quadrant A	W	point 2	Soil	39.62	2921	311	22	34	578	38	21252	243	358	51	-7	13	47	8	136	7	7	4	0	1	46	2	309	5	175	5	2	2	-21	9	4	12	3	19	-27	21	NA		192	108	1	4	0	4	134	6	4	2
8	24-Jun-13	TC-pit	Quadrant C	E	point 1	Soil	39.48	1474	284	50	37	366	36	17059	222	69	48	-5	13	152	12	199	9	248	22	0	3	31	2	62	2	52	4	25	3	7	10	10	13	10	21	-3	23	NA		-47	102	6	6	6	7	3529	45	1	2
9	24-Jun-13	TC-pit	Quadrant C	E	point 2	Soil	39.29	3039	308	21	34	635	40	21992	249	325	52	14	13	56	8	255	9	19	7	1	1	46	2	286	5	186	5	3	2	-18	9	-12	12	18	19	-4	21	NA		57	105	2	4	-6	4	352	9	5	2
10	24-Jun-13	TC-pit	Quadrant B	N	point 1	Soil	40.51	2349	305	17	34	1141	49	19769	231	275	49	-23	12	61	8	75	6	11	3	-1	1	45	2	218	4	154	5	5	2	-23	10	-4	12	-13	19	13	21	NA		305	109	2	4	7	4	63	5	1	2
12	24-Jun-13	TC-pit	Quadrant B	N	point 2	Soil	40.49	3747	334	16	35	854	45	24420	276	337	55	4	13	36	8	91	6	0	3	1	1	60	2	266	5	248	6	4	3	-27	10	6	12	-19	19	-8	21	NA		137	112	4	4	4	4	54	5	4	2
14	24-Jun-13	TC-pit	Quadrant D	S	point 1	Soil	40.45	1553	338	15	42	2821	83	31596	375	342	68	-6	16	1148	27	1337	26	118	16	0	2	115	3	91	3	142	5	47	3	7	11	26	14	25	22	-1	24	NA		401	126	13	9	-2	7	1814	27	2	2
15	24-Jun-13	TC-pit	Quadrant D	S	point 2	Soil	41.18	4973	417	55	42	696	48	37347	429	569	74	1	16	104	11	657	16	18	3	-1	1	50	2	382	6	204	6	3	3	9	10	14	13	0	21	-11	23	NA		542	140	4	6	7	5	22	4	0	2
8	25-Jun-13	BLM-shaft1	Quadrant B	N	point 1	Soil	43.34	786	321	35	39	606	44	12973	193	-10	44	21	14	34	9	102	7	5	3	1	1	102	3	141	4	92	5	370	6	3	11	13	14	-13	23	36	26	NA		600	126	3	4	2	4	32	5	-2	2
9	25-Jun-13	BLM-shaft1	Quadrant B	N	point 2	Soil	40.01	1747	279	50	35	783	42	19715	229	326	49	3	13	45	8	114	6	13	3	-1	1	48	2	243	4	122	4	14	2	-35	9	19	12	10	19	-30	21	NA		97	102	6	4	-2	3	19	4	6	2
11	25-Jun-13	BLM-shaft1	Quadrant A	W	point 1	Soil	42.98	1750	323	88	41	2324	75	20967	269	255	56	-1	14	64	10	154	8	22	6	-1	1	88	3	114	3	152	5	45	3	3	11	12	13	13	22	0	24	NA		249	120	2	4	-2	4	172	7	4	2
12	25-Jun-13	BLM-shaft1	Quadrant A	W	point 2	Soil	41.12	2379	317	-68	34	899	47	26958	306	484	60	19	15	68	9	120	7	12	3	-1	1	93	3	178	4	183	5	19	3	-36	10	-14	12	2	19	3	21	NA		188	114	-5	4	9	4	13	4	9	2
14	25-Jun-13	BLM-shaft1	Quadrant C	E	point 1	Soil	43.85	1193	313	-30	36	642	44	14756	209	159	48	10	14	15	9	65	6	13	3	1	1	137	4	239	5	111	5	30	3	3	11	31	14	20	22	30	25	NA		351	119	7	4	8	5	23	4	3	2
15	25-Jun-13	BLM-shaft1	Quadrant C	E	point 2	Soil	41.23	3618	344	23	37	581	41	27923	318	301	60	26	15	44	9	84	6	12	3	-1	1	49	2	306	5	181	5	13	3	-24	10	-12	12	18	20	-19	22	NA		141	117	4	4	-2	3	11	4	4	2
16	25-Jun-13	BLM-shaft1	Quadrant D	S	point 1	Soil	40.7	1349	310	13	35	2729	74	15613	197	115	44	-5	12	17	8	104	6	7	4	-2	1	84	3	215	4	83	4	25	3	-11	10	-4	12	3	20	11	22	NA		744	119	13	4	0	4	63	5	0	2
17	25-Jun-13	BLM-shaft1	Quadrant D	S	point 2	Soil	40.47	3605	314	40	35	667	40	20951	239	325	51	-3	13	19	7	92	6	8	3	-1	1	45	2	287	5	170	5	12	2	-38	9	-21	12	-7	19	6	20	NA		-33	105	7	4	-3	3	12	4	6	2
18	25-Jun-13	TC-shaft2	Quadrant A	W	point 1	Soil	39.58	1331	287	20	35	513	38	22912	262	283	53	-9	13	43	8	144	7	29	5	1	1	91	3	92	3	109	4	22	3	7	10	14	12	29	20	27	22	NA		274	108	0	4	9	4	190	7	4	2
19	25-Jun-13	TC-shaft2	Quadrant A	W	point 2	Soil	40.68	3198	343	30	37	736	44	26492	305	418	60	-1	14	41	9	135	7	9	3	-2	1	53	2	289	5	188	5	5	3	6	10	-10	13	-21	20	-35	22	NA		304	120	3	4	0	4	37	4	4	2
20	25-Jun-13	TC-shaft2	Quadrant B	N	point 1	Soil	41.51	971	299	73	40	189	33	22396	281	193	57	-18	14	27	9	145	8	57	12	3	2	105	3	45	2	190	5	93	3	9	11	2	13	24	22	-28	24	NA		210	114	1	5	6	5	1023	19	3	2
21	25-Jun-13	TC-shaft2	Quadrant B	N	point 2	Soil	41.27	3370	360	55	40	819	48	29001	338	461	64	-30	14	51	9	158	8	12	3	-1	1	55	2	281	5	205	6	6	3	-3	10	16	13	-14	21	-15	23	NA		338	126	-1	4	3	4	36	5	6	2
22	25-Jun-13	TC-shaft2	Quadrant C	E	point 1	Soil	39.84	1870	284	37	34	534	37	20306	236	310	50	-3	13	30	8	150	7	3	6	0	1	80	3	156	3	153	5	28	3	-6	10	-28	12	-11	20	12	21	NA		105	102	4	4	7	4	280	8	2	2
23	25-Jun-13	TC-shaft2	Quadrant C	E	point 2	Soil	39.78	2495	305	18	34	844	44	22176	251	386	52	-20	13	26	8	108	6	6	3	1	1	62	2	263	4	198	5	3	2	-19	9	-17	12	-1	19	22	20	NA		242	108	4	4	4	4	20	4	3	2
24	25-Jun-13	TC-shaft2	Quadrant D	S	point 1	Soil	39.79	3110	339	122	39	665	43	24093	281	281	56	20	14	47	9	146	7	8	4	2	1	68	2	200	4	123	5	-3	2	14	10	-3	13	37	21	-24	23	NA		314	118	3	4	5	4	99	6	-1	2
25	25-Jun-13	TC-shaft2	Quadrant D	S	point 2	Soil	38.6	2722	288	13	32	592	36	20163	222	275	47	3	12	35	8	165	7	10	3	0	1	52	2	302	5	164	5	3	2	-37	9	-2	11	12	18	45	19	NA		125	100	0	4	3	3	25	4	2	2
26	25-Jun-13	TC-mill	Quadrant A	W	point 1	Soil	39.6	2250	307	90	37	485	37	19997	236	298	51	17	13	92	9	208	9	25	8	0	1	35	2	355	6	125	5	14	3	-6	10	-8	12	21	20	40	21	NA		263	111	-4	4	10	4	537	12	5	2
27	25-Jun-13	TC-mill	Quadrant A	W	point 2	Soil	38.9	2230	267	-27	29	452	32	15101	174	276	41	-34	11	53	8	357	10	16	9	0	1	30	2	206	4	98	4	10	2	-31	9	15	11	-15	17	8	18	NA		88	95	-3	4	10	4	756	13	6	2
28	25-Jun-13	TC-mill	Quadrant A	W	point 3	Soil	40.06	2640	307	35	35	620	39	21057	243	304	51	3	13	47	8	101	6	5	4	-1	1	45	2	339	5	187	5	5	2	-33	9	0	12	-28	19	-17	21	NA		183	108	8	4	-5	3	120	6	3	2
29	25-Jun-13	TC-mill	Quadrant B	N	point 1	Soil	37.58	2267	280	5	31	411	33	18810	216	349	48	11	13	27	8	103	6	7	4	0	1	51	2	227	4	147	5	22	2	-3	9	5	12	-8	19	7	21	NA		49	98	2	4	0	3	135	6	-1	2
31	25-Jun-13	TC-mill	Quadrant B	N	point 2	Soil	40.33	1725	267	-6	31	383	32	13804	171	162	41	-1	12	38	8	101	6	6	6	0	1	34	2	390	6	111	5	14	2	-28	9	-20	12	-5	19	-11	20	NA		113	97	0	4	5	4	341	9	2	2
32	25-Jun-13	TC-mill	Quadrant B	N	point 3	Soil	41.11	3990	355	101	39	522	40	24569	287	316	57	40	15	37	8	87	6	18	5	-2	1	39	2	399	6	138	5	2	3	-22	10	-20	12	-25	20	-16	22	NA		216	119	5	4	4	4	150	7	3	2
33	25-Jun-13	TC-mill	Quadrant C	E	point 1	Soil	38.61	746	237	-34	29	153	25	9551	130	106	34	14	12	121	10	399	11	1	16	3	2	38	2	146	3	67	4	20	2	-2	9	0	12	-13	19	27	20	NA		78	90	5	5	7	6	2254	29	1	2
34	25-Jun-13	TC-mill	Quadrant C	E	point 2	Soil	36.95	1463	235	-7	28	229	26	9997	129	132	34	4	11	58	8	205	8	-20	9	0	1	23	2	250	4	75	4	7	2	-17	9	9	11	2	18	-18	19	NA		-77	84	-1	4	7	4	837	14	1	2
35	25-Jun-13	TC-mill	Quadrant D	S	point 1	Soil	40.87	2048	293	54	35	452	36	20141	234	272	50	3	13	32	8	162	7	1	4	-2	1	61	2	297	5	169	5	5	2	-28	10	15	12	-8	19	-33	21	NA		211	106	0	4	6	4	128	6	2	2
36	25-Jun-13	TC-mill	Quadrant D	S	point 2	Soil	40.5	1068	293	50	38	64	29	28349	323	203	60	6	14	22	8	33	5	24	3	7	1	139	3	128	3	156	5	38	3	11	10	-9	13	-12	20	-11	22	NA		273	112	6	4	5	4	12	4	2	2
37	25-Jun-13	TC-mill	Quadrant D	S	point 3	Soil	40.19	2499	285	-14	31	617	38	19155	218	271	47	-25	12	17	7	155	7	7	3	1	1	52	2	280	5	169	5	6	2	-51	9	-4	11	-22	18	-18	20	NA		65	99	-4	3	3	3	64	5	2	2
38	25-Jun-13	TC-camp	Quadrant A	W	point 1	Soil	41.34	3614	340	47	37	560	41	23808	282	344	57	5	14	53	9	152	8	15	3	-1	1	46	2	342	6	165	5	-1	3	-4	10	-13	13	29	20	8	22	NA		40	114	-1	4	1	4	27	4	5	2
39	25-Jun-13	TC-camp	Quadrant A	W	point 2	Soil	41.63	2405	326	67	38	378	36	19970	244	308	52	12	14	33	8	130	7	18	3	0	1	34	2	321	5	131	5	4	3	-12	10	-2	13	7	20	-13	22	NA		369	118	-1	4	1	4	22	4	4	2
40	25-Jun-13	TC-camp	Quadrant B	N	point 1	Soil	40.28	4093	380	114	42	628	44	29275	338	369	63	21	15	52	9	76	6	16	3	-1	1	47	2	336	6	172	5	3	3	-10	10	1	13	-14	20	4	22	NA		496	131	2	4	3	4	12	4	2	2
41	25-Jun-13	TC-camp	Quadrant A	W	point 3	Soil	41.58	3051	333	74	38	660	43	25338	293	258	57	18	14	25	8	51	5	10	3	-3	1	53	2	307	5	139	5	5	3	-19	10	-2	12	21	20	9	21	NA		220	116	2	4	4	4	13	4	3	2
42	25-Jun-13	TC-camp	Quadrant B	N	point 2	Soil	42.85	4957	428	16	42	657	48	35734	424	258	72	23	16	43	9	59	6	26	3	0	1	47	2	368	6	166	6	0	3	-3	11	-12	13	29	22	0	24	NA		558	144	2	4	5	4	13	4	2	2
43	25-Jun-13	TC-camp	Quadrant B	N	point 3	Soil	42.44	4431	406	109	44	742	49	35660	414	301	71	-8	15	57	9	57	6	20	3	1	1	45	2	331	6	143	5	-4	3	-7	10	-4	13	-38	21	-48	23	NA		507	138	2	4	1	4	7	4	1	2
44	25-Jun-13	TC-camp	Quadrant C	E	point 1	Soil	41.18	3965	354	75	40	606	42	27505	318	305	60	23	15	42	9	102	6	21	3	0	1	44	2	326	5	137	5	6	3	1	10	-9	13	17	20	21	22	NA		73	119	-1	4	-1	3	11	4	9	2
45	25-Jun-13	TC-camp	Quadrant C	E	point 2	Soil	39.91	4927	389	20	39	724	45	29539	338	370	63	24	15	76	9	76	6	15	3	-2	1	48	2	368	6	207	6	-4	3	16	10	-20	13	45	21	6	23	NA		351	129	3	4	3	4	33	4	5	2
46	25-Jun-13	TC-camp	Quadrant C	E	point 3	Soil	42.32	6019	481	191	51	867	55	45413	537	411	83	24	18	54	10	79	7	31	3	1	1	49	2	380	6	219	6	1	3	15	11	11	14	21	23	-12	25	NA		822	162	2	4	2	4	2	4	3	2
47	25-Jun-13	TC-camp	Quadrant D	S	point 1	Soil	40.18	1123	256	10	32	499	35	13942	172	187	41	-1	12	24	8	324	10	8	3	0	1	71	2	387	6	105	5	7	2	-31	9	-11	12	16	18	-13	20	NA		128	98	0	4	7	4	22	4	7	2
48	25-Jun-13	TC-camp	Quadrant D	S	point 2	Soil	39.74	1587	276	77	34	273	30	9767	139	77	36	45	13	19	8	76	6	6	2	1	1	21	2	289	5	54	4	0	2	-7	10	11	13	-18	20	-28	22	NA		157	101	-2	3	3	3	12	4	-1	2
49	25-Jun-13	SC-bench	Quadrant A	W	point 1	Soil	39.07	1125	247	-28	29	207	26	11958	150	42	36	18	11	24	7	152	7	11	9	-1	1	29	2	485	6	87	4	51	3	-5	9	-30	11	-3	18	39	19	NA		142	93	2	4	1	4	738	13	3	2
50	25-Jun-13	SC-bench	Quadrant A	W	point 2	Soil	39.36	881	222	-76	26	205	25	8553	115	146	31	-23	10	51	8	148	7	6	8	-2	1	23	2	293	5	87	4	13	2	-43	9	7	11	-6	18	-20	19	NA		-41	84	-2	4	1	4	613	12	7	2
51	25-Jun-13	SC-bench	Quadrant B	N	point 1	Soil	40.28	303	233	-111	29	292	30	17436	203	266	45	-9	12	17	7	273	9	11	4	-3	1	55	2	418	6	80	4	19	2	-46	9	8	11	111	18	22	19	NA		70	94	9	4	-3	4	72	5	11	2
52	25-Jun-13	SC-bench	Quadrant B	N	point 2	Soil	41.55	3914	359	50	37	589	42	24432	291	195	57	33	14	43	9	55	5	5	3	0	1	46	2	283	5	169	5	-4	3	0	10	-1	13	10	21	-51	23	NA		238	120	-1	4	11	4	15	4	-1	2
53	25-Jun-13	SC-bench	Quadrant C	E	point 1	Soil	38.42	2241	287	24	33	487	35	18306	213	169	46	9	12	37	8	52	5	8	2	-2	1	40	2	432	6	133	5	4	2	-27	9	-21	12	11	19	13	20	NA		135	102	1	3	0	3	9	3	2	2
54	25-Jun-13	SC-bench	Quadrant C	E	point 2	Soil	39.54	2375	267	-4	30	422	32	16486	190	194	43	-6	11	3	7	84	5	1	3	-2	1	29	2	326	5	110	4	5	2	-29	9	-8	11	-3	18	-38	19	NA		-66	92	-2	3	0	3	37	4	3	2
55	25-Jun-13	SC-bench	Quadrant D	S	point 1	Soil	36.65	751	197	-43	24	157	22	8502	107	116	29	-14	9	21	7	79	5	5	4	0	1	34	2	461	6	67	4	27	2	-28	8	0	10	15	16	13	18	NA		-106	74	2	3	-5	3	108	5	2	1
56	25-Jun-13	SC-bench	Quadrant D	S	point 2	Soil	39.88	2694	328	-6	37	627	42	25067	291	315	57	4	14	97	10	433	13	45	11	2	2	51	2	380	6	158	5	11	3	-8	10	5	13	25	20	-17	22	NA		229	116	0	5	9	5	1008	17	7	2
57	25-Jun-13	SC-bench	Quadrant D	S	point 3	Soil	38.39	2079	277	-48	31	650	38	16146	193	157	43	-13	11	20	7	156	7	13	5	-3	1	50	2	352	5	136	5	11	2	-26	9	-12	12	-15	19	-2	20	NA		56	99	-3	4	2	3	156	6	8	2
58	25-Jun-13	SC-outwash	Quadrant A	W	point 1	Soil	43.32	372	241	33	32	60	21	2354	59	-15	19	14	11	6	8	27	4	-1	2	-1	1	7	1	357	6	14	4	5	3	-32	10	-11	13	-29	20	-24	22	NA		182	97	-2	3	-2	3	4	3	1	2
59	25-Jun-13	SC-outwash	Quadrant A	W	point 2	Soil	39.45	2336	288	55	33	352	32	15419	187	209	43	-2	12	31	8	46	5	9	3	1	1	36	2	293	5	108	4	2	2	-6	9	-13	12	-7	19	-22	21	NA		157	102	8	4	-2	3	36	4	1	2
60	25-Jun-13	SC-outwash	Quadrant A	W	point 3	Soil	41.9	5144	392	67	41	678	45	31856	366	428	66	40	16	64	9	77	6	12	3	-1	1	48	2	350	6	252	6	2	3	-25	10	-1	13	11	20	-9	22	NA		180	128	0	4	2	4	7	4	5	2
61	25-Jun-13	SC-outwash	Quadrant B	N	point 1	Soil	42.67	935	267	22	34	114	26	5253	99	18	29	17	12	26	9	132	8	22	7	-2	1	9	1	345	6	24	4	12	3	-3	11	-7	14	-6	21	-16	23	NA		76	102	2	4	8	4	258	9	3	2
62	25-Jun-13	SC-outwash	Quadrant B	N	point 2	Soil	40.99	3612	359	51	38	554	40	24197	284	348	57	12	14	38	8	43	5	11	3	0	1	41	2	346	6	181	5	4	3	-11	10	0	13	37	20	-4	22	NA		465	125	7	4	-1	4	1	4	5	2
63	25-Jun-13	SC-outwash	Quadrant B	N	point 3	Soil	40.45	3328	342	0	36	548	40	21526	258	281	53	6	14	54	9	128	7	4	5	-1	1	48	2	333	5	153	5	10	3	-9	10	-15	12	-18	20	14	22	NA		293	118	3	4	-2	4	206	8	5	2
64	25-Jun-13	SC-outwash	Quadrant C	E	point 1	Soil	43.57	733	247	1	32	143	26	4514	88	15	26	14	12	13	8	34	5	1	3	-1	1	11	1	379	6	35	4	7	3	-19	10	27	13	-11	21	-38	22	NA		-28	96	1	3	0	3	46	5	5	2
65	25-Jun-13	SC-outwash	Quadrant C	E	point 2	Soil	42.3	952	232	-4	29	169	25	5032	89	4	26	2	11	11	7	52	5	5	4	-1	1	11	1	331	5	35	4	0	2	-39	10	5	12	-11	19	2	21	NA		-112	87	0	3	-2	3	84	5	2	2
66	25-Jun-13	SC-outwash	Quadrant C	E	point 3	Soil	42.67	882	257	11	32	234	29	7637	120	130	34	-4	12	25	8	91	6	9	5	-2	1	17	2	343	6	64	4	6	3	-12	10	-6	13	-5	20	16	22	NA		100	99	0	4	6	4	125	6	3	2
67	25-Jun-13	SC-outwash	Quadrant D	S	point 1	Soil	43.67	1112	247	8	32	166	26	4248	84	9	25	26	12	0	8	29	4	3	2	0	1	11	1	391	6	30	4	8	3	-37	10	12	13	-13	21	-46	22	NA		-162	92	1	3	1	3	-3	4	5	2
68	25-Jun-13	SC-outwash	Quadrant D	S	point 2	Soil	40.41	2088	282	-2	33	441	35	17007	204	242	46	7	12	11	7	46	5	11	2	-2	1	36	2	500	7	121	5	12	2	-17	9	-5	12	29	19	-9	21	NA		63	101	0	3	2	3	0	3	6	2
69	25-Jun-13	SC-outwash	Quadrant D	S	point 3	Soil	40.16	2563	306	23	34	437	35	17592	211	252	47	11	13	17	8	47	5	11	3	-1	1	38	2	514	7	248	6	13	3	4	10	-7	12	-11	19	22	21	NA		229	109	1	3	-3	3	5	4	5	2
70	25-Jun-13	SC-outwash		center		Soil	44.16	509	240	13	32	41	21	747	35	16	14	-19	10	-20	7	21	4	0	2	0	1	2	1	399	6	8	4	-1	3	-29	11	-3	13	9	21	4	23	NA		31	95	-1	3	-3	3	0	4	2	2

Reading	Date	Location	Quadrant[1]	Direction	Lateral[2]	Mode	Run time[3]	Ti	Ti +/-	Cr	Cr +/-	Mn	Mn +/-	Fe	Fe +/-	Co	Co +/-	Ni	Ni +/-	Cu	Cu +/-	Zn	Zn +/-	As	As +/-	Se	Se +/-	Rb	Rb +/-	Sr	Sr +/-	Zr	Zr +/-	Mo	Mo +/-	Ag	Ag +/-	Cd	Cd +/-	Sn	Sn +/-	Sb	Sb +/-	I	I +/-	Ba	Ba +/-	W	W +/-	Hg	Hg +/-	Pb	Pb +/-	Th	Th +/-
74	25-Jun-13	TC-shaft6	Quadrant A	W	point 1	Soil	47	1185	428	-7	51	311	50	38125	564	-194	88	-1	18	28	11	30	6	35	4	2	2	159	5	106	4	151	6	367	7	34	14	-3	17	44	28	-12	31	NA	514	163	2	5	2	5	16	5	1	2
75	25-Jun-13	TC-shaft6	Quadrant A	W	point 2	Soil	37.82	1646	275	-32	31	933	43	15494	183	214	42	-2	12	32	8	87	6	4	3	0	1	38	2	309	5	149	5	5	2	-21	9	-1	12	3	18	14	20	NA	315	103	-1	3	3	3	51	4	5	2
76	25-Jun-13	TC-shaft6	Quadrant B	N	point 1	Soil	42.75	795	263	8	33	517	38	12446	171	64	41	-2	12	79	9	95	6	7	4	-2	1	72	3	49	2	87	4	41	3	-13	10	-31	13	-19	21	-63	23	NA	110	101	1	4	3	4	78	5	2	2
77	25-Jun-13	TC-shaft6	Quadrant B	N	point 2	Soil	39.08	1705	268	-18	31	1145	46	17528	199	125	43	-2	11	17	7	82	5	5	3	-2	1	49	2	270	4	169	5	14	2	-16	9	8	11	-13	18	18	19	NA	194	99	2	3	-1	3	34	4	5	2
78	25-Jun-13	TC-shaft6	Quadrant C	E	point 1	Soil	42.41	917	283	7	35	286	33	15991	209	28	46	-2	12	13	8	18	4	0	2	-1	1	57	2	8	1	85	4	63	3	-5	10	16	13	5	21	13	23	NA	263	109	7	4	-1	4	12	4	2	2
79	25-Jun-13	TC-shaft6	Quadrant C	E	point 2	Soil	39.82	3031	332	17	36	880	45	23640	269	234	54	17	13	33	8	84	6	8	3	-2	1	55	2	291	5	235	6	8	3	-14	10	14	12	14	20	11	21	NA	414	118	2	3	-2	3	17	4	4	2
80	25-Jun-13	TC-shaft6	Quadrant D	S	point 1	Soil	41.87	1306	336	104	46	1110	57	43575	499	262	78	-11	16	76	10	62	6	17	3	2	1	117	3	152	4	156	5	95	3	-5	11	-1	13	-17	22	0	24	NA	250	127	6	4	-1	4	16	4	5	2
81	25-Jun-13	TC-shaft6	Quadrant D	S	point 2	Soil	40.37	1928	277	-38	31	1141	47	17490	204	132	44	-6	12	28	7	84	6	15	2	0	1	34	2	234	4	130	4	5	2	-55	9	-8	11	-14	18	8	20	NA	152	100	1	3	1	3	4	3	4	2
82	25-Jun-13	TC-adit4	Quadrant A	W	point 1	Soil	39.71	1588	280	-23	33	609	40	17148	212	80	46	17	13	107	10	353	11	271	19	4	2	30	2	70	2	54	4	98	3	8	10	-5	12	9	20	-24	22	NA	64	101	7	6	-7	6	2562	33	3	2
83	25-Jun-13	TC-adit4	Quadrant A	W	point 2	Soil	41.12	2232	326	26	37	855	46	22097	261	239	53	1	13	17	8	124	7	0	5	-2	1	60	2	311	5	202	5	19	3	-10	10	-8	12	1	20	-2	22	NA	480	120	8	4	-3	4	144	7	6	2
84	25-Jun-13	TC-adit4	Quadrant B	N	point 1	Soil	41.14	1493	301	47	38	1246	54	22762	272	74	54	16	13	113	10	610	15	9	5	2	1	112	3	143	3	176	5	39	3	-9	10	17	13	-16	21	-8	23	NA	242	112	-2	6	10	5	146	7	4	2
85	25-Jun-13	TC-adit4	Quadrant B	N	point 2	Soil	41.29	2151	271	-35	30	777	40	16552	192	188	43	-9	11	11	7	142	7	9	3	-2	1	42	2	218	4	145	4	14	2	-25	9	7	11	3	18	12	19	NA	33	96	0	4	2	3	30	4	6	2
86	25-Jun-13	TC-adit4	Quadrant C	E	point 1	Soil	45.25	2020	319	-26	35	186	32	14317	206	47	47	-28	12	-6	8	60	6	10	3	-2	1	57	2	56	2	76	4	27	3	-2	11	2	14	-33	22	-8	24	NA	53	114	8	4	1	4	3	4	3	2
87	25-Jun-13	TC-adit4	Quadrant C	E	point 2	Soil	40.25	2143	282	33	33	748	41	18412	214	250	47	0	12	25	8	281	9	2	5	-1	1	52	2	274	5	175	5	8	2	-31	9	7	12	-5	18	8	20	NA	91	101	2	4	1	4	168	6	4	2
88	25-Jun-13	TC-adit4	Quadrant D	S	point 1	Soil	38.84	635	332	54	44	1156	57	22226	289	142	58	17	15	173	13	864	20	383	34	5	4	112	4	70	3	122	5	105	4	55	11	15	14	-13	22	12	24	NA	608	128	16	9	-17	9	7708	91	1	2
89	25-Jun-13	TC-adit4	Quadrant D	S	point 2	Soil	39.16	1579	249	-64	28	639	36	13562	162	181	39	-11	11	18	7	142	7	7	4	-2	1	45	2	228	4	129	4	13	2	-23	9	-1	11	-2	18	9	19	NA	28	91	3	4	0	3	81	5	6	2
90	25-Jun-13	TC-shaft4	Quadrant A	W	point 1	Soil	40.64	720	321	-8	40	898	52	22438	294	75	58	4	15	83	11	577	16	122	19	-1	2	110	3	124	3	145	5	209	5	29	11	-19	14	21	23	3	25	NA	434	125	8	7	-3	6	2345	35	2	2
91	25-Jun-13	TC-shaft4	Quadrant A	W	point 2	Soil	40.59	2959	318	-2	34	878	44	21166	243	279	51	-18	12	29	8	123	7	12	3	-1	1	53	2	301	5	202	5	4	2	-30	9	-6	12	-17	19	29	20	NA	288	111	5	4	-2	3	45	4	5	2
92	25-Jun-13	TC-shaft4	Quadrant B	N	point 1	Soil	38.96	393	218	24	29	544	34	3383	68	-42	20	11	10	6	7	116	6	56	8	1	1	6	1	4	1	7	3	10	2	2	10	-15	12	9	20	1	22	NA	49	86	6	4	3	4	425	10	-2	1
93	25-Jun-13	TC-shaft4	Quadrant B	N	point 2	Soil	41.04	740	243	-62	30	765	40	15090	184	279	43	-12	12	18	7	194	8	5	4	-2	1	44	2	269	4	164	5	8	2	-41	9	-3	12	-23	18	2	20	NA	66	95	-2	4	-1	3	128	6	7	2
94	25-Jun-13	TC-shaft4	Quadrant C	E	point 1	Soil	43.97	403	256	1	33	500	37	9596	145	-23	36	4	12	13	8	146	8	26	5	0	1	61	2	58	2	73	4	15	3	-15	10	-14	13	7	21	-6	23	NA	151	102	2	4	-4	4	121	6	3	2
95	25-Jun-13	TC-shaft4	Quadrant C	E	point 2	Soil	40.98	2585	337	-80	34	915	48	23518	280	260	56	-20	13	88	10	538	14	36	10	0	2	56	2	239	4	167	5	49	3	1	10	6	13	-17	21	-3	22	NA	418	121	8	6	-1	5	791	15	5	2
96	25-Jun-13	TC-shaft4	Quadrant D	S	point 1	Soil	39.18	598	295	42	38	183	32	21544	265	127	54	-1	14	91	10	264	10	75	22	3	3	83	3	38	2	99	4	556	7	2	10	-19	13	30	21	16	23	NA	450	113	12	6	-12	6	3722	46	-4	2
97	25-Jun-13	TC-shaft4	Quadrant D	S	point 2	Soil	40.02	2826	321	-5	35	836	44	22623	260	282	53	-3	13	23	8	154	7	11	4	-1	1	57	2	310	5	212	5	12	3	2	10	3	12	-6	20	-16	21	NA	279	113	-2	4	7	4	72	5	5	2
98	25-Jun-13	TC-shaft5	Quadrant A	W	point 1	Soil	42.62	1644	365	99	46	1385	63	35624	436	204	73	10	16	26	9	64	6	5	4	1	1	117	3	335	6	151	6	310	5	8	11	9	14	-15	23	9	25	NA	536	137	-1	4	2	4	72	6	0	2
99	25-Jun-13	TC-shaft5	Quadrant A	W	point 2	Soil	40.46	2561	319	0	35	1338	53	24043	270	304	54	-10	13	33	8	95	6	7	3	-1	1	45	2	265	4	186	5	12	2	-21	10	-15	12	2	19	-17	21	NA	419	114	4	4	-2	3	23	4	2	2
100	25-Jun-13	TC-shaft5	Quadrant B	N	point 1	Soil	43.66	1113	318	-27	38	546	44	25961	327	93	61	7	15	42	9	68	6	18	4	0	1	132	4	151	4	146	5	17	3	1	11	-19	14	20	22	43	24	NA	269	121	9	4	2	4	38	5	3	2
101	25-Jun-13	TC-shaft5	Quadrant B	N	point 2	Soil	40.95	3342	326	97	37	764	43	22185	258	226	52	25	14	15	8	83	6	8	3	-2	1	55	2	275	5	215	5	4	3	-14	10	-19	12	-28	20	2	21	NA	136	111	5	4	2	4	11	4	2	2
102	25-Jun-13	TC-shaft5	Quadrant C	E	point 1	Soil	41.03	136	280	-3	33	441	34	3958	81	44	25	-11	11	22	8	13	4	0	2	-1	1	45	2	819	11	11	5	-2	3	6	10	-5	13	-14	21	-31	23	NA	752	115	1	3	-3	3	6	4	-2	2
103	25-Jun-13	TC-shaft5	Quadrant C	E	point 2	Soil	41	2877	329	34	36	772	44	22374	263	211	53	0	13	25	8	379	12	5	4	-2	1	63	2	285	5	192	5	8	3	-33	10	-11	12	4	20	-11	21	NA	286	116	4	5	4	4	87	5	4	2
104	25-Jun-13	TC-shaft5	Quadrant D	S	point 1	Soil	43.42	1467	327	-7	38	1012	52	20654	268	35	54	-4	13	44	9	47	5	12	3	-1	1	92	3	293	5	143	5	74	3	-2	11	-20	14	-8	22	9	24	NA	419	123	7	4	7	4	27	5	4	2
105	25-Jun-13	TC-shaft5	Quadrant D	S	point 2	Soil	41.57	3036	337	27	36	1081	50	23421	272	193	54	-35	12	24	8	91	6	7	2	0	1	61	2	321	5	229	6	7	3	-17	10	-22	12	7	19	4	21	NA	386	118	-1	3	1	3	7	4	3	2

Notes

1 "Quadrant" defines the quarter of the area being delineated. For practical purposes, these were aligned with the four cardinal directions of the compass.

2 "Lateral" defines the distance away from the center of the feature, with 1 being the closest. Where a distinct boundary of the feature could be visually observed, two points were collected. Where a feature boundary was suspected but not visually distinct, three points were collected.

3 "Run time" is the amount of time the XRF instrument took in seconds to collect a measurement.

4 All measurements, including range, are in milligrams per kilogram.

5 COPCs are highlighted gray.

Appendix C

Table 2, Background Soil Sample XRF Measurements

Reading	Date	Location	Mode	Run time[1]	Ti	Ti +/-	Cr	Cr +/-	Mn	Mn +/-	Fe	Fe +/-	Co	Co +/-	Ni	Ni +/-	Cu	Cu +/-	Zn	Zn +/-	As	As +/-	Se	Se +/-	Rb	Rb +/-	Sr	Sr +/-	Zr	Zr +/-	Mo	Mo +/-	Ag	Ag +/-	Cd	Cd +/-	Sn	Sn +/-	Sb	Sb +/-	I	I +/-	Ba	Ba +/-	W	W +/-	Hg	Hg +/-	Pb	Pb +/-	Th	Th +/-
1	24-Jun-13	13-bkd-ss05	Soil	39.95	3702	360	41	38	530	40	26532	306	210	58	22	14	38	8	56	5	12	2	0	1	51	2	291	5	152	5	5	3	-10	10	-21	12	-9	20	-35	22	NA		423	125	-1	4	8	4	0	4	4	2
2	24-Jun-13	13-bkd-ss04	Soil	41.59	5229	417	84	43	668	46	35023	401	589	71	3	16	37	9	71	6	12	3	2	1	49	2	318	5	249	6	3	3	-30	10	-17	13	-8	21	5	23	NA		559	140	1	4	0	4	10	4	2	2
3	24-Jun-13	13-bkd-ss06	Soil	42.24	2351	321	18	37	796	45	24527	288	358	57	-6	14	35	8	81	6	8	2	-2	1	40	2	222	4	160	5	3	3	-35	10	-1	12	27	20	26	22	NA		258	115	-6	3	5	3	4	4	3	2
4	24-Jun-13	13-bkd-ss08	Soil	42.28	3521	371	131	44	856	50	33266	385	444	68	47	16	81	10	105	7	17	3	-3	1	62	2	259	5	212	6	10	3	-12	10	-5	13	10	21	2	23	NA		303	129	0	4	5	4	5	4	7	2
5	24-Jun-13	13-bkd-ss01	Soil	39.06	4113	340	72	37	613	40	24036	270	397	55	13	14	35	8	51	5	18	3	-2	1	45	2	386	6	175	5	0	2	-12	10	-25	12	16	19	-23	21	NA		167	114	5	4	3	4	6	4	4	2
20	24-Jun-13	13-Bkd-SS09	Soil	40.06	3030	312	-26	32	507	36	20655	236	446	51	-21	13	35	8	61	5	14	3	0	1	39	2	290	5	153	5	3	2	-24	9	-6	12	-26	19	2	20	NA		230	108	-2	3	2	3	7	3	3	2
21	24-Jun-13	13-bkd-ss10	Soil	41.89	3595	357	29	38	611	42	25960	306	362	60	0	14	25	8	64	5	10	3	-2	1	45	2	251	5	191	5	1	3	-9	10	-20	13	19	20	7	22	NA		313	122	-1	4	5	4	8	4	2	2
23	24-Jun-13	13-bkd-ss07	Soil	41.45	3822	375	68	41	833	49	30771	360	464	66	41	16	46	9	98	7	11	3	0	1	53	2	275	5	247	6	1	3	9	10	-22	13	33	21	-16	23	NA		307	128	-2	4	3	4	11	4	3	2
24	24-Jun-13	13-bkd-ss02	Soil	40.86	4659	372	89	39	658	43	27324	314	323	60	-3	14	38	8	51	5	13	3	-1	1	52	2	388	6	177	5	-2	3	-1	10	-4	13	9	20	5	22	NA		264	123	5	4	3	4	14	4	1	2
25	24-Jun-13	13-bkd-ss03	Soil	40.66	2916	317	1	35	684	42	25339	289	355	57	-4	14	40	8	100	6	10	3	-2	1	51	2	261	5	211	5	5	3	-30	10	-5	12	26	20	-3	21	NA		50	110	-2	4	6	4	16	4	6	2

Notes

1 "Run time" is the amount of time the XRF instrument took in seconds to collect a measurement.

2 All measurements, including range, are in milligrams per kilogram.

3 COPCs are highlighted gray.

Appendix C

Table 3, Crescent Claim Soil Screening XRF Measurements

Reading	Date	Location	Sub location	Mode	Run time[1]	Ti	Ti +/-	Cr	Cr +/-	Mn	Mn +/-	Fe	Fe +/-	Co	Co +/-	Ni	Ni +/-	Cu	Cu +/-	Zn	Zn +/-	As	As +/-	Se	Se +/-	Rb	Rb +/-	Sr	Sr +/-	Zr	Zr +/-	Mo	Mo +/-	Ag	Ag +/-	Cd	Cd +/-	Sn	Sn +/-	Sb	Sb +/-	I	I +/-	Ba	Ba +/-	W	W +/-	Hg	Hg +/-	Pb	Pb +/-	Th	Th +/-
71	25-Jun-13	CC-tailings	screen 1	Soil	39.93	13	221	-12	30	50	23	11417	150	144	38	2	12	46	9	141	8	-35	11	8	2	48	2	22	2	60	4	123	3	30	10	5	12	-6	19	7	21	NA		111	89	81	7	-6	6	1011	17	-1	2
72	25-Jun-13	CC-tailings	screen 2	Soil	40.86	1789	265	18	31	349	31	10567	144	136	37	1	12	18	8	213	9	6	4	-1	1	91	3	245	4	123	5	27	3	9	10	3	12	4	20	15	22	NA		-38	94	5	4	2	4	85	5	2	2
73	25-Jun-13	CC-tailings	screen 3	Soil	40.23	645	237	-16	29	103	24	12101	155	152	38	-1	11	27	8	120	7	978	14	2	1	20	1	20	1	35	3	-1	2	-8	9	-2	12	-23	19	14	21	NA		115	91	2	4	2	4	124	6	-1	1

Notes

1 "Run time" is the amount of time the XRF instrument took in seconds to collect a measurement.

2 All measurements, including range, are in milligrams per kilogram.

3 COPCs are highlighted gray.

Appendix C

Table 4, XRF Measurements of Soil Samples Collected for Laboratory Analysis

Reading	Date	Location	subsample[1]	Time	Mode	Run time[2]	As	As +/-	Cr	Cr +/-	Cu	Cu +/-	Pb	Pb +/-	Ag	Ag +/-	Ba	Ba +/-	Br	Br +/-	Au	Au +/-	Bi	Bi +/-	Ca	Ca +/-	Cd	Cd +/-	Cl	Cl +/-	Co	Co +/-	Fe	Fe +/-	Hg	Hg +/-	I	I +/-	K	K +/-	LE	LE +/-	Mn	Mn +/-	Mo	Mo +/-	Ni	Ni +/-	P	P +/-	Rb	Rb +/-	S	S +/-	Sb	Sb +/-	Se	Se +/-	Sn	Sn +/-	Sr	Sr +/-	Ti	Ti +/-	Zn	Zn +/-	Zr	Zr +/-
9	18-Jun-13	13-TC-PIT1-SS1	Composite	10:37:18	Soil	41.36	119	15	<LOD	135	147	11	1332	23	<LOD	41	<LOD	0	<LOD	8	<LOD	6	<LOD	8	NA		<LOD	50	<LOD	0	352	71	45516	537	<LOD	16	NA		NA		<LOD	0	816	50	55	3	<LOD	44	NA		99	3	NA		<LOD	95	<LOD	7	<LOD	86	222	5	3460	340	610	16	113	3
16	18-Jun-13	13-TC-PIT2-SS1	Composite	12:52:55	Soil	40.41	408	29	<LOD	135	562	20	4597	61	<LOD	42	<LOD	0	<LOD	12	<LOD	10	<LOD	14	NA		<LOD	52	<LOD	0	653	77	48136	582	23	8	NA		NA		<LOD	0	1052	57	90	4	<LOD	49	NA		85	3	NA		<LOD	98	<LOD	12	<LOD	89	146	4	2537	341	811	20	73	3
23	18-Jun-13	13-TC-CAMP-SS1	Composite	15:58:09	Soil	42.13	12	4	<LOD	99	38	8	51	5	<LOD	39	<LOD	0	7	2	<LOD	3	<LOD	5	NA		<LOD	46	<LOD	0	327	49	22453	279	<LOD	10	NA		NA		<LOD	0	569	38	17	3	<LOD	33	NA		38	2	NA		<LOD	85	<LOD	4	<LOD	78	350	6	2150	263	157	8	91	3
30	18-Jun-13	13-TC-MILL-SS1	Composite	18:07:26	Soil	42.19	<LOD	15	<LOD	106	37	8	142	7	<LOD	38	<LOD	0	<LOD	5	<LOD	3	7	2	NA		<LOD	46	<LOD	0	271	51	26525	316	<LOD	11	NA		NA		<LOD	0	522	38	24	3	<LOD	35	NA		68	2	NA		<LOD	86	<LOD	4	<LOD	77	252	5	2874	284	168	8	105	3
37	18-Jun-13	13-TC-MILL-SS2	Composite	19:37:22	Soil	42.43	<LOD	42	<LOD	95	101	10	1374	23	<LOD	39	<LOD	0	<LOD	7	<LOD	5	<LOD	8	NA		<LOD	47	<LOD	0	254	46	19435	251	<LOD	15	NA		NA		<LOD	0	358	33	22	3	<LOD	33	NA		48	2	NA		122	28	<LOD	6	<LOD	79	311	6	2167	261	331	11	79	3
10	19-Jun-13	13-SC-BENCH-SS1	Composite	9:29:41	Soil	42.75	<LOD	17	<LOD	94	<LOD	22	191	8	<LOD	39	<LOD	0	<LOD	5	<LOD	4	<LOD	5	NA		<LOD	46	<LOD	0	299	54	28322	337	<LOD	11	NA		NA		<LOD	0	205	30	31	3	<LOD	35	NA		93	3	NA		<LOD	85	<LOD	5	84	26	287	5	<LOD	683	122	7	70	3
16	19-Jun-13	13-SC-BENCH-SS2	Composite	11:17:05	Soil	42.23	<LOD	17	<LOD	92	30	8	202	8	<LOD	39	<LOD	0	<LOD	5	<LOD	4	<LOD	6	NA		<LOD	47	<LOD	0	247	43	17447	229	<LOD	11	NA		NA		<LOD	0	555	37	54	3	<LOD	31	NA		117	3	NA		<LOD	87	<LOD	5	<LOD	79	371	6	<LOD	668	157	8	96	3
24	19-Jun-13	13-TC-SHAFT4-SS1	Composite	14:05:01	Soil	40.72	49	15	<LOD	82	30	8	1578	24	<LOD	38	<LOD	0	<LOD	7	<LOD	5	<LOD	8	NA		<LOD	46	<LOD	0	<LOD	99	11244	159	<LOD	13	NA		NA		<LOD	0	395	31	256	5	<LOD	28	NA		52	2	NA		<LOD	88	<LOD	7	<LOD	79	47	2	<LOD	575	363	11	44	2
30	19-Jun-13	13-TC-ADIT4-SS1	Composite	15:52:27	Soil	41.54	180	17	<LOD	99	135	11	1971	29	<LOD	39	<LOD	0	<LOD	8	<LOD	6	<LOD	9	NA		<LOD	46	<LOD	0	200	47	21752	272	<LOD	15	NA		NA		<LOD	0	800	44	103	3	<LOD	35	NA		92	3	NA		<LOD	88	<LOD	8	<LOD	80	87	3	1021	240	491	14	71	3
37	19-Jun-13	13-TR-SHAFT5-SS1	Composite	17:57:36	Soil	40.49	<LOD	12	<LOD	91	46	8	77	5	<LOD	38	<LOD	0	<LOD	4	<LOD	3	6	2	NA		<LOD	46	<LOD	0	251	47	21600	268	<LOD	11	NA		NA		<LOD	0	1226	51	35	3	<LOD	32	NA		104	3	NA		<LOD	87	<LOD	4	99	26	212	4	995	227	125	7	101	3
2	26-Jun-13	SC-outwash	Composite		Soil	42.53	10	4	27	33	18	8	95	6	-26	10	105	99	NA		NA		NA		NA		10	13	NA		45	26	4235	84	1	4	NA		NA		<LOD	0	110	24	7	3	12	12	NA		7	1	NA		-7	22	-1	1	-38	21	376	6	854	257	61	5	26	4

Notes

1 "Subsample" field indicates that measurement is collected from a composite of all five original subsamples.

2 "Run time" is the amount of time the XRF instrument took in seconds to collect a measurement.

3 All measurements, including range, are in milligrams per kilogram.

4 COPCs are highlighted gray.

Appendix C

Table 5, XRF Measurements of Subsample Locations of Soil Samples Collected for Laboratory Analysis

Reading	Date	Location	subsample[1]	direction	Time	Mode	Run time[2]	As	As +/-	Cr	Cr +/-	Cu	Cu +/-	Pb	Pb +/-	Ag	Ag +/-	Ba	Ba +/-	Br	Br +/-	Au	Au +/-	Bi	Bi +/-	Ca	Ca +/-	Cd	Cd +/-	Cl	Cl +/-	Co	Co +/-	Fe	Fe +/-	Hg	Hg +/-	I	I +/-	K	K +/-	LE	LE +/-	Mn	Mn +/-	Mo	Mo +/-	Ni	Ni +/-	P	P +/-	Rb	Rb +/-	S	S +/-	Sb	Sb +/-	Se	Se +/-	Sn	Sn +/-	Sr	Sr +/-	Ti	Ti +/-	Zn	Zn +/-	Zr	Zr +/-
4	18-Jun-13	13-TC-PIT1-SS1	A		9:03:35	Soil	43.55	<LOD	11	<LOD	117	33	8	49	5	<LOD	41	<LOD	0	<LOD	5	<LOD	3	<LOD	6	NA		<LOD	50	<LOD	0	251	55	26083	336	<LOD	11	NA		NA		<LOD	0	717	45	17	3	<LOD	36	NA		134	4	NA		<LOD	93	<LOD	4	<LOD	85	239	5	1829	301	143	8	103	3
5	18-Jun-13	13-TC-PIT1-SS1	B		9:26:44	Soil	42.75	58	14	<LOD	111	174	12	1113	21	<LOD	41	<LOD	0	<LOD	7	<LOD	5	<LOD	8	NA		60	17	<LOD	0	<LOD	166	27593	351	<LOD	15	NA		NA		<LOD	0	1252	56	67	3	<LOD	37	NA		120	3	NA		<LOD	93	<LOD	6	<LOD	84	167	4	1654	290	1625	30	87	3
6	18-Jun-13	13-TC-PIT1-SS1	C		9:48:43	Soil	41.85	211	18	<LOD	152	48	10	1395	26	<LOD	45	<LOD	0	<LOD	9	<LOD	7	<LOD	9	NA		<LOD	54	<LOD	0	918	106	83507	1029	<LOD	17	NA		NA		<LOD	0	624	56	107	4	<LOD	59	NA		70	3	NA		<LOD	102	<LOD	8	<LOD	93	210	5	4043	427	205	10	121	4
7	18-Jun-13	13-TC-PIT1-SS1	D		10:07:53	Soil	42.01	20	4	<LOD	115	56	9	79	5	<LOD	39	<LOD	0	8	2	<LOD	4	<LOD	5	NA		<LOD	48	<LOD	0	358	57	30398	365	<LOD	10	NA		NA		<LOD	0	786	45	14	3	<LOD	39	NA		60	2	NA		96	29	<LOD	5	<LOD	81	352	6	3407	322	125	7	122	3
8	18-Jun-13	13-TC-PIT1-SS1	E	S	10:22:18	Soil	42.1	339	33	<LOD	162	328	17	5347	74	<LOD	45	<LOD	0	<LOD	14	<LOD	11	<LOD	16	NA		<LOD	54	<LOD	0	839	100	73529	914	31	9	NA		NA		<LOD	0	849	60	83	4	<LOD	57	NA		104	4	NA		<LOD	102	<LOD	13	<LOD	93	150	4	2724	396	773	21	116	4
10	18-Jun-13	13-TC-PIT2-SS1	A	N	11:39:44	Soil	40.73	101	18	<LOD	115	273	14	2008	30	<LOD	40	<LOD	0	<LOD	8	<LOD	7	<LOD	9	NA		<LOD	48	<LOD	0	477	70	46573	531	<LOD	17	NA		NA		<LOD	0	741	47	35	3	<LOD	44	NA		86	3	NA		<LOD	93	<LOD	8	<LOD	84	77	3	1082	279	1120	23	62	3
11	18-Jun-13	13-TC-PIT2-SS1	B	E	11:56:03	Soil	39.18	453	29	<LOD	101	518	17	5709	67	<LOD	39	<LOD	0	<LOD	12	<LOD	10	<LOD	14	NA		<LOD	47	<LOD	0	239	54	29045	344	36	8	NA		NA		<LOD	0	1027	49	50	3	<LOD	38	NA		41	2	NA		<LOD	88	16	4	86	27	107	3	2385	275	686	17	40	2
13	18-Jun-13	13-TC-PIT2-SS1	C	CENTER	12:39:48	Soil	39.04	159	23	<LOD	106	294	14	3570	46	<LOD	39	<LOD	0	<LOD	10	<LOD	8	<LOD	12	NA		<LOD	47	<LOD	0	299	56	30279	358	<LOD	18	NA		NA		<LOD	0	386	36	54	3	<LOD	37	NA		61	3	NA		<LOD	89	<LOD	10	83	27	72	3	1540	264	336	12	54	3
14	18-Jun-13	13-TC-PIT2-SS1	D	W	12:41:56	Soil	40.25	<LOD	32	<LOD	121	137	11	759	16	<LOD	40	<LOD	0	<LOD	6	<LOD	5	<LOD	7	NA		<LOD	49	<LOD	0	612	65	37274	440	<LOD	13	NA		NA		<LOD	0	726	46	10	3	<LOD	43	NA		51	2	NA		<LOD	93	<LOD	6	<LOD	83	344	6	4925	363	439	13	153	4
15	18-Jun-13	13-TC-PIT2-SS1	E	S	12:44:10	Soil	39.15	332	38	<LOD	140	1430	33	8124	101	<LOD	43	<LOD	0	<LOD	15	<LOD	12	<LOD	18	NA		<LOD	52	<LOD	0	598	78	48093	589	29	9	NA		NA		<LOD	0	1074	58	188	5	<LOD	48	NA		75	3	NA		<LOD	97	16	5	<LOD	89	98	3	1441	308	1061	24	62	3
18	18-Jun-13	13-TC-CAMP-SS1	A		15:42:03	Soil	41.77	15	4	<LOD	104	54	9	80	6	<LOD	40	<LOD	0	7	2	<LOD	3	<LOD	5	NA		<LOD	49	<LOD	0	371	56	27159	340	<LOD	10	NA		NA		<LOD	0	784	46	15	3	<LOD	39	NA		40	2	NA		<LOD	89	<LOD	4	<LOD	81	363	6	3199	320	148	8	95	3
19	18-Jun-13	13-TC-CAMP-SS1	B		15:44:45	Soil	41.39	<LOD	17	<LOD	105	59	9	192	8	<LOD	40	<LOD	0	6	2	<LOD	4	<LOD	5	NA		<LOD	47	<LOD	0	311	52	24962	311	<LOD	11	NA		NA		<LOD	0	685	42	12	3	<LOD	37	NA		37	2	NA		<LOD	88	<LOD	5	<LOD	81	327	6	2497	290	269	10	77	3
20	18-Jun-13	13-TC-CAMP-SS1	C		15:46:53	Soil	41.01	<LOD	8	<LOD	85	40	7	28	4	<LOD	35	<LOD	0	8	1	<LOD	3	5	1	NA		<LOD	42	<LOD	0	212	36	14603	183	<LOD	9	NA		NA		<LOD	0	446	31	14	3	<LOD	28	NA		48	2	NA		<LOD	77	<LOD	4	<LOD	70	311	5	703	203	168	7	75	3
21	18-Jun-13	13-TC-CAMP-SS1	D		15:49:12	Soil	23.51	<LOD	15	<LOD	140	<LOD	32	51	6	<LOD	53	<LOD	0	<LOD	6	<LOD	5	<LOD	6	NA		<LOD	64	<LOD	0	386	75	28961	472	<LOD	15	NA		NA		<LOD	0	565	54	<LOD	11	<LOD	52	NA		50	3	NA		<LOD	121	<LOD	6	<LOD	109	337	8	4175	445	132	10	84	4
22	18-Jun-13	13-TC-CAMP-SS1	E		15:50:44	Soil	33.61	14	3	<LOD	103	45	9	18	4	<LOD	42	<LOD	0	11	2	<LOD	3	6	2	NA		<LOD	50	<LOD	0	145	42	14427	214	<LOD	11	NA		NA		<LOD	0	505	39	<LOD	9	<LOD	30	NA		25	2	NA		94	31	<LOD	4	<LOD	85	317	6	1729	261	178	9	68	3
24	18-Jun-13	13-TC-MILL-SS1	A		17:47:07	Soil	42.3	<LOD	10	<LOD	108	<LOD	22	54	5	<LOD	38	<LOD	0	<LOD	4	<LOD	3	6	2	NA		<LOD	46	<LOD	0	373	53	27874	329	<LOD	10	NA		NA		<LOD	0	529	38	16	3	<LOD	36	NA		52	2	NA		<LOD	84	<LOD	4	<LOD	77	324	6	3433	304	112	7	124	3
26	18-Jun-13	13-TC-MILL-SS1	B		17:52:10	Soil	35.81	23	6	<LOD	116	27	8	155	7	<LOD	42	<LOD	0	<LOD	6	<LOD	4	<LOD	6	NA		<LOD	51	<LOD	0	251	55	25760	337	15	4	NA		NA		<LOD	0	555	42	17	3	<LOD	39	NA		95	3	NA		<LOD	95	<LOD	5	<LOD	87	187	4	1810	289	96	7	96	3
27	18-Jun-13	13-TC-MILL-SS1	C		17:57:25	Soil	41.46	19	4	<LOD	131	28	8	34	5	<LOD	41	<LOD	0	<LOD	5	<LOD	4	6	2	NA		<LOD	50	<LOD	0	458	67	39046	468	<LOD	12	NA		NA		<LOD	0	592	44	24	3	<LOD	44	NA		72	3	NA		<LOD	93	<LOD	5	<LOD	84	327	6	4052	358	92	7	125	4
28	18-Jun-13	13-TC-MILL-SS1	D		17:59:33	Soil	41.81	<LOD	18	<LOD	92	32	7	238	8	<LOD	38	<LOD	0	5	2	<LOD	4	<LOD	5	NA		<LOD	45	<LOD	0	303	47	22582	271	<LOD	10	NA		NA		<LOD	0	610	38	16	3	<LOD	33	NA		72	2	NA		<LOD	84	<LOD	5	<LOD	76	241	5	1931	255	110	7	105	3
29	18-Jun-13	13-TC-MILL-SS1	E		18:01:21	Soil	41.27	33	10	<LOD	111	40	8	601	14	<LOD	39	<LOD	0	<LOD	6	<LOD	5	<LOD	7	NA		<LOD	47	<LOD	0	302	54	28588	341	17	5	NA		NA		<LOD	0	599	40	27	3	<LOD	39	NA		93	3	NA		<LOD	88	<LOD	6	<LOD	81	262	5	2754	297	312	11	118	3
32	18-Jun-13	13-TC-MILL-SS2	A	W	19:20:52	Soil	41.99	<LOD	13	<LOD	111	35	8	92	6	<LOD	40	<LOD	0	<LOD	5	<LOD	3	<LOD	5	NA		<LOD	48	<LOD	0	347	55	27426	341	<LOD	10	NA		NA		<LOD	0	604	42	20	3	<LOD	38	NA		60	2	NA		90	30	<LOD	4	<LOD	82	292	5	2695	310	135	8	119	3
33	18-Jun-13	13-TC-MILL-SS2	B	CENTER	19:23:47	Soil	40.08	<LOD	28	<LOD	89	50	8	647	13	<LOD	37	<LOD	0	<LOD	6	<LOD	4	<LOD	6	NA		<LOD	45	<LOD	0	273	44	19656	240	16	4	NA		NA		<LOD	0	393	32	20	3	<LOD	31	NA		47	2	NA		<LOD	83	<LOD	5	<LOD	75	244	5	2066	248	188	8	96	3
34	18-Jun-13	13-TC-MILL-SS2	C	E	19:26:14	Soil	40.75	<LOD	64	<LOD	112	102	10	3049	41	<LOD	40	<LOD	0	<LOD	10	<LOD	8	<LOD	11	NA		<LOD	48	<LOD	0	325	56	28513	350	<LOD	18	NA		NA		<LOD	0	381	36	27	3	<LOD	40	NA		39	2	NA		<LOD	90	<LOD	9	<LOD	82	359	6	3270	311	301	11	91	3
35	18-Jun-13	13-TC-MILL-SS2	D	N	19:27:52	Soil	41.35	<LOD	47	<LOD	79	130	10	1858	27	<LOD	37	<LOD	0	<LOD	7	<LOD	6	<LOD	8	NA		<LOD	45	<LOD	0	170	34	11287	158	<LOD	15	NA		NA		<LOD	0	233	27	21	3	<LOD	29	NA		40	2	NA		<LOD	85	<LOD	7	<LOD	77	114	3	616	197	520	14	69	3
36	18-Jun-13	13-TC-MILL-SS2	E	S	19:29:49	Soil	40.83	104	14	<LOD	81	90	9	1508	22	<LOD	36	<LOD	0	<LOD	7	<LOD	5	<LOD	8	NA		<LOD	42	<LOD	0	226	40	17339	212	21	5	NA		NA		<LOD	0	423	32	34	3	<LOD	31	NA		39	2	NA		141	26	<LOD	7	<LOD	70	223	4	1175	215	537	14	61	3
5	19-Jun-13	13-SC-BENCH-SS1	A	W	9:13:18	Soil	41.71	<LOD	23	<LOD	85	39	7	442	11	<LOD	37	<LOD	0	9	2	<LOD	4	<LOD	5	NA		<LOD	43	<LOD	0	160	38	16034	202	<LOD	10	NA		NA		<LOD	0	236	27	17	3	<LOD	31	NA		31	2	NA		<LOD	80	<LOD	5	<LOD	73	439	6	1749	223	139	7	62	3
6	19-Jun-13	13-SC-BENCH-SS1	B	S	9:15:20	Soil	40.67	<LOD	19	<LOD	78	23	7	293	8	<LOD	36	<LOD	0	7	2	<LOD	4	<LOD	5	NA		<LOD	42	<LOD	0	226	35	12811	166	<LOD	9	NA		NA		<LOD	0	196	24	39	3	<LOD	26	NA		27	2	NA		78	25	<LOD	5	<LOD	69	477	7	796	190	215	8	63	3
7	19-Jun-13	13-SC-BENCH-SS1	C	CENTER	9:17:22	Soil	42.4	16	4	<LOD	107	<LOD	22	40	5	<LOD	39	<LOD	0	<LOD	4	<LOD	3	7	2	NA		<LOD	47	<LOD	0	259	57	32410	383	<LOD	10	NA		NA		<LOD	0	339	35	28	3	<LOD	36	NA		103	3	NA		<LOD	89	<LOD	4	<LOD	80	138	3	<LOD	699	83	6	91	3
8	19-Jun-13	13-SC-BENCH-SS1	D	N	9:19:29	Soil	41.89	10	3	<LOD	96	<LOD	20	11	3	<LOD	37	<LOD	0	<LOD	4	<LOD	3	<LOD	5	NA		<LOD	45	<LOD	0	213	46	22183	265	<LOD	10	NA		NA		<LOD	0	80	24	16	3	<LOD	31	NA		113	3	NA		<LOD	84	6	2	<LOD	76	187	4	<LOD	608	37	4	67	3
9	19-Jun-13	13-SC-BENCH-SS1	E	E	9:21:22	Soil	42.34	<LOD	14	<LOD	102	29	8	113	6	<LOD	39	<LOD	0	<LOD	5	<LOD	3	6	2	NA		<LOD	46	<LOD	0	314	55	30030	354	<LOD	11	NA		NA		<LOD	0	158	29	36	3	<LOD	36	NA		104	3	NA		111	29	<LOD	5	<LOD	79	220	4	1110	231	131	7	84	3
11	19-Jun-13	13-SC-BENCH-SS2	A	W	11:00:43	Soil	42.01	<LOD	10	<LOD	103	36	8	38	5	<LOD	41	<LOD	0	<LOD	5	<LOD	3	7	2	NA		<LOD	49	<LOD	0	<LOD	139	19673	263	<LOD	10	NA		NA		<LOD	0	748	44	100	4	<LOD	32	NA		89	3	NA		<LOD	92	<LOD	4	<LOD	84	455	7	1029	255	71	6	92	3
12	19-Jun-13	13-SC-BENCH-SS2	B	CENTER	11:02:38	Soil	43.4	21	7	<LOD	104	27	8	264	9	<LOD	40	<LOD	0	<LOD	5	<LOD	4	9	2	NA		<LOD	48	<LOD	0	249	50	22759	294	<LOD	11	NA		NA		<LOD	0	501	38	49	3	<LOD	34	NA		136	4	NA		<LOD	91	<LOD	5	<LOD	82	200	4	1212	259	270	11	111	3
13	19-Jun-13	13-SC-BENCH-SS2	C	N	11:04:34	Soil	42.67	<LOD	8	<LOD	87	34	8	16	4	<LOD	39	<LOD	0	<LOD	4	<LOD	3	8	2	NA		<LOD	47	<LOD	0	<LOD	123	16512	220	<LOD	10	NA		NA		<LOD	0	460	35	68	3	<LOD	30	NA		111	3	NA		<LOD	89	<LOD	4	<LOD	81	483	7	741	230	63	5	92	3
14	19-Jun-13	13-SC-BENCH-SS2	D	E	11:06:29	Soil	43.47	30	7	<LOD	97	34	8	310	10	<LOD	40	<LOD	0	<LOD	5	<LOD	4	7	2	NA		<LOD	48	<LOD	0	207	44	17362	234	<LOD	12	NA		NA		<LOD	0	443	36	41	3	<LOD	30	NA		131	3	NA		113	30	<LOD	5	83	27	241	5	1270	244	254	10	101	3
15	19-Jun-13	13-SC-BENCH-SS2	E	S	11:08:37	Soil	42.59	<LOD	9	<LOD	96	<LOD	22	23	4	<LOD	40	<LOD	0	<LOD	5	<LOD	3	9	2	NA		<LOD	48	<LOD	0	186	41	15129	208	<LOD	11	NA		NA		<LOD	0	621	39	30	3	<LOD	30	NA		107	3	NA		<LOD	92	<LOD	5	<LOD	83	694	10	772	225	89	6	114	4
17	19-Jun-13	13-TC-SHAFT4-SS1	A	CENTER	13:39:31	Soil	41.36	93	19	<LOD	102	89	10	2333	34	<LOD	40	<LOD	0	<LOD	9	<LOD	7	<LOD	10	NA		<LOD	49	<LOD	0	274	55	27370	341	<LOD	17	NA		NA		<LOD	0	520	40	445	7	<LOD	38	NA		80	3	NA		<LOD	92	<LOD	9	<LOD	84	59	3	809	251	657	17	64	3
20	19-Jun-13	13-TC-SHAFT4-SS1	B		13:49:23	Soil	39.24	<LOD	40	<LOD	77	43	7	1544	22	<LOD	34	<LOD	0	<LOD	6	<LOD	5	<LOD	7	NA		<LOD	41	<LOD	0	105	30	10842	142	<LOD	12	NA		NA		<LOD	0	318	27	228	4	<LOD	25	NA		64	2	NA		<LOD	75	<LOD	7	<LOD	68	39	2	564	170	384	11	58	2
21	19-Jun-13	13-TC-SHAFT4-SS1	C		13:51:24	Soil	40.59	100	12	<LOD	78	45	8	1134	19	<LOD	37	<LOD	0	<LOD	6	<LOD	5	<LOD	7	NA		<LOD	44	<LOD	0	<LOD	98	11617	157	<LOD	12	NA		NA		<LOD	0	516	33	54	3	<LOD	27	NA		49	2	NA		<LOD	85	<LOD	6	<LOD	76	44	2	<LOD	549	567	14	44	2
22	19-Jun-13	13-TC-SHAFT4-SS1	D		13:56:55	Soil	41.5	<LOD	23	<LOD	77	<LOD	20	413	10	<LOD	37	<LOD	0	<LOD	5	<LOD	4	<LOD	5	NA		<LOD	45	<LOD	0	<LOD	90	9433	138	<LOD	11	NA		NA		<LOD	0	481	33	58	3	<LOD	26	NA		73	2	NA		<LOD	85	<LOD	5	80	26	54	2	<LOD	564	395	12	62	2
23	19-Jun-13	13-TC-SHAFT4-SS1	E		13:58:41	Soil	41.73	25	6	<LOD	81	<LOD	21	243	8	<LOD	37	<LOD	0	<LOD	5	<LOD	3	6	2	NA		<LOD	45	<LOD	0	101	32	10365	148	<LOD	11	NA		NA		<LOD	0	485	33	38	3	<LOD	27	NA		95	3	NA		<LOD	86	<LOD	4	<LOD	77	56	2	687	196	297	10	67	2
25	19-Jun-13	13-TC-ADIT4-SS1	A	CENTER	15:36:11	Soil	40.55	26	5	<LOD	79	30	7	162	6	<LOD	36	<LOD	0	<LOD	4	<LOD	3	<LOD	5	NA		<LOD	44	<LOD	0	162	34	12765	165	<LOD	9	NA		NA		<LOD	0	345	29	38	3	<LOD	24	NA		60	2	NA		<LOD	82	<LOD	4	<LOD	75	45	2	<LOD	531	125	7	45	2
26	19-Jun-13	13-TC-ADIT4-SS1	B	N	15:39:45	Soil	40.79	<LOD	9	<LOD	89	137	10	41	4	<LOD	37	<LOD	0	<LOD	4	<LOD	3	8	2	NA		50	15	<LOD	0	310	46	21334	256	<LOD	11	NA		NA		<LOD	0	1003	46	56	3	<LOD	34	NA		133	3	NA		<LOD	85	<LOD	4	<LOD	77	100	3	<LOD	641	892	18	112	3
27	19-Jun-13	13-TC-ADIT4-SS1	C		15:42:19	Soil	40.74	13	4	<LOD	94	72	9	62	5	<LOD	39	<LOD	0	<LOD	4	<LOD	3	9	2	NA		<LOD	47	<LOD	0	260	43	17011	222	<LOD	11	NA		NA		<LOD	0	1089	48	39	3	<LOD	31	NA		142	3	NA		<LOD	89	<LOD	4	<LOD	80	135	3	706	224	564	15	116	3
28	19-Jun-13	13-TC-ADIT4-SS1	D		15:44:06	Soil	39.87	196	23	<LOD	102	238	13	3479	46	<LOD	39	<LOD	0	<LOD	10	<LOD	8	<LOD	12	NA		<LOD	47	<LOD	0	375	58	30736	370	<LOD	18	NA		NA		<LOD	0	1216	54	301	5	<LOD	40	NA		128	4	NA		<LOD	91	<LOD	10	117	27	74	3	1099	251	615	16	116	3
29	19-Jun-13	13-TC-ADIT4-SS1	E		15:45:47	Soil	38.91	278	33	<LOD	125	228	14	6759	83	<LOD	42	<LOD	0	<LOD	13	<LOD	11	<LOD	16	NA		<LOD	51	<LOD	0	479	63	32033	402	<LOD	24	NA		NA		<LOD	0	966	52	234	5	<LOD	42	NA		80	3	NA		<LOD	97	15	5	<LOD	87	183	4	2209	295	670	18	103	3
32	19-Jun-13	13-TR-SHAFT5-SS1	A		17:43:53	Soil	41.97	<LOD	10	<LOD	101	47	8	41	4	<LOD	39	<LOD	0	<LOD	4	<LOD	3	<LOD	5	NA		<LOD	47	<LOD	0	227	46	19419	252	<LOD	10	NA		NA		<LOD	0	2582	75	109	4	<LOD	32	NA		95	3	NA		<LOD	90	<LOD	4	<LOD	81	297	5	883	235	69	6	101	3
33	19-Jun-13	13-TR-SHAFT5-SS1	B		17:45:38	Soil	43.66	<LOD	9	<LOD	97	<LOD	22	26	4	<LOD	40	<LOD	0	<LOD	4	<LOD	3	5	2	NA		<LOD	48	<LOD	0	258	45	17099	235	<LOD	11	NA		NA		<LOD	0	470	37	15	3	<LOD	29	NA		104	3	NA		<LOD	91	<LOD	4	<LOD	83	193	4	938	229	57	5	97	3
34	19-Jun-13	13-TR-SHAFT5-SS1	C		17:47:53	Soil	39.64	28	8	<LOD	100	212	11	477	11	<LOD	37	<LOD	0	<LOD	5	<LOD	4	<LOD	5	NA		<LOD	45	<LOD	0	174	47	23913	281	<LOD	12	NA		NA		<LOD	0	1361	52	134	3	<LOD	32	NA		53	2	NA		89	28	<LOD	5	<LOD	77	45	2	708	225	687	16	61	2
35	19-Jun-13	13-TR-SHAFT5-SS1	D		17:49:31	Soil	40.74	<LOD	8	<LOD	102	36	8	16	4	<LOD	38	<LOD	0	<LOD	4	<LOD	3	7	2	NA		<LOD	47	<LOD	0	340	50	23564	289	<LOD	10	NA		NA		<LOD	0	612	39	35	3	<LOD	35	NA		99	3	NA		<LOD	89	<LOD	4	<LOD	80	380	6	1083	242	38	5	99	3
36	19-Jun-13	13-TR-SHAFT5-SS1	E		17:51:13	Soil	41.56	<LOD	7	<LOD	90	47	8	<LOD	10	<LOD	38	<LOD	0	<LOD	4	<LOD	3	6	2	NA		<LOD	46	<LOD	0	270	45	19873	246	<LOD	10	NA		NA		<LOD	0	851	43	33	3	<LOD	31	NA		99	3	NA		<LOD	87	<LOD	4	<LOD	78	229	4	665	218	36	4	77	3

Notes

1 "Subsample" field indicates one of five subsample locations. Subsample were collected from each quadrant and the center of the feature.
2 "Run time" is the amount of time the XRF instrument took in seconds to collect a measurement.
3 All measurements, including range, are in milligrams per kilogram.
4 COPCs are highlighted gray.

Appendix C

Table 6, XRF Quality Assurance and Quality Control

Reading	Date	Location [1]	Time	Mode [2]	Run Time [3]	As	As +/-	Cr	Cr +/-	Cu	Cu +/-	Pb	Pb +/-	Ag	Ag +/-	Ba	Ba +/-	Br	Br +/-	Au	Au +/-	Bi	Bi +/-	Ca	Ca +/-	Cd	Cd +/-	Cl	Cl +/-	Co	Co +/-	Fe	Fe +/-	Hg	Hg +/-	I	I +/-	K	K +/-	LE	LE +/-	Mn	Mn +/-	Mo	Mo +/-	Ni	Ni +/-	P	P +/-	Rb	Rb +/-	S	S +/-	Sb	Sb +/-	Se	Se +/-	Sn	Sn +/-	Sr	Sr +/-	Ti	Ti +/-	Zn	Zn +/-	Zr	Zr +/-	W	W +/-	Th	Th +/-	Match1	MN1	Pass/Fail	Pass Fail Standard
1	18-Jun-13		8:07:32	Standardization	36.7																																																																																						
2	18-Jun-13	BLANK SiO2	8:09:15	Soil	41.2	<LOD	5	<LOD	60	<LOD	17	<LOD	7	<LOD	36	<LOD	0	<LOD	3	<LOD	2	<LOD	3	NA		<LOD	43	<LOD	0	<LOD	18	43	13	<LOD	8	NA	NA	<LOD	0	<LOD	39	<LOD	7	<LOD	20	NA	<LOD	3	NA	97	27	<LOD	3	80	24	<LOD	4	<LOD	367	<LOD	7	7	2																					
3	18-Jun-13	NIST 2702	8:12:54	Soil	44.05	34	6	414	69	80	11	117	8	<LOD	46	<LOD	0	48	3	<LOD	5	10	2	NA		<LOD	55	<LOD	0	1098	109	82697	1037	<LOD	14	NA	NA	<LOD	0	1686	78	18	3	<LOD	62	NA	110	4	NA	<LOD	102	<LOD	6	<LOD	93	116	4	9469	577	401	15	252	5																					
12	18-Jun-13		12:37:25	Standardization	37.57																																																																																					
17	18-Jun-13		14:41:09	Standardization	36.82																																																																																					
31	18-Jun-13		19:17:59	Standardization	38.02																																																																																						
1	19-Jun-13		7:36:11	Standardization	37.79																																																																																							
3	19-Jun-13	BLANK SiO2	7:42:56	Soil	41.59	<LOD	5	<LOD	56	<LOD	16	<LOD	7	<LOD	35	<LOD	0	4	1	<LOD	2	<LOD	3	NA		<LOD	43	<LOD	0	<LOD	18	58	14	<LOD	7	NA	NA	<LOD	0	<LOD	34	<LOD	7	<LOD	19	NA	<LOD	3	NA	<LOD	79	<LOD	3	<LOD	72	<LOD	4	<LOD	364	<LOD	8	6	2																					
4	19-Jun-13	NIST 2702	7:44:46	Soil	44.36	33	6	312	66	108	12	114	7	<LOD	46	<LOD	0	52	3	<LOD	5	10	2	NA		<LOD	55	<LOD	0	1003	108	81957	1027	<LOD	15	NA	NA	<LOD	0	1560	75	17	3	<LOD	63	NA	111	4	NA	<LOD	102	<LOD	6	<LOD	93	112	4	9518	577	378	14	247	5																					
18	19-Jun-13		13:42:34	Standardization	38.32																																																																																					
19	19-Jun-13		13:48:01	Standardization	38.44																																																																																						
31	19-Jun-13		17:41:38	Standardization	39.1																																																																																							
1	21-Jun-13		7:25:39	Standardization	30.43																																																																																							
2	21-Jun-13		7:32:26	Standardization	26.86																																																																																							
16	24-Jun-13			Standardization	28.44																																																																																								0.019751	221	-0.034421	PASS
17	24-Jun-13	Nist 2702		Soil	43.44	47	6	264	67	114	13	106	7	-6	12	1091	212							NA		-10	15	NA		980	123	84572	1029	-3	5	NA	NA	0	0	1822	84	3	3	5	24	NA	132	4	NA	34	26	8	2	51	24	118	4	11259	663	417	15	439	9	4	6	12	2																					
18	24-Jun-13	Nist 2781		Soil	36.93	15	4	30	32	376	13	104	5	-22	9	-85	92							NA		-9	10	NA		176	42	18077	194	-2	4	NA	NA	0	0	438	32	32	2	22	12	NA	21	1	NA	-4	17	8	1	2	16	151	3	2292	258	702	14	270	5	5	5	16	2																					
19	24-Jun-13	SiO2		Soil	38.27	1	2	-103	20	-1	6	-11	3	-53	8	-485	59							NA		-13	10	NA		-12	7	-23	11	-4	2	NA	NA	0	0	-18	13	16	2	-23	7	NA	2	1	NA	0	17	-3	1	20	16	6	1	353	146	-1	2	15	3	-4	2	13	1																					
22	24-Jun-13			Standardization	29.76																																																																																						0.01974	220	-0.025034	PASS
1	25-Jun-13			Standardization	29.34																																																																																							0.019747	221	-0.034623	PASS
2	25-Jun-13			Standardization	0.15																																																																																								0	0	0	
3	25-Jun-13			Standardization	29.94																																																																																								0.019741	227	-0.030878	PASS
4	25-Jun-13	Nist 2781		Soil	39.33	15	5	90	38	545	16	166	7	21	9	218	113							NA		2	11	NA		391	56	27279	291	5	5	NA	NA	0	0	798	43	37	3	52	14	NA	30	2	NA	7	19	16	2	54	18	220	4	3431	323	1074	20	394	7	7	7	11	2																					
5	25-Jun-13	Nist 2702		Soil	41.15	36	4	138	47	58	9	42	5	-37	10	204	141							NA		5	12	NA		423	80	50269	535	0	4	NA	NA	0	0	1121	56	21	3	-11	16	NA	70	2	NA	21	20	0	1	-14	19	64	2	6693	432	259	10	250	6	1	4	18	2																					
6	25-Jun-13	SiO2		Soil	37.78	3	2	-123	20	-14	5	-15	3	-45	8	-459	60							NA		-15	10	NA		-15	7	13	12	1	2	NA	NA	0	0	-45	12	21	2	-17	8	NA	1	1	NA	-11	17	-5	1	-28	16	6	1	160	143	-1	2	12	3	-2	2	16	1																					
30	25-Jun-13			Standardization	30.06																																																																																								0.019741	221	-0.018092	PASS
1	26-Jun-13			Standardization	29.24																																																																																								0.019744	224	-0.028861	PASS

Notes

1 "Location" indicates type of standard tested against. These standards are supplied by the equipment manufacturer and are measured to detect potential drifts in precision.
2 "Mode" indicates whether the XRF instrument was measuring a QC standard or the metal clip supplied for instrument QA.
3 "Run time" is the amount of time the XRF instrument took in seconds to collect a measurement.
4 All measurements, including range, are in milligrams per kilogram.
5 COPCs are highlighted gray.

This page intentionally left blank.