Proposed Plan
Holden Mine Site
Chelan County, Washington

Prepared by
USDA Forest Service

In Cooperation with
US Environmental Protection Agency and
Washington State Department of Ecology

June 1, 2010
4769-15

PROPOSED PLAN
HOLDEN MINE SITE
CHELAN COUNTY, WASHINGTON

Announcement of the Proposed Plan

This Proposed Plan identifies the Preferred Alternative for contaminated soils, groundwater, and surface water at the Holden Mine Site (Site). Discussion includes the Site background, information on the nature and extent of contamination, and the rationale for the Preferred Alternative. This Proposed Plan also summarizes the other remedial alternatives considered during the Remedial Investigation/Feasibility Study (RI/FS) process. This Proposed Plan is issued by the United States Department of Agriculture Forest Service (Forest Service), acting as the lead agency for Site activities, in cooperation with the Washington State Department of Ecology (Ecology) and the US Environmental Protection Agency (EPA). The Forest Service, Ecology, and EPA (jointly referred to as the Agencies) will select a remedy for the Site after reviewing and considering all information submitted during the public comment period. The Confederated Tribes and Bands of the Yakama Nation have and will continue to consult on remedy selection. The public is encouraged to review and comment on all of the alternatives presented in this Proposed Plan.

The Forest Service and EPA are issuing this Proposed Plan as part of their public participation responsibilities under the federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 117(a) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR § 300.430(f)(2). Issuance of this Proposed Plan also satisfies Ecology's public participation responsibility in selecting a cleanup action under Washington's Model Toxics Control Act (MTCA), WAC 173-340-600(14). This Proposed Plan summarizes information that is presented in the RI/FS reports and other documents contained in the Administrative Record files for this Site. The Agencies encourage the public to review these documents to gain a more comprehensive understanding of the Site.

Invitation for Public Comments

Public comment period: June 23, 2010 through August 9, 2010

Comments should be addressed to: Mr. Norman F. Day
Okanogan-Wenatchee National Forest
215 Melody Lane
Wenatchee, WA 98801-5933

Comments may also be submitted by email to: comments-pacificnorthwest-wenatchee-chelan@fs.fed.us

Public meetings will be announced.

Additional information about the Site, results of investigations, and evaluation of alternatives can be reviewed at the following locations:

OFFICIAL ADMINISTRATIVE RECORD

Supervisor's Office
Okanogan-Wenatchee National Forest
215 Melody Lane
Wenatchee, WA 98801-5933
(509) 664-9200 Hours: M-F 7:45-4:30

COPIES OF THE ADMINISTRATIVE RECORD

US Environmental Protection Agency
1200 6th Avenue, Suite 900
Seattle, WA 98101
(206) 553-1200
Hours: M-F 8:00-4:30 (check-in on 12th floor)

Washington State Department of Ecology
Central Regional Office
15 West Yakima Ave, Suite 200
Yakima, WA 98902
(509) 575-2490
Hours: M-F 8:00-5:00

Proposed Plan Available at:

Wenatchee Public Library
310 Douglas Street
Wenatchee, WA 98801
(509) 662-5021

Chelan Public Library
417 S Bradley Street
Chelan, WA 98816
(509) 682-5131

Holden Village
HC00 Stop 2
Chelan, WA 98816-9769
(No phone service)
Contact Holden Village staff to examine documents

Yakama Nation Cultural Center Library
100 Spiel-yi Loop,
Toppenish, WA 98948
(509) 865-2800 ext. 6

National Park Service
Stehekin Ranger Station
Golden West Visitor Center
P.O. Box 7
Stehekin, WA 98852
(360) 854-7200, then x5 (call is routed through Sedro Woolley via satellite phone connection)

Seattle Public Library
1000 Fourth Avenue
Seattle, WA 98104-1109
(206) 386-4636

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SEPA CHECKLIST

ACRONYMS AND DEFINITIONS

Agencies	USDA Forest Service, acting with the US Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology)
AOC	Administrative Order on Consent
AOI	Area of Interest
AKART	All known, available, and reasonable methods of treatment, as referenced in the MTCA regulations [e.g., WAC 173-340-200 (within definition of "All practicable methods of treatment"); WAC 173-340-720(8)(d)]. Note that other state regulations use AKART to refer to all known, available, and reasonable methods of prevention, control, and treatment [e.g., WAC 173-201A-020], and this definition is also applicable to the Site.
APA	Agencies' Proposed Alternative
ARAR	Applicable, or relevant and appropriate requirement
ASFS	Addendum to the Supplemental Feasibility Study (Forest Service 2010b).
BLM	United States Department of the Interior, Bureau of Land Management.
CAP	Cleanup Action Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act [42 USC §§ 9601-9675]
CFR	Code of Federal Regulations
CULs	Cleanup levels; cleanup levels are proposed until final values are selected at the time of the ROD
cy	cubic yard
DFFS	Draft Final Feasibility Study (URS 2004)
DRI	Draft Remedial Investigation report (Dames & Moore 1999)
DSHH	Areas downslope of Honeymoon Heights Waste Rock Piles, as defined in the TEE
Ecology	Washington State Department of Ecology
EPA	US Environmental Protection Agency
ERA	Ecological Risk Assessment
Ferricrete	A cemented deposit of iron oxide precipitate that forms in stream channel sediments as a result of the release of iron sulfates and other hazardous substances.
Forest Service	United States Department of Agriculture, Forest Service

FS	Feasibility Study. For the Holden Mine Site the FS consists of several reports, letters, and other documents; these are listed in Section 2 of this ASFS.
FSQG	Freshwater Sediment Quality Guidelines
FSQV	Freshwater Sediment Quality Values
gpm	gallons per minute
HHRA	Human Health Risk Assessment
HHWRP	Honeymoon Heights Waste Rock Piles
HQ	Hazard Quotient. An HQ is the ratio of the dose of a single hazardous substance over a specified time period to a reference dose to a specific organism for that substance derived for a similar exposure period . The reference dose generally represents the maximum dose for which no adverse effects are likely to result. An HQ greater than 1 (i.e., a hazardous substance concentration or dose above the reference dose) indicates the hazardous substance concentration is likely to cause adverse effects to that organism.
LBI	Lutheran Bible Institute
LRMP	Wenatchee National Forest Land and Resource Management Plan
LWA	Lower West Area
LWA-East	LWA east of the road to the Maintenance Yard
LWA-West	LWA west of the road to the Maintenance Yard, excluding the Lagoon
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
MGY	Million gallons per year
Mining Claims	Portions of public lands claimed for possession of locatable mineral deposits by locating and recording under established rules and pursuant to the 1872 Mining Law.
MNA	Monitored Natural Attenuation
MTCA	Model Toxics Control Act [RCW 70.105D.010-.921]
NCP	National Oil and Hazardous Substances Pollution Contingency Plan [40 CFR Part 300]
NPDES	National Pollutant Discharge Elimination System as authorized by the Clean Water Act [33 USC § 1342, Section 402]
NRRB	National Remedy Review Board
O&M	Operations and Maintenance (also sometimes referred to as OM&M, Operations, Maintenance, and Monitoring)

ACRONYMS AND DEFINITIONS (CONT.)

PCB	Polychlorinated Biphenyl, a toxic chemical
PLP	Potentially Liable Party
Portal	Entrance to an underground mine. Holden Mine had eight portals (300, 550, 700, 800, 1000, 1100, and 1500-level portals and the 1500-level Ventilator Portal, some of which are now caved in). The 1500-level portal is typically referred to as the Main Portal.
PRP	Potentially Responsible Party
RA	Remedial Action
RAO	Remedial Action Objective
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SEPA	State Environmental Policy Act [Chapter 43.21C RCW]
SFS	Supplemental Feasibility Study (Forest Service 2007c).
Site	The Holden Mine Site
SRA	Ventilator Portal Surface Water Retention Area
Tailings	Fine-grained waste materials from an ore-processing operation
TP-1, TP-2, and TP-3	Tailings Pile 1, Tailings Pile 2, and Tailings Pile 3, respectively
TPH	Total petroleum hydrocarbon
TEE	Terrestrial Ecological Evaluation. A TEE is used to determine whether a release of hazardous substances to soil may pose a threat to the terrestrial environment, characterize existing or potential threats to terrestrial plants or animals exposed to hazardous substances in soil, and establish site-specific cleanup standards for the protection of terrestrial plants and animals.
USFWS	US Fish and Wildlife Service
UWA	Upper West Area
Waste Rock	Rock with no commercial value that is removed from the earth during mining.
WMA	Waste Management Area

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1.0 INTRODUCTION

Holden Mine is an inactive underground copper mine located in the Railroad Creek valley on the eastern slopes of the Cascade Mountains in Washington State. The mine was formerly operated by the Howe Sound Company. The Site is located approximately 10 miles west of Lake Chelan and lies within the Wenatchee National Forest. The Site includes the entire area impacted by releases from the former mine as generally depicted on Figure 10. The former miner's town, Holden Village, is located adjacent to the mine and is now occupied by an interdenominational religious retreat. The retreat is operated by a not-for-profit corporation, Holden Village, Inc., under a Special Use Permit with the Forest Service. Holden Village is home to about 60-year-round residents and hosts approximately 5,000 visitors a year.

From 1989 to 1991, the Forest Service took actions to prevent the tailings piles at the Site from eroding into Railroad Creek and being distributed by the wind. In 1998, the USDA Forest Service, acting with the US Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology)—hereafter referred to as the Agencies—entered into an Administrative Order on Consent with Howe Sound Company's successor, Alumet Corporation, requiring it to investigate and clean up the entire Site.

The Agencies have determined that the past mining operations at the Site have resulted in an ongoing release of hazardous substances from the Site, and an appropriate response action is required under both federal and state law. There are adverse water quality impacts in groundwater beneath the Site, in seeps discharging to Railroad Creek, and in surface water (Railroad Creek and the Copper Creek Diversion). High concentrations of hazardous substances have reduced populations of fish and aquatic macroinvertebrates in Railroad Creek adjacent to and downstream of the mine. Concentrations of hazardous substances in groundwater exceed human health criteria for drinking water. Concentrations of hazardous substances in mine tailings, waste rock, and soils at the Site exceed criteria for protection of human health for direct contact and ingestion. In the absence of a complete cleanup action, the release of hazardous substances is anticipated to continue for hundreds of years.

Between 1998 and 2004, Intalco Aluminum Corporation, successor to Alumet Corporation, conducted a remedial investigation (RI) and prepared a feasibility study (FS) report that presented several remedial alternatives. However, upon

review of these studies, the Agencies determined that none of the alternatives presented in the FS were adequate. Subsequently, Intalco and the Agencies evaluated other remedial alternatives and Intalco performed significant additional analyses and field investigations. These efforts led to the production of a number of reports, culminating in the Addendum to the Supplemental Feasibility Study (ASFS) that was prepared by the Agencies in 2010. The ASFS and associated reports document the Agencies' evaluation of three main alternatives for remediation of the Site and form the basis for identifying Alternative 14 as the preferred cleanup alternative.

2.0 SITE BACKGROUND

2.1 History of Operations and Land Ownership

Holden Mine operated from 1938 to 1957. The Howe Sound Mining Company (Howe Sound) developed and operated the mine during this period, constructed an on-site mill for processing ore, and constructed housing for the miners near the mine.

Howe Sound discarded more than 300,000 cubic yards of waste rock on the surface of the Site near the mill building during development of the underground workings. Waste rock is rock with no commercial value that is removed from the earth during mining. Howe Sound processed ore from the mine in the on-site mill to produce a metal concentrate that it shipped off the Site for smelting.

Howe Sound produced roughly 10-million tons of tailings as a byproduct of milling, most of which was discarded in three large piles directly south of Railroad Creek. Tailings are fine-grained waste materials from an ore-processing operation. Howe Sound relocated portions of Railroad Creek northward to make room for construction of the tailings piles.

Howe Sound closed the mine in 1957. In 1960, Howe Sound transferred its patented land and unpatented mining claims and other assets to the Lutheran Bible Institute (LBI). In 1961, LBI transferred the property to Holden Village, Inc. (a not-for-profit corporation) to operate an interdenominational religious retreat in the former miners' town site. Holden Village, Inc. continues to occupy the former company town under a Special Use Permit from the Forest Service. A portion of Holden Village Inc.'s private property (patented mining claims) is used by Holden Village for infrastructure support (hydroelectric power generation, recycling, and woodcutting) and vehicle maintenance and parking.

With the exception of the patented private land, the remainder of the Site is on National Forest System lands administered by the Okanogan-Wenatchee National Forest.

2.2 Chronology of the Remedial Investigation and Feasibility Study Process

Site characterization information, data, and regulatory and technical analyses that are used for remedy selection decision making are presented in the Remedial Investigation and Feasibility Study (RI/FS).

The Remedial Investigation (RI) for the Holden Mine is presented in the following documents:

- Dames & Moore 1999. Draft Final Remedial Investigation Report, Holden Mine Site. Prepared for Alumet Inc. by Dames & Moore. Seattle, Washington. July 28, 1999.

- Forest Service 2002. Letter from Norman F. Day to Dave Jackson, Finalization of the Holden Mine Remedial Investigation Report. February 8, 2002.

The Feasibility Study (FS) for the Holden Mine consists of the following documents:

- URS 2004. Draft Final Feasibility Study. February 19, 2004.

- URS 2005. Alternative 9 Description and Focused CERCLA-MTCA Feasibility Evaluation, Holden Mine Site, Chelan County, Washington. November 18, 2005.

- Forest Service 2007a. Agencies' Comments on the Draft Final Feasibility Study. August 31, 2007.

- Forest Service 2007b. Agencies' Comments on Intalco's Alternative 9 Description. August 31, 2007.

- Forest Service 2007c. Supplemental Feasibility Study. September 2007.

- ERM and URS 2009. Draft Alternative 13M Evaluation Report. August 14, 2009.

- Forest Service 2010a. Agencies' Comments on Intalco's August 14, 2009 Alternative 13M Evaluation Report and related documents. March 30, 2010.

- Forest Service 2010b. Addendum to the Supplemental Feasibility Study, Holden Mine, Chelan County, Washington. March 30, 2010.

In 1993, the Agencies identified Alumet Corporation (a successor in interest to Howe Sound) as a potentially responsible party (PRP) for the Holden Mine cleanup action. On April 11, 1998, Alumet and the Agencies entered into an Administrative Order on Consent/Agreed Order (AOC) to conduct an RI/FS for cleanup of the Site. Alumet Corporation subsequently merged into Intalco Aluminum Corporation and is hereafter referred to as Intalco.

Intalco completed a Draft Remedial Investigation (DRI) report (Dames & Moore 1999). The DRI found that there was an ongoing release of hazardous substances at the Site, which required cleanup under both state and federal law. Intalco prepared a Draft Final Feasibility Study (DFFS, URS 2004). The DFFS described eight proposed remedial alternatives, as well as variations on several of these.

The Agencies reviewed the DFFS and found it was deficient (Forest Service 2007a). The Agencies determined that none of the alternatives presented in the DFFS would meet the threshold requirements that must be satisfied for a remedial alternative to be selected as the final cleanup remedy for a site. Subsequently, both Intalco and the Agencies developed additional remedial alternatives that were designated as Alternatives 9, 10, 11, and 12. These alternatives were described and evaluated in the Supplemental Feasibility Study (SFS, Forest Service 2007c). The Agencies prepared the SFS to address the deficiencies of the DFFS, as provided for in the AOC.

The Agencies prepared a draft Proposed Plan that identified Alternative 11 as the Preferred Alternative for the Site (Forest Service 2007d), whereupon Intalco proposed a variation on Alternative 5c presented in the DFFS, which it designated as Alternative 13 (David E Jackson & Associates et al. 2007).

Intalco proposed extensive studies to evaluate components of Alternative 13 and potential modifications to it (Intalco 2007a and b; and 2008a, b, and c). After initial review of Alternative 13 and Intalco's proposals, the Agencies determined there was insufficient information available to evaluate Alternative 13 or its potential modifications. The Agencies identified additional information that was needed for this evaluation in eight specific areas (USDA OGC 2008) and Intalco agreed to obtain this information (Intalco 2008d).

Intalco subsequently developed a series of work plans that were reviewed and commented on by the Agencies. Fieldwork was accomplished in 2008 and

2009. Intalco briefed the Agencies in a series of technical meetings and teleconferences about the studies that Intalco conducted in 2008 and 2009. During this evaluation process, Intalco modified Alternative 13 and referred to the modified alternative as Alternative 13M. Intalco produced the report titled Draft Alternative 13M Evaluation Report (ERM and URS 2009) on August 14, 2009.

The Agencies reviewed and commented on Intalco's Draft Alternative 13M Evaluation Report (Forest Service 2010a). The Agencies evaluated Alternative 13M relative to other alternatives as described in the Addendum to the Supplemental Feasibility Study (ASFS, Forest Service 2010b). The Agencies prepared the ASFS to present relevant information not included in the Draft Alternative 13M Evaluation Report, update the remedial action objectives (RAOs), describe three remedial alternatives developed after the SFS (Alternatives 11M, 13M, and 14), and evaluate these three additional alternatives. The Agencies developed Alternative 14 to address certain Alternative 13M deficiencies (related to protection of surface water and remediating soils to achieve soil cleanup standards), as provided for in Paragraph 36 of the AOC.

The Agencies accepted a final FS (Forest Service 2010c) that consists of:

- The DFFS and Intalco's Alternative 9 Description (URS 2005), as modified and supplemented by the Agencies' Comments on the Draft Final Feasibility Study (Forest Service 2007a) and the Agencies' comments on Intalco's Alternative 9 Description (Forest Service 2007b);

- The SFS (Forest Service 2007c); and

- Intalco's Draft Alternative 13M Evaluation Report as modified and supplemented by the Agencies' comments (Forest Service 2010a), together with the ASFS.

These documents are included in the Administrative Record for the Site.[1]

[1] The Administrative Record contains all information used to select a response action under CERCLA. The Administrative Record is available for public review at the locations specified at the beginning of this Proposed Plan. The final Administrative record will include comments received during the public comment period and the Agencies' responses to those comments.

2.3 Response Actions Completed to Date

From 1989 to 1991, the Forest Service implemented an interim action to stabilize the tailings piles against wind erosion and to increase resistance to stream erosion. Intalco secured the mine entries and fenced the abandoned mill building to prevent trespass in 2000. Subsequently in 2003, 2004, and 2006, Intalco implemented additional time-critical stabilization measures to control erosion and repair flood damage to the tailings piles.

3.0 SITE CHARACTERISTICS

3.1 Physical Setting

The Site is located in the Railroad Creek Watershed that drains to Lake Chelan. The 1500-level Portal (Main Portal) of the mine and the former Mill Building are located on the south side of the valley, near the base of the relatively steep valley slope. As the mine was developed, piles of waste rock were dumped on the valley slopes, and tailings from the mill were deposited on the wetlands and relatively flat-lying alluvial areas south of and adjacent to Railroad Creek (see Figure 3).

Railroad Creek is the second largest hydrologic source to Lake Chelan and contributes approximately 10 percent of the annual basin input. The area where the mine operated is the largest of only a few floodplain valley reaches in the Railroad Creek drainage and one of the few floodplain valleys in the entire Lake Chelan drainage. Therefore, this flood plain valley is important to the overall ecology of the Lake Chelan Basin. The forest surrounding the Site provides key habitat for riparian-dependent species and important resources for both riparian and upland species.

The former mine is only accessible by road from Lucerne, which is located on Lake Chelan at the mouth of Railroad Creek. Lucerne is accessible by a passenger ferryboat service, commercial barge service, private boat, and/or floatplane. There is no highway access to the former mine.

Groundwater is present at the Site as a shallow unconfined aquifer in the alluvium that overlies glacial till and bedrock. Shallow groundwater at the Site is recharged during the late spring into early summer, primarily by snowmelt. During the remainder of the year, groundwater is supplied by rainfall and locally by surface water loss from the creeks. Groundwater flows into the former mine area throughout the year from the west and south and discharges into Railroad Creek by drainage from the Main Portal. Groundwater also discharges into Railroad Creek as base flow through the creek bed and as surface seeps.

Groundwater and infiltration saturate the surface soils during the spring and early summer, and seeps form where groundwater elevations become higher than the surrounding soil surface. Some seeps discharge directly to Railroad Creek. Other seeps infiltrate back into the ground and become shallow groundwater before discharging to Railroad Creek.

After mining operations ceased in 1957, the mine partially filled with groundwater and water began to drain out of the Main Portal. Drainage from the Main Portal varies annually from about 90 gpm in the fall to around 1,200 gpm (and occasionally higher) in the spring, and discharges overland into Railroad Creek. An underground collapse in 1970 temporarily blocked the discharge from the Main Portal, as collapsed overburden dammed water flowing from the mine until the water pressure was sufficient to break the dam. The surge of water that was released eroded a portion of the main West Waste Rock Pile and turbid water entered Railroad Creek. The force of the released water eroded a cut approximately 10 feet deep where it crossed the road by Holden Village's garage (Forest Service 1970).

3.2 Summary Description of Principal Site Features

The Site comprises a number of informally defined "areas of interest" (AOIs) and other Site features. These features are shown on Figure 3 and described in the following subsections.

3.2.1 Tailings Piles 1, 2, and 3

Tailings at the Site occur in three main piles (identified as Tailings Piles 1, 2, and 3) located along the south side of Railroad Creek. Tailings are also dispersed in other areas, such as the east portion of the Lower West Area (Lower West Area-East), as described below. The three main piles, which range in height up to about 120 feet above the creek, are estimated to contain approximately 8.5 million tons of tailings covering an area of roughly 90 acres.

3.2.2 East and West Waste Rock Piles

The East and West Waste Rock Piles consist of an estimated 307,000 cubic yards (cy) of waste rock that covers about 8 acres, and range in height up to about 165 feet.

3.2.3 Honeymoon Heights Waste Rock Piles

The Honeymoon Heights Waste Rock Piles consist of five discrete waste rock piles associated with the 300-, 550-, 700-, 800-, and 1,100-level portals, totaling

about 49,000 cy, and covering an area of about 5 acres. The Honeymoon Heights Waste Rock Piles are located between about elevation 3,800 to 4,600 feet across a relatively steep north-facing slope that varies from about 50 percent (2H:1V) to 200 percent (1H:2V).

The Honeymoon Heights Waste Rock Piles are located on private land, except for possibly a small portion of the 1,100-level waste rock pile that may be located on National Forest System land. The piles are located in an area that is biologically important as functional riparian habitat (Figure 4).

3.2.4 TEE Areas Downslope from the Honeymoon Heights Waste Rock Piles

The Terrestrial Ecological Evaluation (TEE) described an AOI consisting of a total of about 3 acres of riparian forest habitat directly downslope from the Honeymoon Heights Waste Rock Piles (DSHH) associated with the 300-, 550-, 700-, 800-, and 1100-level portals. The largest of the DSHH, as defined by the TEE, is shown on Figure 3. Like the Honeymoon Heights Waste Rock Piles, the DSHH are located on a relatively steep north-facing slope.

The DSHH are on private land in an area that is biologically important as functional riparian habitat (Figure 4).

3.2.5 Ballfield Area

The Ballfield Area is located several hundred feet east of the edge of the Glacier Peak Wilderness (see Figures 3 and 5) and covers an area of about 8 acres, including the former miners' village baseball field, a campground, and the adjacent area. The Ballfield Area is primarily on National Forest System land, although a small portion is on patented land owned by Holden Village.

3.2.6 Holden Village

Holden Village currently includes about 25 buildings, as well as roads and landscaped areas. The former miner's village covers an area of about 11 acres (see Figure 3). Holden Village, Inc. has operated since 1961 as an interdenominational religious retreat under a Special Use Permit issued by the Forest Service. All of the buildings in the village are located on National Forest System land. Approximately 60 adults and children live at Holden Village year-round. In addition, approximately 5,000 to 6,000 people visit the facility each year, with each person staying an average of 2 to 7 days.

3.2.7 Lower West Area

The Lower West Area covers an area of about 15 acres located south of Railroad Creek and west of Tailings Pile 1. The Lower West Area is roughly bisected by a road running south from the vehicle bridge over Railroad Creek to the Holden Village Maintenance Yard (Figure 3); the eastern portion of the Lower West Area is referred to as Lower West Area-East and the western portion is called Lower West Area-West, excluding the Lagoon. An ephemeral pond, referred to as the Lagoon, is located along this road and is considered as a separate AOI, as discussed later.

3.2.8 Lagoon Area

The Lagoon was reportedly excavated as a surface water management facility during mine operations, and may also have been used for temporary storage of tailings slurry that was pumped to the tailings piles, or perhaps for backfilling portions of the underground mine. The Lagoon covers an area of about one acre, and contains visible accumulations of tailings.

3.2.9 Wind-Blown Tailings Area

The Wind-Blown Tailings Area extends over an area of about 77 acres located north and east of Tailings Pile 2 and Tailings Pile 3. This area is mostly coniferous forest, with a strip of riparian wetland habitat along Railroad Creek. The Wind-Blown Tailings Area has intermittent visible accumulations of tailings. A portion of this area nearest to the creek was clear-cut and became reforested in the early 1960s; other areas were selectively harvested and have residual old growth structure. The remainder has not been logged and has well-established native vegetation.

3.2.10 Maintenance Yard

The Maintenance Yard is an area of about 1 acre where Howe Sound and, subsequently, Holden Village performed equipment maintenance (Figure 3). The surface of the Maintenance Yard is densely compacted gravelly soil with little or no existing vegetation.

3.2.11 Former Mill Building

The former Mill Building is located between the East and West Waste Rock Piles, and extends over an area of about 2 acres. The ground surface is largely covered by concrete slabs and walls, along with debris and remnants of the steel superstructure. The dilapidated condition of the former Mill Building did not

allow safe access during the RI to fully characterize potential hazardous substances.

3.2.12 Ventilator Portal Surface Water Retention Area

The Ventilator Portal Surface Water Retention Area is apparently a former water detention pond that is located downslope of the 1500-level ventilator portal (Figure 3). The Surface Water Retention Area pond is an excavation with a perimeter berm, which extends over less than about a half acre. There are tailings in the soils within the former pond footprint.

3.2.13 Lucerne-Holden Road

In September 2009, the Forest Service found an April 24, 1940, memorandum from the District Ranger, W. O. Shambaugh (Forest Service 1940), indicating that the Howe Sound Company was proceeding with plans to resurface the road between Lucerne and Holden. The memorandum stated that the contractor for the job would install a rock crusher on the "waste dump at the mine" to obtain material for the resurfacing. Subsequent file searches by the Forest Service to date have been unsuccessful in determining whether this plan was actually implemented. Pending further investigation, the Agencies assume that waste rock may have been used for resurfacing the Lucerne-Holden Road and may be a source of contamination within the Site.

3.2.14 Other Areas of the Site

There are several other areas of the Site where former mine activities are associated with the release of hazardous substances to the environment. These areas include:

Underground Mine Workings. Approximately 10 million tons of ore were excavated from the Holden Mine during its operation. The tunnels excavated to develop the mine reportedly total 56 miles in length.

Both Intalco and the Agencies assessed the potential for mine subsidence. Intalco reported that the rock spanning the uppermost stopes (large open underground rooms where the ore was excavated) within the mine is "marginally stable." Analysis by the Agencies indicated that there is about a 75 percent probability that these rock spans (referred to as crown pillars) will someday collapse, and that the resulting ground surface subsidence would likely increase air and water movement through the abandoned workings. An increase in air or water flow through the workings could increase the rate of hazardous substance release from the Main Portal drainage.

Railroad Creek. Railroad Creek, from the Surface Water Retention Area downstream to Lake Chelan, is part of the Site.

Copper Creek. Copper Creek cuts through the Holden Mine Site from the south and flows into Railroad Creek between Tailings Piles 1 and 2. Copper Creek has actively eroded portions of both Tailings Piles 1 and 2 (e.g., in 2003 and 2006) causing a release of tailings into Railroad Creek. South (upslope) of the mine, a portion of Copper Creek is diverted into a penstock that supplies drinking water and hydroelectric generated power to Holden Village. Discharge from the generator station north (downslope) of the Maintenance Yard flows overland and into Railroad Creek. This overland flow, referred to as the Copper Creek Diversion, has eroded a portion of Tailings Pile 1 into Railroad Creek.

Riparian Wetland East of Tailings Pile 3. Riparian wetlands covering a total area of approximately 5 acres are located immediately east of Tailings Pile 3 along Railroad Creek. The riparian wetlands are apparently impacted based on field observations of distressed vegetation and soil staining.

Lucerne Bar. The Lucerne Bar is the area where sediment in Railroad Creek is deposited as the creek discharges into Lake Chelan.

3.3 Groundwater and Surface Water

Groundwater is present at the Site as a shallow unconfined aquifer in the alluvium that is hydraulically connected to Railroad Creek. Figure 7 shows generalized groundwater elevation contours and flow directions.

The DRI, as well as recent investigations, (URS 2008 and URS 2009b) have shown that Railroad Creek consists of alternating segments where groundwater flows upward into the creek (gaining reaches) and where water from the creek flows downward into the groundwater (losing reaches) (Figures 7 and 8).

Flow in Railroad Creek is generally low from late summer through winter; monthly average stream flow is below about 45,000 gpm at Lucerne. Peak flows in Railroad Creek occur during the months of May and June, coinciding with snowmelt in the basin, with average stream flow rates ranging from about 230,000 to 280,000 gpm at Lucerne.

3.4 Summary of the Nature and Extent of Contamination

This section summarizes the nature and extent of contamination at the Site. Sections 4.1 and 4.2 provide additional detail about risks to humans, plants, and animals associated with the contamination.

3.4.1 Surface Water

Surface water in Railroad Creek has been impacted by groundwater discharge (including groundwater from the Main Portal and seeps) and contact with tailings. Groundwater draining from the Main Portal discharges into Railroad Creek and contains concentrations of hazardous substances that exceed state and federal chronic toxicity water quality criteria for the protection of aquatic life. Water quality at sampling stations near the Ballfield Area downstream to the mouth of the creek at Lake Chelan has exceeded state and federal regulatory levels intended to protect aquatic life for aluminum, cadmium, copper, iron, lead, and/or zinc. Surface water in the Copper Creek Diversion (the tailrace channel from the Holden Village hydroelectric plant that discharges to Railroad Creek) has also exceeded regulatory levels for cadmium, copper, and zinc (Table 5). The ratio of surface water concentrations to proposed cleanup levels of these constituents of concern is shown on Figure 10. In general, concentrations are lower in the fall and higher in spring[2] when concentrations of some constituents exceed proposed cleanup levels by factors of 2 to over 10 times at several Railroad Creek sampling stations.

Concentrations of hazardous substances in Copper Creek are at or below state and federal water quality criteria for the protection of aquatic life.

Surface water quality at the Site does not exceed state and federal drinking water criteria.

3.4.2 Groundwater

Groundwater exceeds regulatory levels for drinking water or levels that are protective of aquatic organisms in Railroad Creek (into which groundwater eventually discharges) for aluminum, cadmium, copper, iron, lead, and/or zinc at a number of locations at the Site, most notably from the Main Portal and in seeps and monitoring wells at Tailings Pile 1, 2, and 3, the East and West Waste

[2] Concentrations vary seasonally due primarily to the effect of spring snowmelt and runoff. Flow in Railroad Creek is generally low from late summer through winter. Peak flows in Railroad Creek occur during the months of May and June, coinciding with snowmelt in the Railroad Creek drainage basin. As referenced in this Proposed Plan with respect to concentrations in surface water and groundwater, spring conditions refer to the May to July period approximately 90 days long when snowmelt causes relatively high groundwater levels and relatively high flow conditions in Railroad Creek. Fall conditions represent the other 275 days per year (August to April) typified by lower groundwater levels and relatively low flows in Railroad Creek.

Rock Piles, the Honeymoon Heights Waste Rock Piles, and the Lower West Area. Concentrations of constituents of concern at these areas are summarized in Tables 2 and 7; the ratios of groundwater concentrations of these constituents of concern to proposed cleanup levels are shown on Figure 6.

In general, groundwater concentrations are lower in the fall and higher in spring when concentrations of several constituents exceed proposed cleanup levels by factors of 100 to over 1,000 in several areas. Groundwater downgradient (east) of Tailings Pile 3 also exceeds proposed cleanup levels for aluminum, cadmium, copper, iron, and zinc (see Figure 8).

3.4.3 Soil

Soil at the Site has been impacted by releases from past mining activities and contains concentrations of hazardous substances that exceed regulatory levels for the protection of human health or the environment. Concentrations of these constituents of concern are summarized for each AOI in Tables 3 and 10. The primary constituents of concern are metals or metal-like substances such as aluminum, arsenic, cadmium, copper, and lead. Soils in the Lagoon and Maintenance Yard have also been impacted by petroleum hydrocarbons such as gasoline, diesel fuel, or heavy oils.

3.4.4 Sediment

Iron precipitates have formed in Railroad Creek as a result of the release of ferric sulfate and other hazardous substances from the tailings piles. Observed effects include ferricrete (stream channel gravels cemented with an iron oxide precipitate) and iron flocculent, which fills interstitial pore space in the sediment and coats gravel, cobbles, and boulders in the stream channel. The ferricrete and iron flocculent have caused damage to the aquatic habitat.

Releases from the Site have resulted in concentrations of hazardous substances in sediments in Railroad Creek and the Lucerne Bar that exceed values considered by the State in setting cleanup criteria for freshwater sediment for a number of hazardous substances (Table 12).

3.5 Current and Anticipated Future Land and Water Use

The Site is situated on National Forest System land administered by the Okanogan-Wenatchee National Forest, with the exception of the patented mining and mill site claims (private land) owned by Holden Village, Inc. Holden Village uses portions of the former mine area (primarily on the patented claims) for various infrastructure, including a vehicle maintenance yard and garage,

hydroelectric power plant, potable water treatment facility, recycling, solid waste storage, firewood staging area, and portable sawmill. Holden Village maintains a small museum next to the former Mill Building. Holden Village uses the surface of the West Waste Rock Pile for the storage of miscellaneous materials and solid waste recycling. There are several hiking trails throughout the area. Holden Village residents and/or visitors occasionally use parts of the tailings piles for recreational purposes. The Agencies anticipate that Holden Village, Inc. will continue to occupy the former company town under a Special Use Permit from the Forest Service, during and following implementation of the cleanup action.

The Agencies anticipate that the National Forest portion of the Site and adjacent National Forest System land, would continue to be managed as part of the National Forest following implementation of the remedy, including the Glacier Peak Wilderness which generally bounds the Site to the west, north, and south. Endangered species that may be present in areas impacted by remedial construction include the Gray Wolf and the plants Showy Stickseed and Wenatchee Mountain Checker-Mallow. Threatened species that may be present include Bull Trout, Canada Lynx, Grizzly Bear, Marbled Murrelet, Northern Spotted Owl, and the plant Ute Ladies' Tresses (USFWS 2009).

The Agencies expect the Railroad Creek Watershed will continue to be occupied by a hundred or fewer permanent residents, along with seasonal visitors on the order of 5,000 to 10,000 persons each year.

The beneficial uses of groundwater at the Site are as a potential source of drinking water for residents and visitors and as a source of recharge to local surface water bodies including Railroad Creek. Groundwater at and in the vicinity of the former mine is not currently used as a source of drinking water for residents and visitors who get their drinking water from Copper Creek upstream of the Site. But groundwater is used as a source of drinking water at Lucerne, which is downgradient of the former mine[3]. Groundwater also discharges to local surface water bodies, including Railroad Creek.

The designated beneficial uses of surface water (i.e., Railroad and Copper Creeks) are aquatic life (salmonid spawning, rearing, migration, and core summer habitat), recreation (extraordinary primary contact), water supply

[3] Lucerne is considered to be part of the Site, since hazardous substances in Railroad Creek that exceed proposed cleanup levels extend all the way to Lake Chelan.

(domestic, industrial, agricultural, and stock watering), and miscellaneous (wildlife habitat, harvesting, commerce and navigation, boating, and aesthetic value).

4.0 SUMMARY OF SITE RISKS

4.1 Human Health Risks

Humans potentially exposed to hazardous substances at the Site include Holden Village residents and visitors, other visitors to the National Forest, workers during implementation of the remedy, and Agency personnel. The Agencies have identified the following potential human health risks that exist at the Site:

- Soil at the Honeymoon Heights Waste Rock Piles and DSHH; the Lower West Area including the Lagoon; and the Maintenance Yard exceed proposed soil cleanup levels for protection of human health for direct contact with and/or ingestion of arsenic, cadmium, copper, lead, zinc, and/or gasoline-, diesel-, or heavy oil-range petroleum hydrocarbons (Table 3).

- Soil in the tailings piles, East and West Waste Rock Piles, Honeymoon Heights Waste Rock Piles (and DSHH), the Lower West Area (including the Lagoon), the Maintenance Yard and the Surface Water Retention Area exceed proposed soil cleanup levels for human health-based soil criteria for protection of groundwater for arsenic, cadmium, copper, mercury, selenium, silver, thallium, zinc, and/or gasoline-, diesel-, or heavy oil-range petroleum hydrocarbons (Table 3).

- Groundwater at the Site has hazardous substance concentrations that exceed drinking water standards for aluminum, cadmium, copper, lead, and/or zinc in the Honeymoon Heights Waste Rock Piles, Mine Portal discharge, Lower West Area, East and West Waste Rock Piles, former Mill Building, and Tailings Piles (Table 2).

A supplemental human health risk evaluation of the tailings piles and the East and West Waste Rock Piles and Honeymoon Heights Waste Rock Piles (Appendix F of ERM and URS 2009) concluded that hazardous substances in soil in these areas would not pose unacceptable risks to recreational visitors and construction workers. This evaluation did not address other areas of the Site or evaluate residential use. The Agencies do not accept some of Intalco's findings that were presented in Appendix F, see Forest Service (2010a).

4.2 Ecological Risks

Ecological receptors at the Site include aquatic organisms in Railroad Creek and terrestrial organisms, including plants, soil invertebrates, and wildlife. The Agencies have identified the following potential ecological risks at the Site, as summarized in the following subsections.

4.2.1 Surface Water

Intalco reported that toxicity risks for trout exist in surface water at the Site, predominantly from dissolved copper, based on Hazard Quotients (HQ) for dissolved copper in surface water samples that ranged from 18 to 26 (Dames & Moore 1999). An HQ is the ratio of the dose of a single hazardous substance over a specified time period to a reference dose to a specific organism for that substance derived for a similar exposure period. The reference dose generally represents the maximum dose for which no adverse effects are likely to result. An HQ greater than 1 (i.e., a hazardous substance concentration or dose above the reference dose) indicates the hazardous substance concentration is likely to cause adverse effects to that organism.

In addition, the Agencies found that surface water concentrations of cadmium, copper, zinc, and aluminum exceed levels known to be toxic to trout and other salmonids based on published scientific studies cited in USFWS (2004 and 2005). Iron concentrations in surface water at the Site also have adverse effects on both fish and benthic macroinvertebrates (USFWS 2005).

4.2.2 Sediment

Toxicity risks for benthic invertebrates exist in the Site's aquatic environment from aluminum, cadmium, chromium, copper, iron, silver, and zinc in sediment (Table 12). However, bioassay tests on Lucerne Bar sediment identified only minor adverse effects on aquatic organisms.

There is also a significant risk that future tailings slope failures could produce a mass release of reactive tailings into Railroad Creek. The tailings are not chemically inert. Release of tailings into the creek due to slope failures would increase concentrations of hazardous substances and could cause increased toxicity to aquatic organisms above present conditions.

4.2.3 Soil

A summary of the terrestrial ecological HQs for soil at the Site is presented in Table 14, based on proposed soil cleanup levels presented in Appendix E of the

ASFS (Forest Service 2010b). Toxicity risks for plants and soil macroinvertebrates result from hazardous substance concentrations in soil in almost all areas of the Site, with HQ values ranging to more than 100 for plants and macroinvertebrates. Birds and mammals may be subject to toxicity effects from feeding in Site areas where the highest hazardous substance concentrations were measured (where HQs ranged to more than 100).

4.2.3.1 Tailings Piles 1, 2, and 3

The tailings piles have concentrations of various hazardous substances that produce HQs greater than 1 for plants and soil invertebrates, and cadmium, copper, thallium, and zinc HQs ranging from 4 to 40 for wildlife species.

4.2.3.2 East and West Waste Rock Piles

Waste rock in the East and West Waste Rock Piles has concentrations of various hazardous substances that produce HQ values greater than 1 for plants and soil invertebrates, and barium, chromium, lead, molybdenum, thallium, and zinc HQ values ranging from 2 to 60 for wildlife species.

4.2.3.3 Honeymoon Heights Waste Rock Piles

The waste rock in the Honeymoon Heights Waste Rock Piles has concentrations of various hazardous substances that produce HQ values greater than 1 for plants and soil invertebrates, and barium, copper, lead, molybdenum, silver, and thallium HQs ranging from 2 to 200 for wildlife species.

4.2.3.4 Areas Downslope from the Honeymoon Heights Waste Rock Piles (DSHH)

The DSHH have concentrations of various hazardous substances that produce HQ values greater than 1 for plants and soil invertebrates, and aluminum, barium, copper, and thallium HQs ranging from 2 to 70 for wildlife species.

4.2.3.5 Ballfield Area

Soil at the Ballfield Area has concentrations of copper that produce an HQ value of 2 for soil invertebrates.

4.2.3.6 Holden Village

Soil at Holden Village produces HQs of 3 to 4 for plants and wildlife from aluminum and HQs of 2 for plants and invertebrates from copper and invertebrates from zinc.

4.2.3.7 Lower West Area

Soil in the Lower West Area-East has HQs for plants, soil invertebrates, and wildlife species for several constituents ranging from 2 to 100.

Soil in the Lower West Area-West (other than the Lagoon) does not have HQs greater than 1 for terrestrial ecological receptors.

4.2.3.8 Lagoon Area

Soil within the Lagoon has HQs for a number of constituents (including petroleum hydrocarbons) of 2 to over 100 for plants, soil invertebrates, and wildlife species.

4.2.3.9 Windblown Tailings Area

Soil within the Wind-Blown Tailings Area produces an HQ of 3 for plants from molybdenum.

4.2.3.10 Maintenance Yard

Soil at the Maintenance Yard has concentrations of hazardous substances that produce HQs for a number of constituents (including petroleum hydrocarbons) of 2 to over 100 for plants, soil invertebrates, and wildlife species.

4.2.3.11 Former Mill Building

Soil in the former Mill Building area has not been characterized due to safety concerns associated with the derelict structure. Sources of contamination within the former Mill Building likely include unprocessed ore, mineral concentrates (processing residuals), and mineral salts present on the surface and in abandoned equipment. The presence of potential hazardous substances is inferred from groundwater seeps from the mill area that have concentrations of several hazardous substances above state and federal criteria for the protection of aquatic life, and cadmium and copper concentrations above drinking water criteria.

4.2.3.12 Ventilator Portal Surface Water Retention Area

Soils within the Surface Water Retention Area have HQs for aluminum, barium, copper, molybdenum, and zinc of 2 to over 100 for plants, soil invertebrates, and wildlife species.

5.0 NEED FOR ACTION

It is the Agencies' current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in this Proposed Plan, is necessary to protect public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment.

6.0 PROPOSED REMEDIAL ACTION OBJECTIVES AND CLEANUP REQUIREMENTS

6.1 Proposed Remedial Action Objectives

CERCLA provides for the establishment of Remedial Action Objectives (RAOs) that specify "contaminants and media of concern, potential exposure pathways and remediation goals," 40 CFR § 300.430(e)(2)(i). The remediation goals (and thus the RAOs) are to be modified as more information becomes available; final remedial goals are determined when the ROD is issued.

The Agencies presented RAOs in the SFS. The Agencies subsequently revised the RAOs in the ASFS as provided in 40 CFR § 300.430(e)(2)(i), as shown below.

1. Reduce surface water concentrations of hazardous substances to levels that are protective of aquatic life and comply with applicable, or relevant and appropriate requirements (ARARs) in Railroad Creek and other surface waters.

2. Eliminate the adverse effect of ferricrete to aquatic life in Railroad Creek and monitor sediment quality to determine whether any further action is needed to protect aquatic life and comply with ARARs.

3. Prevent migration of hazardous substances that exceed cleanup levels in groundwater (including the Main Portal discharge) from on-site waste management areas (WMAs) to protect aquatic life and comply with ARARs.

4. Reduce exposure to hazardous substances in soil (including tailings and other wastes) to protect terrestrial organisms and comply with ARARs.

Prevent future releases of tailings and other wastes into surface water to protect aquatic receptors from hazardous substances.

5. Protect human health and comply with ARARs by reducing human exposure to hazardous substances in soil and other wastes, and in groundwater as a drinking water resource.

6. Implement the remedial action in a manner that complies with ARARs and protects human health, welfare, and the environment, including the Holden Village residential community during and after construction.[4]

The RAOs do not include cleanup of groundwater to drinking water or surface water quality standards within waste management areas (WMAs) at the Site. CERCLA provides that groundwater will be returned to its beneficial uses within a reasonable restoration time frame wherever practicable. Although the point of compliance for groundwater cleanup under CERCLA (and MTCA) is generally throughout the contaminated plume, the NCP recognizes that remedies may involve areas where waste materials will be managed in place, as proposed at this Site. Groundwater may remain contaminated within a WMA, and cleanup levels attained at and beyond the edge of the WMA [55 Fed Reg 8712, 8753, March 8, 1990], so long as measures are taken to contain and prevent exposure

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[4] The Agencies understand that Holden Village, Inc. has concerns for the viability of its operations in the event that remedial construction results in substantial curtailment of the Village's normal activities for more than two consecutive years, or a second curtailment within five years of the first construction period. Intalco will propose a construction schedule, subject to Agency approval, that will evaluate the feasibility and timing of conducting the work sequentially or concurrently. Intalco has already indicated a willingness to accomplish some work ahead of, or following, the period of major construction, and the Agencies believe this approach will mitigate impacts on Holden Village. While the Agencies do not expect that it will be necessary for Holden Village to suspend operations during remedial construction, the Agencies understand a large construction project does not lend itself to the usual expected Holden Village experience. Through review, input, and approval of remedial design, the Agencies are prepared to assist Holden Village to mitigate impacts of construction to the extent possible. The Agencies will also take into account Holden Village's request for a five-year gap between the conclusion of the first phase of construction and the initiation of any second phase, as is reflected in the Preferred Alternative.

to the contaminated groundwater, and restoration to beneficial uses remains the goal beyond the WMA.

The DFFS found that it is not practicable to clean up the Site without leaving waste in place within a WMA, or to restore groundwater to its beneficial uses within the WMA in a reasonable restoration time frame. Therefore, the Preferred Alternative includes a waiver of applicable and relevant and appropriate groundwater standards within the WMA, and restoration to beneficial uses and associated cleanup levels beyond the WMA.

As discussed in Section 3.5, one of the beneficial uses for groundwater at this Site is as a potential source of drinking water. As a result, Maximum Contaminant Levels (MCLs) under the Safe Drinking Water Act are relevant and appropriate standards for groundwater cleanup. Drinking water standards must be met at a point of compliance for groundwater at and beyond the boundary of the WMA.

In addition to being a potential source of drinking water, a beneficial use of groundwater at the Site is recharge to surface water to support aquatic life. Groundwater discharging through seeps, springs, or base flow that would otherwise adversely impact surface water must be managed for surface water protection.

Both CERCLA and MTCA seek to restore groundwater quality wherever practicable. CERCLA requires consideration of the state's stream classification for protection of site-specific uses that could be impacted by groundwater discharging into the surface water.[5] At a minimum, this includes preventing receptors in the creeks from being exposed to groundwater that exceeds aquatic life protection criteria and drinking water standards by controlling hazardous substances before they enter the surface water (see the NCP preamble [55 FR 8713]). The proposed point of compliance for groundwater to meet ambient water quality standards is as close as practicable to the source, but not to exceed the point or points where groundwater flows into the surface water.

[5] In this case, the Washington State regulations [WAC 173-201A-200 and -600] require protection of Railroad Creek's and Copper Creek's designated beneficial uses. Per WAC 173-201A-600, the following are the designated beneficial uses of surface water at the Site (use categories in parentheses): aquatic life (salmonid spawning, rearing, migration, and core summer habitat), recreation (extraordinary primary contact), water supply (domestic, industrial, agricultural, and stock watering), and miscellaneous (wildlife habitat, harvesting, commerce and navigation, boating, and aesthetic value).

MTCA independently requires cleanup of groundwater that exceeds aquatic life protection criteria before the hazardous substances enter the surface water [WAC 173-340-720(1)(c)]. Under MTCA, a conditional point of compliance for groundwater may be established where the Site abuts surface water, provided specific criteria are met, including that the remedy applies all known, available, and reasonable methods of treatment [AKART, see WAC 173-340-720(8)(d)(i)(D)]. Where groundwater discharges to surface water, the anticipated conditional point of compliance under MTCA would be at the interface between groundwater and surface water (e.g., Railroad and Copper Creeks), and surface water cleanup levels will be applied to groundwater at the conditional point of compliance. This MTCA requirement is also a potential ARAR under CERCLA.

6.2 Cleanup Requirements

6.2.1 Potential Applicable or Relevant and Appropriate Requirements

Potential applicable or relevant and appropriate requirements (ARARs) are defined in the NCP (40 CFR Part 300). "Applicable" requirements are those cleanup standards and other environmental protection requirements promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site. While not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, "relevant and appropriate" requirements address problems or situations sufficiently similar to those encountered at a site that their use is well suited to the site. ARARs are potential or preliminary until finalized by the lead agency in a Record of Decision (ROD).

ARARs fall into three broad categories, based on the manner in which they are applied: chemical-, action-, and location-specific.

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

- Action-specific ARARs set performance, design, or similar controls or restrictions on particular kinds of activities related to the management of hazardous substances, pollutants, or contaminants. The need to follow these

ARARs depends on the particular remedial action selected for implementation. Action-specific ARARs indicate how, or to what level, the alternative must achieve the requirements. For example, the National Pollutant Discharge Elimination System (NPDES) discharge requirements are an action-specific ARAR when the remedy includes a groundwater treatment facility that discharges treated effluent to surface water. In general, only the substantive requirements of an ARAR need to be implemented at a site.

- Location-specific ARARs are restrictions based on the concentration of hazardous substances or the conduct of activities in specific locations. They relate to the geographic or physical position of a site. Remedial actions may be restricted or precluded depending on the location or characteristics of a site and the requirements that apply to it. Location-specific ARARs may apply to actions in natural or man-made features. Examples of natural site features include wetlands and floodplains. An example of a man-made feature is an archaeological site. Also, since the Site is located within the Glacier Peak Wilderness Area Class 1 Airshed, specific air quality ARARS need to be addressed under the Clean Air Act (42 USC § 7401 et Seq.; 40 CFR Part 50) and related regulations.[6]

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

Preliminary ARARs and TBCs were identified in Section 2.3 of the SFS, and the complete list of ARARs that must be addressed by the selected remedy will be identified and discussed along with the selected remedy in the ROD following consideration of public comment. Key ARARs for evaluation of the alternatives considered in this Proposed Plan are listed below.

[6] These air quality regulations are frequently considered to be action-specific ARARs since they may be triggered by specific actions such as the potential for generation of fugitive dust during tailings regrading. However, the Clean Air Act and related ARARs are also location-specific because the Holden Site is located adjacent to the Glacier Peak Wilderness Area, and must meet both the National Ambient Air Quality Standards and the Prevention of Significant Deterioration and Visibility Regulations.

6.2.1.1 Key Potential ARARs

All of the potential ARARs identified for the Site are discussed in the SFS (Forest Service 2007c) and/or the ASFS (Forest Service 2010b). The potential ARARs discussed below include the potential chemical-specific ARARs used to establish proposed cleanup levels for the Site and other potential ARARs that are met by some—but not all—of the remedial alternatives.

6.2.1.1.1 Key Potential Chemical-Specific ARARs

National Recommended Water Quality Criteria [Federal Water Pollution Control Act (Clean Water Act) 33 USC § 1314(a), Section 304(a)]. The National Recommended Water Quality Criteria (NWQC) are guidance established by the EPA for evaluating toxics effects on human health and aquatic organisms. The 2004 NWQC and the 2007 copper criterion[7] are potentially relevant and appropriate for protection of aquatic life at the Site under CERCLA [Section 121(d)(2)]. The 1999 NWQC criteria are potentially applicable to protection of aquatic life at the Site [WAC 173-340-730(3)(b)(i)(B)] as these were the NWQC criteria available when the MTCA regulations were last updated. Even if not potentially applicable, the 1999 criteria are potentially relevant and appropriate for protection of aquatic life under MTCA [WAC 173-340-710(4)]. The 2006 NWQC and subsequent NWQC (such as the 2007 copper criterion) are potentially relevant and appropriate for protection of aquatic life under MTCA [WAC 173-340-710(4)].

National Toxics Rule [40 CFR Part 131]. The National Toxics Rule (NTR) established numeric water quality standards for protection of human health and aquatic organisms for states that did not fully comply with Section 303(c)(2)(C) of the Clean Water Act (CWA). The State of Washington is required to comply with certain standards in the NTR [40 CFR § 131.36(d)(14)], and MTCA identifies

[7] The Aquatic Life Ambient Freshwater Quality Criteria—Copper 2007 Revision (2007 copper criterion, EPA 2007) was published in the Federal Register on February 22, 2007. The 2007 copper criterion provides a basis to determine acute and chronic concentrations for protection of aquatic organisms based on the Biotic Ligand Model. The model determines concentrations that are protective based on an analysis of ambient conditions for a number of parameters. To date, relatively few data have been collected at the Site to provide a basis for predicting acute and chronic copper concentrations for Railroad Creek under this criterion. The Agencies anticipate the cleanup level established at the time of the ROD would be based on the background concentration for dissolved copper in accordance with WAC 173-340-730(5)(c), and that this could be modified in accordance with ARARs based on additional data collection as part of implementing the remedy.

the NTR as a potential ARAR [WAC 173-340-730(3)(b)(i)(C)]. The NTR standards mandated for Washington are potentially applicable for the Site.

Maximum Contaminant Levels and National Maximum Contaminant Level Goals [40 CFR Part 141]. Under the Safe Drinking Water Act [SDWA; 42 USC § 300 et seq.], EPA establishes health goals based on risk and sets legal limits—maximum contaminant levels (MCLs)—to help ensure consistent quality of the water supply. Since surface water and groundwater at the Site are potentially potable under MTCA [Chapter 173-340 WAC], the federal MCLs are potentially relevant and appropriate. EPA has also established health-based MCL goals (MCLGs) for public water systems. Non-zero MCLGs are potentially relevant and appropriate for surface water and groundwater at the Site.

Washington State Drinking Water Standards [RCW 119A; Chapter 246-290 WAC]. Washington State has established health-based MCLs to protect consumers using public water supplies. MTCA identifies state MCLs as being directly applicable to potential surface water and groundwater sources of drinking water at the Site.

Washington State Water Quality Standards for Surface Water [RCW 90.48; Chapter 173-201A WAC]. Washington State has established aquatic life criteria for hazardous substances in freshwater. These provisions and standards in Chapter 173-201A WAC are potentially applicable for the Site, including the antidegradation policy (Section 300) and the narrative criteria (Section 260).

Washington State Model Toxics Control Act [RCW 70.105D; Chapter 173-340 WAC]. The Model Toxics Control Act (MTCA) is directly applicable to the surface water, groundwater, and soil at the Site. MTCA surface water cleanup standards are generally based on the highest beneficial use and reasonable maximum exposure expected under current and potential future site uses. MTCA also has some provisions for soil cleanup that are based on protection of human health and terrestrial ecological receptors, as well as groundwater and/or surface water resources.

6.2.1.1.2 Key Potential Action-Specific ARARs

Washington Model Toxics Control Act [RCW 70.105D; Chapter 173-340 WAC]. MTCA establishes administrative processes and standards to identify, investigate, and clean up facilities where hazardous substances are located. Many MTCA provisions are potentially applicable to the Site under CERCLA, though MTCA is also being implemented independently by the State of Washington at the Site.

Resource Conservation and Recovery Act [42 USC § 6901 et seq.], Subtitle C - Hazardous Waste Management [40 CFR Parts 260 to 279], and Subtitle D - Managing Municipal and Solid Waste [40 CFR Parts 257 and 258]. Subtitle C hazardous waste regulations specify hazardous waste identification, management, and disposal requirements. These regulations are potentially relevant and appropriate for generation and management of hazardous waste at the Site. Where Washington has an authorized state hazardous waste program (RCW 70.105; Chapter 173-303 WAC), it applies in lieu of the federal program. Subtitle D of RCRA establishes a framework for controlling the management of non-hazardous solid waste. These regulations establish guidelines and criteria from which states develop solid waste regulations. Subtitle D is potentially relevant and appropriate to solid waste generation and management at the Site.

Washington State Hazardous Waste Management Act and Dangerous Waste Regulations [RCW 70.105; Chapter 173-303 WAC]. Washington State Dangerous Waste regulations govern the handling and disposition of dangerous waste, including identification, accumulation, storage, transport, treatment, and disposal. Washington State has not adopted an exemption for certain mining wastes (such as the Bevill Amendment) from regulation under RCRA Subtitle C.[8] The Dangerous Waste regulations are potentially applicable to generating, handling, and managing dangerous waste at the Site, and would be potentially relevant and appropriate even if dangerous wastes are not managed during remediation. In particular, the subsection regarding point of compliance [WAC 173-303-645(6)] may be relevant and appropriate to any waste management areas established at this Site.

Washington State Solid Waste Handling Standards [RCW 70.95; Chapter 173-350 WAC]. Washington State Solid Waste Handling Standards apply to facilities and activities that manage solid waste. The regulations set minimum functional performance standards for proper handling and disposal of solid waste; describe responsibilities of various entities; and stipulate requirements for solid waste handling facility location, design, construction, operation, and closure. Particular to the Site, tailings and waste rock pile operations ceased prior to enactment of the Solid Waste Management Act, Chapter 70.95 RCW, and before the effective date of Chapter 173-350 WAC, and the tailings and waste rock piles are not currently being operated as limited purpose landfills. However, all substantive

[8] Washington did adopt a limited exemption from the Dangerous Waste regulations for mining overburden returned to the Site. However, overburden is defined as a material used for reclaiming a surface mine and is not a discarded material within the scope of RCRA (45 FR 33000; May 19, 1980, and 67 FR 63060; October 10, 2002).

requirements for closure and post-closure of limited purpose landfills [WAC 173-350-400] are potential ARARs [WAC 173-340-710(7)(c)]. The tailings and waste rock piles at the Site are landfills that contain solid waste and are releasing hazardous substances above both state and federal cleanup standards.

This regulation is also potentially applicable for management of excavated soil, soil-like material, and debris that will be generated during the Site cleanup. The regulation is potentially applicable to the proposed limited purpose landfill that will be constructed at the Site for disposal of the sludge that will be produced during long-term groundwater treatment operations.

Portions of the MM-3 Standard (Forest Service 1990 and subsequent amendments) also include potentially relevant and appropriate requirements for management of mining wastes at the Site. These potential requirements are described more fully below under potential location-specific ARARs.

Federal Water Pollution Control Act--National Pollution Discharge Elimination System [Clean Water Act; 33 USC § 1342, Section 402]. The NPDES regulations establish requirements for point source discharges and stormwater runoff. In particular for the Site, these regulations are potentially applicable for any point source discharge of contaminated water (e.g., discharge following treatment of groundwater), stormwater runoff at the Site, and management of stormwater runoff during construction where the remedial construction site involves 1 acre or more.

6.2.1.1.3 Key Potential Location-Specific ARARs

Clean Water Act (CWA), Section 401 and 404 [33 USC 1344, 40 CFR Part 230, 33 CFR §§ 320-330]. The CWA restricts discharge of dredged or fill material into surface waters, including wetlands. If wetlands are disturbed as part of the cleanup action, the disturbance should comply with the substantive requirements of the US Army Corps of Engineers Nationwide Permit 38.

National Forest Management Act [16 USC §§ 1600 – 1614] (NFMA) and Land and Resource Management Plan for Wenatchee National Forest (LRMP, Forest Service 1990), as Amended by Pacific Northwest Forest Plan (NWFP, 1994) and subsequent amendments of the NWFP (2001, 2004 and 2007). NFMA, which is the primary statute governing the administration of national forests, requires management based on multiple-use, sustained-yield principles. The Forest Service promulgated the LRMP, as required by NFMA. Portions of the LRMP (and the NWFP amendments to the LRMP) are potentially applicable or relevant and appropriate for assessing Site remedial alternatives. The LRMP and NWFP include standards and guidelines that are potentially relevant and

appropriate to actions at the Site, including activities within, or that affect Riparian Management Areas along Railroad and Copper Creeks, or are otherwise necessary to meet Aquatic Conservation Strategy (ACS) objectives. These standards and guidelines include RF-2 through RF-7, which control the design, construction, and use of temporary and permanent roads and other modifications within Riparian Reserves; and MM-3, which controls solid waste and mine waste facilities within Riparian Reserves. Particular aspects of MM-3 that are potentially relevant and appropriate to closure of the tailings and waste rock piles at the Site include requirements for: a) analysis based on best conventional methods; b) designing waste facilities using best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials; and c) reclamation and monitoring waste facilities to ensure chemical and physical stability, and to meet ACS objectives.

6.2.1.1.4 Key Potential To Be Considered Criteria

TBCs are used in developing remedial alternatives if no potential ARARs address a particular chemical or situation, or if existing ARARs do not provide adequate information.

Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management. This order establishes a policy that Federal agencies conduct their activities in an environmentally sound and sustainable manner.

Superfund Green Remediation Strategy, Office of Superfund Remediation and Technology Innovation, August 2009. This sets out the plans of the Superfund Remedial Program to reduce greenhouse gas (GHG) emissions and other negative environmental impacts that might occur during remediation of a hazardous waste site.

Incorporating Sustainable Practices into Remediation of Contaminated Sites, April, 2008, EPA 542-R-08-002. This outlines the principles of green remediation and describes opportunities to reduce the footprint of cleanup activities throughout the life of a project.

EPA's Principles for Greener Cleanups, August 27, 2009. This sets forth the goal to evaluate cleanup actions comprehensively to ensure protection of human health and the environment and to reduce the environmental footprint of cleanup activities, to the maximum extent possible.

Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance, October 5, 2009. This requires federal agencies to

make reductions in greenhouse gas emissions a priority for federal agencies. The EO states that the federal government must lead by example in increasing energy efficiency, reducing greenhouse gas emissions, etc.

EPA Region 10's Clean and Green Policy, August 13, 2009. EPA Region 10's *Clean and Green Policy* applies to all Superfund cleanups including those performed by Potentially Responsible Parties (PRPs). The Policy encourages cleanup practices that, among other things, employ 100% use of renewable energy, and energy conservation and efficiency approaches including EnergyStar equipment; and use of cleaner fuels and diesel emissions controls.

Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration, OSWER Directive 9283. This Directive provides a compilation of some key existing EPA groundwater policies to assist EPA Regions in making groundwater restoration decisions pursuant to CERCLA and the NCP.

Numeric Values for Freshwater Sediment Quality. Neither the federal government nor Washington State has current promulgated freshwater sediment standards. However, this is an area that is the subject of active scientific evaluations by EPA and Ecology, as well as other agencies (e.g., US Army Corps of Engineers et al. 2006). The results of the ongoing interagency cooperative assessment provide information that is helpful in establishing protective cleanup levels. For the Site, sediment cleanup levels that are potentially relevant and appropriate are based on state freshwater sediment quality values, the Sediment Evaluation Framework for the Pacific Northwest screening levels (US Army Corps of Engineers et al. 2006), and scientific literature, as discussed in the SFS.

Final ARARs and TBCs will be determined in the ROD.

6.2.2 Cleanup Levels

The Agencies developed proposed cleanup levels for constituents of concern in soil, surface water, groundwater, and freshwater sediment. Table 1 summarizes proposed cleanup levels, along with the basis for their selection. The development of the proposed cleanup levels is described in Sections 2.4 and 2.5 of the ASFS. Points of compliance, which are the locations at the Site where proposed cleanup levels must be met, are summarized in Table 13 of this Proposed Plan and discussed in Section 2.6 of the ASFS.

7.0 SCOPE OF REMEDIAL ACTION

The Agencies' strategy for remediating the Site is to issue a ROD for a final cleanup action for the entire Site. The preferred remedial alternative described

in this Proposed Plan is expected to be such a final cleanup action. For a cleanup action to be considered a final cleanup action, it must meet the two CERCLA threshold criteria, which are: 1) be protective of human health and the environment; and 2) meet all ARARs. This includes achieving the Remedial Action Objectives and Cleanup Levels selected in the Record of Decision such that no further response actions are necessary at the Site.

The tailings, waste rock, and contaminated soil at the Site are the primary sources of contamination and constitute or contribute to the most serious threats. The Preferred Alternative would address these source materials and eliminate pathways for exposure to them primarily through containment. Because of the nature of the sources and the volume of material, none of the feasible alternatives would satisfy the statutory preference for treatment as a principle element of the remedy.

8.0 SUMMARY OF ALTERNATIVES EVALUATED

This section summarizes the remedial alternatives considered by the Agencies. The alternatives that have been considered for the Site are:

- Alternatives 1 through 8, developed and evaluated by Intalco in the DFFS (URS 2004);
- Alternative 9, developed by Intalco (URS 2005);
- Alternatives 10, 11, and 12, developed by the Agencies and evaluated, along with Alternative 9, in the SFS (Forest Service 2007c);
- Alternative 13M, developed by Intalco (ERM and URS 2009); and
- Alternatives 11M and 14 (the Preferred Alternative), developed by the Agencies and evaluated, along with Alternative 13M, in the ASFS (Forest Service 2010b).[9]

Alternatives 1 through 10 were evaluated in 2007 and found not to be acceptable as a final remedial action (Forest Service 2007d). The three most

[9] As part of preparing the ASFS, the Agencies refined Alternative 11 to reflect additional data collected in 2008 and 2009 and termed the refined alternative "Alternative 11M." The net present value for long-term costs was calculated using a discount rate of 7 percent and a period of 50 years.

recently developed and most comprehensive alternatives, Alternatives 14, 11M, and 13M, as well as Alternative 12, the No Action Alternative, are presented below.

8.1 Alternative 14 (The Preferred Alternative)

The following table summarizes the estimated costs for Alternative 14, which is described below.

Alternative 14	
Estimated Capital Cost	$76,100,000
Net Present Value of Long-Term Operations, Maintenance and Monitoring	$30,700,000
Total Estimated Cost[10]:	$107,000,000

Figure 14 shows the principal components of Alternative 14. A number of design details of Alternative 14 (or any other alternative) would be determined during remedial design, including final slope grade and buttress design for the tailings piles, final waste rock slope grade, design of caps to isolate contaminated materials, final design of the groundwater treatment facilities, and *in situ* soil treatment (i.e., pH adjustment through lime application).

8.1.1 Soil

Under Alternative 14, cleanup actions for soils are proposed for different areas of the Site (referred to as Areas of Interest, or AOIs) considering the risks due to existing hazardous substance concentrations, as well as the feasibility and impacts of accomplishing different kinds of cleanup. In some parts of the Site, existing topographic conditions and critical and sensitive habitat limit or preclude actions, such as removal or capping contaminated soil (i.e., Honeymoon Heights Waste Rock Piles, the DSHH, the Wind-Blown Tailings Area, portion of the Lower West Area, Holden Village, and portions of the Ballfield Area, see Figure 14). In these and other AOIs, removal or capping would have severe, long-term (possibly permanent) adverse impacts that could result in more environmental harm than benefit. *In situ* treatment is proposed

[10] All costs presented in this Plan are shown in current (2010) dollars, rounded to three significant figures. See Appendix A of the ASFS for more information.

for these areas, although—pending completion of treatability studies—the effectiveness of this is not as certain as removal or capping. CERCLA provides for an ARAR waiver and selection of a remedy that does not attain an ARAR if the administrative record supports a finding that compliance at a given site or portion of a site will result in greater risk to human health and the environment than alternative options. Waiver of the cleanup standard in this situation would occur through an Explanation of Significant Differences or ROD Amendment.

MTCA, which is a potential ARAR under CERCLA, as well as the basis for the state's independent cleanup authority, allows consideration of the environmental risk of the cleanup action as part of a disproportionate cost analysis to determine whether a cleanup action is permanent, to the maximum extent practicable. Also, the State Environmental Policy Act (SEPA) provides Ecology with substantive authority, subject to certain provisions, to modify a proposed cleanup action to mitigate adverse environmental impacts.

As a result, Alternative 14 does not include capping or soil removal/cleanup to the proposed cleanup levels in certain critical and sensitive areas where the Agencies believe those actions would cause more ecological harm (e.g., permanent habitat destruction) than the threat posed by existing site contamination. As a result, in some AOIs, Alternative 14 includes *in situ* soil treatment that the Agencies anticipate will eventually achieve cleanup standards, although potentially this may require more time than an approach with a significant adverse impact.

8.1.1.1 Tailings Piles 1, 2, and 3

Under Alternative 14, the tailings pile slopes would be regraded so they are stable under steady state and seismic (maximum design earthquake [MDE]) conditions and comply with potential ARARs. This would include construction of benches and buttressing. Prior to regrading, Railroad Creek would be diverted northward into a new channel, which would also reduce the risk of long-term erosion or other instability that would release hazardous substances into Railroad Creek.[11] In addition, the Copper Creek channel would be improved to reduce the risk of adversely impacting Tailings Pile 1 and 2.

[11] Portions of the toes of Tailings Piles 1 and 2 would likely need to be pulled back from Copper Creek and, depending on the extent of stream relocation, possibly from portions of Railroad Creek. This may be needed to provide sufficient room for construction of other remedy components (such as slope buttresses, and components of the groundwater containment

The three tailings piles would be capped with a soil cover that satisfies potential ARARs, including the state's performance requirements for closure of limited purpose landfills, and Forest Service Standards and Guidelines. Soils with hazardous substances that are consolidated from other portions of the Site (described below), and possibly excess waste rock from regrading the East and/or West Waste Rock Piles, would be consolidated onto the tailings piles before capping.

8.1.1.2 East and West Waste Rock Piles

Under Alternative 14, The East and West Waste Rock Pile side slopes would be regraded to configurations that are stable under steady state and seismic conditions. The top and side slopes of the waste rock piles would then be capped with a soil cover that satisfies potential ARARs.

8.1.1.3 Honeymoon Heights Waste Rock Piles (Including DSHH)

Under Alternative 14, the Honeymoon Heights Waste Rock Piles and DSHH AOIs would be cleaned up using *in situ* treatment to reduce bioavailability and mobility of hazardous substances by adjusting pH, to the extent practicable, without degrading existing habitat. The method and rate of application, frequency of treatment, and other aspects would be determined based on treatability tests conducted during remedial design and on post-implementation monitoring. Access warning signs and institutional controls (e.g., deed restrictions) would also be implemented in these areas to address potential human heath risks from lead and arsenic.

8.1.1.4 Ballfield Area

Under Alternative 14, soil with hazardous substances above proposed cleanup levels would be removed and consolidated into the tailings piles prior to capping. The area would then be revegetated with native vegetation. *In situ* treatment may also be used if further characterization indicates that hazardous substances extend into adjacent areas of late succession riparian habitat.

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and collection system) and to address potential risk of erosion and scour that could lead to future instability. The need for such actions would be determined during RD.

8.1.1.5 Holden Village

Under Alternative 14, soil would be remediated using *in situ* treatment to reduce risk to plants and animals. Institutional controls would be developed and implemented, including a soil management plan to address handling of soil excavated in the future, and provisions to further address cleanup of soils with hazardous substances in the event of future land use changes.

8.1.1.6 Lower West Area, including the Lagoon

Under Alternative 14, impacted soil in some locations (including the Lagoon, the portion of the Lower West Area-East to be occupied by the west groundwater treatment system, and soils with hazardous substances in existing disturbed areas) would be removed and consolidated into the tailings piles prior to capping. Soil located in areas of late succession riparian habitat (primarily in the Lower West Area-West), would be remediated using *in situ* treatment to limit impacts to this habitat. Access warning signs and institutional controls (e.g., access restrictions via Forest Service Order) would also be implemented in the Lower West Area to address human heath risks from arsenic, cadmium, copper, and lead in soils.

8.1.1.7 Wind-Blown Tailings Area

Under Alternative 14, a portion of the impacted soil in the Wind-Blown Tailings Area would be removed during relocation of Railroad Creek and consolidated into the tailings piles prior to capping. Soil in the remaining portion of this AOI would be remediated using *in situ* treatment to limit impacts to the high-value, late succession habitat that occupies much of this AOI. Additional removal or treatment of impacted soil would be evaluated in the event land use changes (e.g., if timber harvesting occurs) in the future.

8.1.1.8 Maintenance Yard

Under Alternative 14, the Maintenance Yard area would be capped (e.g., with asphalt or concrete pavement) to isolate contaminated soil. The extent of the cap would be determined based on additional soil characterization during remedial design.

8.1.1.9 Former Mill Building

Under Alternative 14, the unsafe structural components would be demolished, consistent with ARARs, as needed to remove contaminated soil and ore processing residuals. These materials would be consolidated onto the tailings

piles prior to capping, except for any State Dangerous Wastes that may be encountered which would be disposed of off-site.

8.1.1.10 Surface Water Retention Area Soils

Under Alternative 14, soil above proposed cleanup levels would be excavated from the Surface Water Retention Area and consolidated into the tailings piles prior to capping.

8.1.2 Groundwater

Under Alternative 14, the Main Portal drainage, along with contaminated seeps downslope from Honeymoon Heights (seeps SP-12 and SP-23), would be collected and treated. Concentrations of hazardous substances in the Main Portal discharge would be reduced by taking measures to reduce airflow through the mine, thus reducing the rate of oxidation of sulfide minerals within the mine. Alternative 14 includes monitoring seep SP-26 as well as groundwater downslope of Honeymoon Heights, to determine if additional groundwater should be collected for treatment following source controls.

Water from the Main Portal drainage and seeps SP-12 and SP-23 would be conveyed and treated in a water treatment facility constructed in the Lower West Area in the vicinity of the Lagoon, referred to as the west treatment system. To optimize the function of the west treatment system, the seasonal extremes in discharge from the Main Portal drainage would be equalized by installing hydraulic bulkheads in the mine. Depending on results of treatability studies, the west treatment system might be used to pre-treat flow from the mine and Honeymoon Heights seeps. Effluent from the west treatment facility may need to be piped to the area east of Tailings Pile 3 for further treatment prior to discharge, in order to meet surface water criteria.

Under Alternative 14, the other main contaminant source areas (e.g., the tailings piles, main East and West Waste Rock Piles, and the Lower West Area) would be designated waste management areas (WMAs). Groundwater within these areas would be contained to prevent its discharge to surface water and to facilitate groundwater collection for treatment. Alternative 14 includes a waiver of applicable and relevant and appropriate groundwater standards within the WMA, and restoration to beneficial uses and associated cleanup levels at and beyond the edge of the WMA. Institutional controls would be implemented to prevent use of the groundwater as drinking water within the WMAs. Under MTCA, conditional points of compliance will also be established at Railroad Creek for groundwater entering into surface water. Both authorities require that

proposed cleanup levels for protection of surface water would be met in groundwater before groundwater discharges into Railroad Creek

A fully penetrating groundwater containment barrier wall and collection system would be constructed around Tailings Pile 1 and the Lower West Area. The system would extend west of Copper Creek to where the Main Portal drainage currently discharges into Railroad Creek. This system would intercept impacted groundwater that would otherwise enter Railroad Creek and Copper Creek from the Lower West Area and Tailings Pile 1. Water collected from this system would be conveyed to a treatment facility located east of Tailings Pile 3, referred to as the east treatment system.[12]

Alternative 14 also includes constructing a fully penetrating barrier wall and collection system downgradient of Tailings Piles 2 and 3. Water collected by this system would be treated at the east treatment system. The former Railroad Creek channel may form part of the collection system along the northwest side of Tailings Pile 2. Intalco has expressed concerns that this barrier wall is not necessary and will add costs and construction time. However, there is currently no basis to show that without the barrier wall, proposed cleanup levels based on protection of surface water (i.e., the aquatic life criteria, which are lower than the drinking water criteria) would be met in groundwater before the groundwater discharges into surface water downstream of Tailings Piles 2 and 3. The groundwater containment barrier design could be modified, or the barrier may not need to be built, if Intalco can demonstrate (as described in Section 10.2) that: 1) groundwater above drinking water standards will remain contained within the WMA; and 2) an alternative approach, such as monitored natural attenuation, is effective at reducing groundwater concentrations to below proposed cleanup levels at the point(s) where groundwater discharges to Railroad Creek. In the second case, the conditional point of compliance has to be in groundwater at or before groundwater discharges into surface water. Consideration must also be given to the factors outlined in WAC 173-340-370(7). Such a change may constitute a significant change to the selected remedy and would require documentation of the basis for the change.

[12] Under Alternative 14, both the east and west treatment systems would use treatment ponds lined with concrete or an impermeable membrane to prevent infiltration.

8.1.3 Surface Water

Alternative 14 would address surface water by preventing the erosion of tailings and stopping the discharge of contaminated groundwater (including seeps and discharge from the Main Portal) into surface water, including Railroad Creek, Copper Creek, and the Copper Creek Diversion. As described in Sections 8.1.1 and 8.1.2, Alternative 14 includes the following actions to clean up surface water:

- Stabilizing the tailings pile slopes, diverting Railroad Creek away from the toes of the tailings piles, and modifying the Copper Creek Diversion and the Copper Creek channel to prevent release of tailings into surface water;

- Capturing and treating impacted groundwater from the Main Portal and Honeymoon Heights seeps; and

- Containing and treating impacted groundwater from the Lower West Area and Tailings Piles 1, 2, and 3.

Alternative 14 includes relocation of some portion(s) of Railroad Creek to reduce risk of erosion or scour undermining the tailings piles slopes, and to provide access for construction of groundwater containment and collection facilities. The extent of stream relocation and tailings regrading will be further assessed during remedial design and may be different from that proposed under Alternative 13M, for a number of reasons. For example, the creek relocation proposed by Intalco for Alternative 13M may not leave enough room for construction of the barrier wall adjacent to the west part of Tailings Pile 1. Under Alternative 14, the reach to be relocated could be extended upstream to avoid the need to move the toe of Tailings Pile 1 slopes in this area (see the dashed line segments on the creek relocation on Figure 14). Similarly, the feasibility of relocating Railroad Creek adjacent to Tailings Pile 2 needs to be further evaluated to demonstrate whether buttress construction can be accomplished without pulling back the toe of the tailings (or alternatively moving the Holden-Lucerne Road). Finally, the extent of relocating the Railroad Creek Channel downstream of Tailings Pile 3 may depend on further geomorphic analysis and further evaluation of the area required for the proposed water treatment facility east of Tailings Pile 3. In summary, the Agencies found Intalco's analysis of these issues, to date, to be sufficient for remedy selection, but not sufficient for final design (see Forest Service 2010a, Comments to Appendix D: Draft Proposed Railroad Creek Realignment Technical Memorandum).

Alternative 14 also includes construction of stormwater diversion swales and other measures, upgradient from Tailings Piles 1, 2, and 3 and the East and the West Waste Rock Piles, to control surface water run-on.

8.1.4 Sediment

Alternative 14 includes relocation of Railroad Creek so that the portions impacted by existing ferricrete would not pose a risk to aquatic life. As described in Section 1.2.2.4 of the SFS, the Agencies do not consider existing sediment concentrations (other than ferricrete) to be severe enough to require active sediment cleanup. Alternative 14 includes monitoring in Railroad Creek and at the Lucerne Bar in Lake Chelan to determine whether additional sediment actions are needed in the future.

Alternative 14 would protect sediment from recontamination by preventing the erosion of tailings and the discharge of untreated groundwater (including seeps and discharge from the Main Portal) into Railroad Creek and Copper Creek as described above in Sections 8.1.1 and 8.1.2.

8.1.5 Other Remedial Components

Alternative 14 also includes the following remedial activities and components not mentioned above:

- Construction of a limited purpose landfill for disposal of sludge from the water treatment systems, and potentially contaminated soils that may be generated by future excavations in Holden Village or other portions of the Site.

- Development of remedy infrastructure, including quarry site(s), borrow pit(s), reconstruction of the Lucerne barge landing facility, construction work camp and related infrastructure improvements at Holden Village, improvements to the Lucerne-Holden Road including bridges, electric power infrastructure, and other infrastructure, as needed. (The Agencies consider development of hydroelectric power generating capacity as part of the remedy to be highly desirable. Other electrical infrastructure could be developed, as needed.)

- Institutional controls to: a) prevent changes in Site use that would reduce effectiveness of the remedy; b) require future remediation prior to changes in land use for various AOIs; c) provide financial assurance to ensure that the remedy will be monitored and maintained; and d) provide for permanent access to privately-owned lands in order to monitor and maintain the remedy.

- As described in Section 3.2.13, Forest Service records suggests that waste rock may have been used in the past to resurface the Lucerne-Holden Road. Under Alternative 14, a sampling and analysis plan would be developed during remedial design to investigate and evaluate the nature and extent of environmental impacts related to the potential presence of waste rock on the road. This investigation would be carried out during remedial design; the results of the investigation would be used to develop a cleanup approach which, if necessary, would be carried out during remedial implementation.

- Long-term monitoring to assess remedy performance, ARAR compliance, and protectiveness.

8.2 Other Alternatives Considered in the ASFS

The following subsections present the two alternatives that were developed and evaluated in the ASFS along with the Alternative 14. In addition to the actions described below, these two alternatives include the general remedial components listed above in Section 8.1.5 for Alternative 14.

8.2.1 Alternative 11M

The following table summarizes the estimated costs for Alternative 11M, which is described below.

Alternative 11M	
Estimated Capital Cost	$88,500,000
Net Present Value of Long-Term Operations, Maintenance and Monitoring	$31,800,000
Total Estimated Cost[13]:	$120,000,000

Alternative 11M is a refinement of an earlier alternative, Alternative 11, which was presented in the SFS (Forest Service 2007c). Some soil cleanup components could not be specified at the time Alternative 11 was developed, pending completion of an ecological risk assessment. Intalco collected data for

[13] All costs presented in this Plan are shown in current (2010) dollars, rounded to three significant figures. See Appendix A of the ASFS for more information. The net present value for long-term costs was calculated using a discount rate of 7 percent and a period of 50 years.

the ecological risk assessment in 2008 (ERM 2008 and ERM 2009), which enabled the Agencies to calculate proposed soil cleanup levels and to develop remedial components to reduce risk to terrestrial receptors. These soil cleanup components were added to Alternative 11, and the resulting alternative is termed Alternative 11M.

8.2.1.1 Soil

Under Alternative 11M, the tailings piles and the East and West Waste Rock Piles would be regraded to improve slope stability and capped in accordance with potential ARARs, including state landfill standards and the Forest Service Standards and Guidelines. Regrading would include construction of slope buttresses and benches to improve stability. The tailings and waste rock caps would consist of 2 feet of soil and a geomembrane (the presumptive cover prescribed by state regulations), unless analyses during remedial design indicate that an alternative cover would satisfy performance standards for landfill closure [WAC 173-350-400(3)(e)(i)].

Under Alternative 11M, the Honeymoon Heights Waste Rock Piles and the impacted DSHH area would be cleaned up by consolidation onto the West Waste Rock Pile prior to capping. Soils exceeding proposed cleanup levels at the former Mill Building, Lagoon Area, and Surface Water Retention Area would be consolidated into a permanent on-site containment area. Soils exceeding proposed cleanup criteria in the Maintenance Yard would be capped with a concrete or asphalt slab.

Alternative 11M includes cleanup in the Lower West Area, the Wind-Blown Tailings Area, and in Holden Village by a combination of *in situ* treatment, consolidation of soils with hazardous substances, and institutional controls, based on the degree of contamination, the function of the habitat, and the succession stage of the habitat.

8.2.1.2 Groundwater

Under Alternative 11M, the Main Portal drainage, along with contaminated seeps downslope from Honeymoon Heights (seeps SP-12 and SP-23), would be collected for treatment. Concentrations of hazardous substances in the Main Portal discharge would be reduced by taking measures to reduce airflow through the mine, thus reducing the rate of oxidation of sulfide minerals within the mine. Alternative 11M includes monitoring seep SP-26 as well as groundwater downslope of Honeymoon Heights to determine if additional groundwater should be collected for treatment following implementation of source controls.

Alternative 11M includes a continuous groundwater containment barrier and collection system around WMAs consisting of the tailings piles and the Lower West Area, to protect surface water from release of groundwater above aquatic protection standards.

Groundwater seep and base flow into Railroad Creek from the Lower West Area (including groundwater from the upgradient Upper West Area) and from below the tailings piles would be contained and collected using groundwater barrier wall technology and an associated collection system. The groundwater barrier wall would be fully penetrating (i.e., keyed into a lower relatively impermeable layer of glacial till or bedrock).

All collected groundwater would be treated to achieve proposed cleanup levels, in a treatment facility located downstream of Tailings Pile 3, on the north side of Railroad Creek. The treatment ponds would be lined in order to satisfy potential ARARs.

Alternative 11M includes institutional controls to prevent the potential future use of groundwater that exceeds human health risk-based criteria as a drinking water source, i.e., within WMAs.

8.2.1.3 Surface Water

Alternative 11M would address surface water by preventing the erosion of tailings and stopping the discharge of contaminated groundwater (including seeps and discharge from the Main Portal) into Railroad Creek and Copper Creek. As described in Sections 8.2.1.1 and 8.2.1.2, Alternative 11M includes the following actions to address surface water:

- Stabilizing the tailings pile slopes, pulling the toes of the tailings piles away from Railroad Creek, and modifying the Copper Creek Diversion and the Copper Creek channel to prevent release of tailings into surface water;

- Capturing and treating impacted groundwater from the Main Portal and Honeymoon Heights seeps;

- Containing and treating impacted groundwater from the Lower West Area and Tailings Piles 1, 2, and 3.

Alternative 11M also includes construction of stormwater diversion swales and other measures upgradient from Tailings Piles 1, 2, and 3 and the East and West Waste Rock Piles, to control surface water run-on.

8.2.1.4 Sediment

Alternative 11M includes removal of ferricrete from Railroad Creek and long-term sediment monitoring in Railroad Creek and in Lake Chelan (at the Lucerne Bar) to determine whether additional sediment cleanup actions are required following the elimination of the sources of hazardous substances.

8.2.5 Other Remedial Components

Alternative 11M also includes the following remedial activities and components not mentioned above:

- Construction of a limited purpose landfill for disposal of sludge from the water treatment systems, and potentially contaminated soils that may be generated by future excavations in Holden Village or other portions of the Site.

- Development of remedy infrastructure, including quarry site(s), borrow pit(s), reconstruction of the Lucerne barge landing facility, improvements to the Lucerne-Holden Road including bridges, electric power infrastructure, and other infrastructure, as needed. (The Agencies consider development of hydroelectric power generating capacity as part of the remedy to be highly desirable. Other electrical infrastructure could be developed, as needed.)

- Institutional controls to: a) prevent changes in Site use that would reduce effectiveness of the remedy; b) require future remediation prior to changes in land use for various AOIs; c) provide financial assurance to ensure that the remedy will be monitored and maintained; and d) provide for permanent access to privately-owned lands in order to monitor and maintain the remedy.

- As described in Section 3.2.13, Forest Service records suggest that waste rock may have been used in the past to resurface the Lucerne-Holden Road. Under Alternative 11M, a sampling and analysis plan would be developed during remedial design to investigate and evaluate the nature and extent of environmental impacts related to the potential presence of waste rock on the road. This investigation would be carried out during remedial design; the results of the investigation would be used to develop a cleanup approach which, if necessary, would be carried out during remedial implementation.

- Long-term monitoring to assess remedy performance, ARAR compliance, and protectiveness.

8.2.2 Alternative 13M

The following table summarizes the estimated costs for Alternative 13M, which is described below.

Alternative 13M	
Estimated Capital Cost	$56,400,000
Net Present Value of Long-Term Operations, Maintenance and Monitoring	$26,400,000
Total Estimated Cost[14]:	$79,800,000

8.2.2.1 Soil

Under Alternative 13M, the tailings pile slopes would be regraded so they are stable under steady state and seismic (maximum design earthquake [MDE]) conditions to satisfy potential ARARs. This would include construction of benches and buttressing. To address potential erosion of the toes of the tailings piles, Railroad Creek would be diverted northward, into a new channel. The diversion would begin near the middle of the northern side of Tailings Pile 1 and extend east (downstream) to a point where it would rejoin the original channel about 1200 feet east of Tailings Pile 3. In addition, the Copper Creek channel would be improved to reduce the risk of erosion and scour from impacting Tailings Piles 1 and 2.

A cover, potentially consisting of 6 inches of soil/gravel and wood slash, would be placed on the top surfaces of the tailings piles and 8- to 12-inches of soil/gravel would be placed on the tailings pile side slopes.[15]

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[14] All costs presented in this Plan are shown in current (2010) dollars, rounded to three significant figures. See Appendix A of the ASFS for more information. The net present value for long-term costs was calculated using a discount rate of 7 percent and a period of 50 years.

[15] Intalco proposed the six-inch soil/gravel and slash cover for the top of the tailings and waste rock piles as part of the Alternative 13M Evaluation Report (ERM and URS 2009). Subsequently, Intalco submitted a more detailed discussion (ERM 2010) that recommended a cover consisting of either 12 inches of soil or a combination of soil and amended tailings. The Agencies anticipate that design for the final cap for the tailings piles, waste rock piles, and other areas with contaminated soils such as the Maintenance Yard, will be determined during remedial design.

The mill building superstructure would be demolished, and contaminated materials remaining on the mill building foundation would be removed and/or covered with waste rock, covered with soil cover and revegetated.

The East and West Waste Rock Pile side slopes would be regraded for stability, and the excess rock generated from the regrading actions would be relocated onto the former Mill Building foundation and Tailings Pile 1. A vegetated soil cover would be placed on the waste rock piles.

Contaminated soils associated with the Surface Water Retention Area and Lagoon would be excavated under Alternative 13M and placed in a permanent, on-site disposal facility. Contaminated soils in the Maintenance Yard would be covered with a concrete slab or an impermeable liner and gravel.

Soil in other areas of the site that exceed proposed cleanup levels (i.e., the Ballfield Area, Lower West Area, Wind-Blown Tailings Area, and Honeymoon Heights) would be monitored based on Intalco's assertion that remediation would occur naturally over time (referred to as "natural restoration").

8.2.2.2 Groundwater

Under Alternative 13M, the Honeymoon Heights seeps and the Main Portal drainage would be collected and conveyed to a treatment facility constructed in the Lagoon area of the Lower West Area, referred to as the west treatment system.

Hydraulic bulkheads would be installed in the mine to control and equalize the rate of groundwater discharging from the Main Portal. Air restrictors would be installed within open portals to reduce oxygen transport through the mine on the premise that this would slow the release of hazardous substances in the Main Portal drainage.

Contaminated groundwater that would otherwise enter Railroad Creek and Copper Creek from the Lower West Area and Tailings Pile 1 would be contained and collected using a fully penetrating groundwater barrier and collection system. The collected water would be conveyed to a treatment facility located east of Tailings Pile 3, referred to as the east treatment system.

Along the northwest side of Tailings Pile 2, the former creek channel would be used to collect groundwater impacted by seepage from the western portion of Tailings Pile 2, and conveyed to the west treatment system.[16]

Groundwater impacted by seepage from Tailings Pile 3 and the remainder of Tailings Pile 2 would not be contained or collected under Alternative 13M, but instead would continue to flow eastward and discharge into Railroad Creek at presently unknown locations. Intalco asserted that concentrations of hazardous substances in groundwater have decreased over time, downgradient (east) of Tailings Piles 2 and 3 [see Figures 1-14a and 1-14b of ERM and URS (2009)]. However, not all wells show a similar trend, as indicated on Figure 9, and as discussed in Forest Service (2010a). Under Alternative 13M, Intalco assumed that natural attenuation and other components of the remedy would reduce concentrations of hazardous substances in groundwater to acceptable levels, before entering Railroad Creek.[17] Should an extended period of monitoring demonstrate that this is not the case, Intalco proposed that unspecified contingent actions for Alternative 13M would be evaluated. However, the Agencies do not have any information to show that proposed cleanup levels, based on protection of surface water, would be met in groundwater before it enters Railroad Creek downstream of Tailings Piles 2 and 3, without a barrier wall.

Alternative 13M also includes institutional controls to prevent future use of groundwater that exceeds human health risk-based criteria from future use as drinking water.

8.2.2.3 Surface Water

Alternative 13M would address surface water by preventing the release of tailings and stopping the discharge of contaminated groundwater (including seeps and discharge from the Main Portal) into Railroad Creek and Copper

[16] Under Alternative 13M, both the east and west treatment systems would use unlined treatment ponds. These would facilitate dewatering of the treatment sludge, but would allow infiltration of water being treated into the underlying soil and groundwater.

[17] The other components referred to by Intalco include diversion trenches upslope of the tailings piles, regrading and capping the tailings piles, collection and treatment of groundwater in the Lower West Area and Tailings Piles 1, and collection and treatment of groundwater northwest of Tailings Pile 2. These components are common to Alternatives 11M, 13M and 14, see Table 15.

Creek. As described in Sections 8.2.2.1 and 8.2.2.2, Alternative 13M includes the following actions to address surface water:

- Stabilizing the tailings pile slopes, diverting Railroad Creek away from the toe of Tailings Piles 2 and 3, and a portion of Tailings Pile 1; and modifying the Copper Creek channel to reduce the risk of the creek undermining Tailings Piles 1 and 2 that could result in a release of tailings into surface water;

- Capturing and treating impacted groundwater from the Main Portal and Honeymoon Heights seeps;

- Containing and treating impacted groundwater from the Lower West Area, Tailings Pile 1, and a portion of Tailings Pile 2; and

- Relying on monitored natural attenuation, along with other remedy components, to reduce concentrations of hazardous substances in groundwater from Tailings Pile 3 and a portion of Tailings Pile 2 to acceptable levels before this groundwater enters Railroad Creek.

Alternative 13M also includes construction of stormwater diversion swales and other measures upgradient from Tailings Piles 1, 2, and 3 and East and West Waste Rock Piles to control surface water run-on.

Alternative 13M includes relocation of some portion(s) of Railroad Creek to reduce risk of erosion or scour undermining the tailings piles slopes, and to provide access for construction of groundwater containment and collection facilities. As described in Section 8.1.3, the Agencies found Intalco's analysis of a number of issues relating to the extent of the stream relocation and tailings regrading were sufficient for remedy selection, but not sufficient for final design (see Forest Service 2010a, Comments to Appendix D). The extent of stream relocation and tailings regrading will need to be further assessed during remedial design.

8.2.2.4 Sediment

Under Alternative 13M, ferricrete would be isolated from aquatic life in the reach of Railroad Creek that would be relocated.

8.2.2.5 Other Remedial Components

Alternative 13M also includes the following remedial activities and components not mentioned above:

- Construction of a lined and covered landfill for disposal of impacted soil and other solid waste generated during remedial construction. Intalco proposed a separate landfill for long-term disposal of sludge from the water treatment systems that would not include any lining or leachate collection system because Intalco proposed to locate this landfill on Tailings Pile 1 within the groundwater containment barrier around the Lower West Area and Tailings Pile 1.

- Development of remedy infrastructure, including a quarry site (near Tenmile Creek), a borrow pit (Dan's Camp), reconstruction of the Lucerne barge landing facility, improvements to the Lucerne-Holden Road including bridges, electric power infrastructure, and other infrastructure, as needed.

- Institutional controls to limit potential for human contact with hazardous substances and prevent changes in Site use that would reduce effectiveness of the remedy.

- Long-term monitoring to assess remedy performance, ARAR compliance, and protectiveness.

8.3 Alternative 12 (No Action Alternative)

CERCLA requires a "no action alternative" to be developed and considered in the analysis of the developed alternatives. The no action alternative would leave the Site untouched and would not include institutional controls or long-term monitoring. Ongoing releases of hazardous substances would continue under this alternative. Existing risks caused by hazardous substances in soils, groundwater, and surface water would not be eliminated except by source depletion and possibly natural attenuation that would occur gradually over a period of hundreds of years.

8.4 Previously Considered Alternatives

Alternatives considered earlier in the DFFS and the SFS are summarized in Sections 8.2 and 8.3 of the 2007 Draft Proposed Plan. In general, these alternatives are significantly less comprehensive than those evaluated in the ASFS and the current Proposed Plan. Except for Alternative 11, which was refined and evaluated in the ASFS as Alternative 11M, the Agencies determined that the alternatives considered in the DFFS and SFS (Alternatives 1 through 10) do not meet the threshold requirements required for remedy selection (i.e., protection of human health and the environment, and compliance with potential ARARs), see Section 9.0 of the 2007 Draft Proposed Plan.

9.0 EVALUATION OF ALTERNATIVES

This section discusses the Agencies' evaluation of Alternatives 11M, 12, 13M, and 14 under CERCLA and MTCA.

9.1 Evaluation of Alternatives Under CERCLA

Under CERCLA, the following criteria are used to evaluate remedial alternatives:

Threshold Criteria

1) Overall protection of human health and the environment; and
2) Compliance with ARARs.

Primary Balancing Criteria

1) Long-term effectiveness and permanence;
2) Reduction of toxicity, mobility, and volume through treatment;
3) Short-term effectiveness;
4) Implementability; and
5) Cost.

Modifying Criteria

1) State acceptance of the alternatives; and
2) Community acceptance of the alternatives.

The threshold criteria are requirements that an alternative must meet to be eligible for selection. The primary balancing criteria form the basis for evaluation of alternatives that satisfy the threshold requirements. The modifying criteria are evaluated in the ROD following the receipt of state and public comments on the RI/FS and the Proposed Plan, and are not evaluated in this document.

9.1.1 Threshold Criteria

9.1.1.1 Overall Protection of Human Health and the Environment

9.1.1.1.1 Overall Protection of Human Health

Alternatives 11M, 13M and 14 would protect human health.

Under Alternative 14, risks to humans from soil (including the tailings and waste rock in Tailings Piles 1, 2, and 3, and the East and West Waste Rock Piles), at the

former Mill Building, Lagoon, Maintenance Yard, a portion of the Lower West Area, and the Surface Water Retention Area would be addressed by capping the material in place or moving the material and then capping it to prevent exposure. Risks from soil materials in remainder of the Lower West Area, Honeymoon Heights Waste Rock Piles, and DSHH would be addressed through institutional controls. Potential future use of impacted groundwater and surface water for drinking would be restricted by institutional controls. In addition, safety to residents and visitors would be addressed through mine access restrictions.

Alternative 13M addresses human-health risk from impacted soil (including soil with hazardous substances that exceed human health-based criteria for protection of groundwater) through a combination of removal, capping, and institutional controls. However, in the Lower West Area, Honeymoon Heights Waste Rock Piles and DSHH AOIs where there is risk to humans from direct contact or ingestion of hazardous substances in soils, Alternative 13M would also rely on institutional controls instead of any active cleanup measures.

Alternative 11M would protect human health in the same manner as Alternative 14, except that exposure to waste rock at Honeymoon Heights and soil in the DSHH that exceed proposed direct contact and ingestion-based cleanup levels would be addressed by moving the waste rock and impacted soil to the tailings piles for capping, instead of relying on institutional controls.

9.1.1.1.2 Overall Protection of the Environment

Under Alternative 14, risks to terrestrial organisms from Tailings Piles 1, 2, and 3, the East and West Waste Rock Piles; former Mill Building; Lagoon; Maintenance Yard; a portion of the Lower West Area, and the Surface Water Retention Area would be addressed by excavation (consolidation) or capping materials with hazardous substances in place to prevent exposure. Risks to terrestrial receptors in other areas (e.g., the remainder of the Lower West Area, Wind-Blown Tailings Area, the remainder of the Ballfield Area, and in Holden Village) would be addressed by *in situ* treatment and possible future removal, capping, or treatment. To protect aquatic organisms, contaminant inputs from groundwater (including base flow, seeps and the mine drainage) would be intercepted and treated before it discharges to surface water. The potential release of hazardous substances into Railroad and Copper Creeks from failure of the tailings pile slopes would be addressed by regrading and buttressing the slopes, capping, and stabilizing the existing and relocated reaches of Railroad Creek. Risks to aquatic organisms from ferricrete would be addressed by rerouting Railroad Creek. The toe of the tailings piles adjacent to Copper Creek (and possibly other areas along Railroad Creek) would be pulled back as needed to construct

stable slopes and the groundwater containment and collection components. Sediment in Railroad Creek and Lake Chelan would be monitored to confirm that risks remain low and decrease over time following implementation of source controls.

Alternative 11M would protect the terrestrial and aquatic environment in a manner similar to Alternative 14, with a few significant differences:

- Under Alternative 11M, protection of the Railroad and Copper Creeks from tailings piles instability would require pulling the toe of the tailings piles back all along the slopes abutting the creeks; and

- Under Alternative 11M, exposure to waste rock at Honeymoon Heights and DSHH would be addressed by moving the material to the tailings piles and capping it instead of through *in situ* treatment.

Alternative 11M would protect the aquatic environment in a manner similar to Alternative 14, except that the water treatment system to address contaminant inputs to surface water would differ as depicted on Figures 12 and 14.

Alternatives 11M and 14 differ somewhat in other aspects related to the surface water environment. Alternative 11M would eliminate sources of hazardous substances being released into the wetland east of Tailings Pile 3, and the wetland could be restored. Under Alternative 14, the wetland would become the location of a groundwater treatment facility and would need to be addressed in accordance with ARARs.

Alternatives 11M and 14 would both be protective of the aquatic and terrestrial environments.

There are significant differences in the way in which Alternative 13M would address the environment compared to Alternatives 14 and 11M. As a consequence of these differences, Alternative 13M would not fully protect the environment.

- Under Alternative 13M, the risk to terrestrial receptors from materials in the Lower West Area, Honeymoon Heights Waste Rock Piles, DSHH, Holden Village, and the Wind-Blown Tailings Area would not be addressed except by monitoring.

- Alternative 13M would intercept and treat groundwater from some parts of the Site before it enters surface water, and includes the former Railroad Creek channel as the collection system along the northwest side of Tailings

Pile 2, but it does not include a barrier wall downgradient of Tailings Piles 2 and 3. Under Alternative 13M, there is considerable uncertainty about whether proposed surface water cleanup levels would be met in groundwater before it enters Railroad Creek downstream from Tailings Piles 2 and 3. As discussed above, however, the barrier wall included in Alternative 14 to address this concern may not need to be constructed, or the design could be modified if Intalco can demonstrate as discussed in Section 10.2 that monitoring data show a sustainable trend that would protect aquatic life and comply with ARARs, without the barrier wall, or that some other alternative component(s) will be protective and result in compliance.

Like Alternative 14, Alternative 13M would also eliminate the wetland east of Tailings Pile 3 to enable construction of a groundwater treatment facility.

9.1.1.2 Compliance with Potential ARARs

The other threshold criterion under CERCLA is compliance with potential ARARs [40 CFR § 300.430(e)(9)(iii)(B)]. In this section, the alternatives are assessed to determine potential ARARs attainment under federal environmental laws and state environmental or facility siting laws, or whether there are grounds for invoking one of the waivers listed in 40 CFR § 300.430(f)(1)(ii)(C).

The ability of the alternatives to meet potential chemical-specific ARARs at the points of compliance for surface water, groundwater, and soil, and to meet potential action-specific and location-specific ARARs, are compared below.

9.1.1.2.1 Potential Chemical-Specific Requirements for Surface Water

Under Alternatives 11M and 14, implementation of cleanup actions is expected to satisfy chemical-specific ARARs for surface water based on protection of aquatic life in Railroad Creek and the Copper Creek Diversion as discussed in ASFS Sections 6.2.1.2.1 and 6.2.3.2.1.

Under Alternative 13M, there is considerable uncertainty about whether proposed surface water cleanup levels based on protection of aquatic life would be met in Railroad Creek downstream from Tailings Piles 2 and 3, because of uncontrolled discharge of groundwater from Tailings Piles 2 and 3 to surface water. Alternative 13M may not meet chemical-specific ARARs for surface water as discussed in ASFS Sections 6.2.2.1 and 6.2.2.2.1.

A mixing zone may be required for discharge of the treated groundwater into Railroad Creek. Alternatives 11M and 14 are expected to satisfy the all known,

available, and reasonable methods of treatment (AKART) requirements for Ecology to approve a mixing zone. The Agencies are not prepared to conclude that Alternative 13M satisfies AKART because, as stated above, there is uncertainty about whether proposed groundwater cleanup levels based on protection of surface water would be met before groundwater enters Railroad Creek downstream of Tailings Piles 2 and 3 without the barrier wall. As discussed above, however, the barrier wall included in Alternative 14 may not need to be constructed or the design could be modified, if Intalco can demonstrate, as discussed in Section 10.2, that monitoring data show a sustainable trend that would protect aquatic life and comply with ARARs without the barrier wall, or that some other alternative component(s) will be protective and result in compliance.

Drinking water ARARs for surface water would be met for all three alternatives.

9.1.1.2.2 Potential Chemical-Specific Requirements for Groundwater

Under Alternatives 14 and 11M, groundwater exceeding proposed cleanup levels would be contained within WMAs at the Site. Groundwater ARARs within the WMAs would be waived because they are technically impracticable to meet. Institutional controls would be implemented to limit exposure to contaminated groundwater. Following implementation of source controls, Alternatives 11M and 14 are both expected to meet chemical-specific ARARs for groundwater in areas beyond the edge of the WMAs.

Intalco's description of Alternative 13M did not include establishment of any WMAs. Institutional controls would be implemented to limit exposure to contaminated groundwater. However, groundwater discharging from Tailings Piles 2 and 3 would not be contained, and may continue to enter Railroad Creek above concentrations that are protective of aquatic life. Protection of aquatic life is a designated beneficial use for groundwater at the Site, as discussed in Section 1.2.1.2 of the SFS. Without a barrier wall, there is uncertainty about whether proposed cleanup levels based on protection of surface water would be met in groundwater before it enters Railroad Creek downstream of Tailings Piles 2 and 3 without the barrier wall. As discussed above, however, the barrier wall design could be modified or the barrier wall may not need to be constructed if Intalco can demonstrate that it is not needed, or that some other alternative component(s) will result in compliance. Such a demonstration would be based on monitoring (as discussed in Section 10.2) that shows groundwater concentrations that would protect aquatic life and comply with ARARs without the barrier wall.

9.1.1.2.3 Potential Chemical-Specific Requirements for Soil

Under Alternatives 14 and 11M, soil exceeding proposed cleanup levels would be addressed through a combination of removal, containment, *in situ* soil treatment, and monitoring. Alternatives 11M and 14 are both expected to meet chemical-specific ARARs for soil, except where they might be waived because of the greater harm to the environment that would result from the remedial action.

Alternative 13M does not address soil contamination except for monitoring in the Honeymoon Heights Waste Rock Piles, the DSHH, Lower West Area (outside the Lagoon), Holden Village, or the Wind-Blown Tailings Area. As a result, Alternative 13M would not satisfy chemical-specific ARARs for soil.

9.1.1.2.4 Potential Chemical-Specific Requirements for Sediment

Under Alternatives 14 and 13M, ferricrete in Railroad Creek would be isolated by stream relocation. Ferricrete would be removed from Railroad Creek under Alternative 11M.

Remediation under Alternative 11M and 14 would include preventing all discharges of iron-rich groundwater from the tailings piles, which would eliminate formation of floc that contains hazardous substances in Railroad Creek. Under both of these alternatives, sediment in Railroad Creek downstream from Tailings Pile 3 and in Lake Chelan at the Lucerne Bar would be monitored to confirm that risks to benthic macroinvertebrates remain low and decrease over time with continued natural deposition of clean sediment. These actions are expected to comply with ARARs.

Under Alternative 13M, groundwater containing elevated concentrations of dissolved iron from Tailings Piles 2 and 3 would continue to flow into Railroad Creek and it is not clear if floc would continue to form. Sediment downstream from the relocated stream section and in Lake Chelan at the Lucerne Bar may not comply with ARARs.

9.1.1.2.5 Potential Action- and Location-Specific Requirements

Final ARARs will be identified by the Agencies for the selected remedy at the time of the ROD. The Agencies anticipate that Alternatives 11M and 14 would satisfy potential action- and location-specific ARARs. It is not clear whether Alternative 13M satisfies all action- and location-specific ARARs, as discussed in ASFS Section 6.2.2.2.5.

Mitigation to address adverse impacts of the cleanup action, e.g., destruction of habitat to construct remedy components, disturbance of habitat (especially for threatened and endangered species) during construction; visual quality; air quality; etc., would be implemented as required by the Forest Plan. In the event mitigation would not satisfactorily address requirements of the Forest Plan, the Forest Service may amend the Forest Plan or portions of this ARAR could be waived under CERCLA.

Monitoring during and after implementation would be used for all three alternatives, to assess compliance, as required under both CERCLA and MTCA.

9.1.2 Primary Balancing Criteria

According to the NCP, the selected alternative must provide the best balance of tradeoffs among alternatives (that satisfy the threshold criteria) in terms of the five primary balancing criteria [40 CFR § 300.430(f)(1)(ii)(D) and (E)].

Under CERCLA, only alternatives that meet the CERCLA threshold criteria for selecting a final remedy are typically carried forward and compared using the primary balancing criteria. As presented in ASFS Section 6.2 and above in Section 9.1.1, Alternatives 14 and 11M meet the threshold criteria and, therefore, will be carried forward. Although Alternative 13M does not meet the threshold criteria, it is also carried forward in the following discussion for completeness and to better compare and understand these three alternatives.

9.1.2.1 Long-Term Effectiveness and Permanence

Alternatives shall be assessed for their long-term effectiveness and permanence, along with the degree of certainty that the alternative will be successful [40 CFR § 300.430(e)(9)(iii)(C)]. The two factors considered for long-term effectiveness and permanence are:

- Magnitude of residual risk remaining from the untreated waste or treatment residuals remaining at the conclusion of the remedial activities; and

- Adequacy and reliability of controls necessary to manage treatment residuals and untreated waste.

9.1.2.1.1 Magnitude of Residual Risk Remaining at the Conclusion of the Remedial Activities

Alternatives 11M and 14 would fully address human health and ecological risk associated with soils (including tailings and waste rock) in most areas of the Site,

as well as all groundwater, surface water, and sediment. Pending the result of treatability studies during remedial design, there is some question of the time required for *in situ* treatment to achieve proposed cleanup levels, and whether the *in situ* treatment proposed for Alternatives 11M and 14 would fully address risks to terrestrial receptors in the Wind-Blown Tailings Area, Holden Village, portions of the Ballfield Area, portions of the Lower West Area, the Honeymoon Heights Waste Rock Piles and the DSHH Area. Site-specific studies would be accomplished during remedial design to determine the most effective methods of treatment, and whether pH adjustment could, in fact, be accomplished without causing other more adverse impacts than the existing risks due to hazardous substances.

Alternative 13M would also address human health risks associated with soils. Alternative 13M would rely on natural recovery but does not include any active measures to address risks to terrestrial organisms in the Lower West Area, Honeymoon Heights, Holden Village, DSHH, the Ballfield Area, and the Wind-Blown Tailings Area. Alternative 13M would not address potential risks to aquatic organisms associated with groundwater from Tailings Piles 2 and 3 discharging to Railroad Creek.

Alternative 13M would result in more residual risk at the conclusion of remedial activities compared to Alternatives 11M and 14.

9.1.2.1.2 Adequacy and Reliability of Controls

To assess the adequacy and reliability of controls at the Site, items to be addressed under CERCLA are: 1) uncertainties associated with land disposal of treatment system residuals; 2) potential need to replace technical components of the remedy; and 3) potential risk if components of the remedy need replacement [40 CFR § 300.430(e)(9)(iii)(C)(2)]. These three items are discussed below.

All three Alternatives 14, 11M, and 13M include permanent disposal of water treatment system sludge in a monitored on-site landfill constructed for that purpose. Since the landfill would need to satisfy state requirements for location, design, construction, operation, closure, and monitoring of limited purpose landfills, it is unlikely that hazardous substances would be re-released from the landfill to the environment for any of the three alternatives.

Technical component replacement requirements under Alternatives 11M, 13M, and 14 would be similar, except that the membrane liner system used in the Alternative 11M tailings and waste rock pile caps would be more difficult to maintain and repair, and the Alternative 11M relies on more mechanical

equipment (pumps and generators) that would need to be maintained compared to Alternatives 13M and 14.

As discussed in the ASFS, there would be a similarly low risk to human health and the environment, compared with existing conditions, should remedy components fail or need to be replaced under Alternatives 14, 11M, and 13M.

9.1.2.2 Reduction of Toxicity, Mobility, or Volume through Recycling or Treatment

The second criterion of the primary balancing criteria is assessing the degree to which alternatives employ recycling or treatment to reduce toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site [40 CFR § 300.430(e)(9)(iii)(D)].

Under Alternatives 14, 11M, and 13M, hazardous substances would be immobilized in landfilled sludge following treatment of intercepted groundwater. Alternatives 14 and 11M would immobilize hazardous substances in groundwater from all known source areas. Alternative 13M would immobilize a smaller amount of hazardous substances because groundwater from Tailings Piles 2 and 3 would continue to discharge to Railroad Creek and would not be contained and treated.

9.1.2.3 Short-Term Effectiveness

Evaluation of short-term effectiveness under CERCLA includes the following items:

- Short-term risks that might be posed to the community during implementation of an alternative;
- Potential impacts on workers and the effectiveness and reliability of protective measures;
- Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation; and
- Time until protection is achieved.

Short-term risks to the community would be primarily associated with construction traffic, and would be similar under Alternatives 14, 11M, and 13M. The risk would be mitigated through implementation of a traffic control plan.

Potential impacts to workers during remedial construction would be similar for Alternatives 14, 11M, and 13M, and would generally include construction hazards (mine entry, traffic, exposure to Site soils, excavation, demolition, and heavy equipment operation). These could be adequately mitigated under each alternative through adherence to applicable safety and health regulations (OSHA, L&I, MSHA, etc.) including worker training, monitoring, and protective measures.

Human health risks associated with remedy implementation also include handling fuel and caustic chemicals used in operating the groundwater treatment system. For all three alternatives this risk can be mitigated through development and implementation of an appropriate accident prevention plan and worker training.

All of the Alternatives have some **potential adverse environmental impacts** that are not compliant with the Forest Plan. Mitigation to address adverse impacts such as permanent habitat destruction, temporary disturbance of habitat during construction, visual impacts, etc., would be implemented as required by the Forest Plan. In the event mitigation would not satisfactorily address requirements of the Forest Plan, the Forest Service may amend the Forest Plan or portions of this ARAR could be waived under CERCLA.

The relative effects of Alternatives 11M, 13M and 14 are discussed in the ASFS and summarized below.

- Alternatives 11M, 13M and 14 all involve construction of hydraulic barriers in the underground mine, and share a common risk that this will degrade water quality of the mine discharge. However, each of these alternatives includes collection and treatment of the mine discharge.

- Alternatives 14 and 13M would mitigate most of the risk of tailings pile instability impacting the relocated portion of Railroad Creek. Alternatives 14 and 11M include pulling back portions of Tailings Piles 1 and 2 from Copper Creek as well as improvement of the Copper Creek channel, but Alternative 13M would not eliminate the risk that future instability would release tailings into Copper Creek.

- All three alternatives pose some risk of a bentonite/cement release to surface water during barrier wall construction, with the risk for Alternative 11M being greater than Alternatives 14 or 13M. All three alternatives also involve the risk of spills of hazardous materials during construction vehicle fueling and maintenance, and from long-term operation of the treatment system.

- Alternative 14 includes *in situ* treatment to address the Honeymoon Heights Waste Rock Piles, the DSHH, a portion of the Ballfield Area, Holden Village, a portion of the Lower West Area, and the Wind-Blown Tailings Area. Depending on the effectiveness of *in situ* treatment, this could increase the time required before proposed cleanup levels are achieved in these areas, but with significantly less disturbance and loss of habitat compared to alternative, more intrusive measures. The Agencies anticipate that if *in situ* treatment is found not to be effective, for the State, Ecology using its substantive authority under SEPA would not require other active measures with greater potential adverse impacts on the existing habitat. For the purposes of CERCLA, a waiver of the MTCA ARAR relating to cleanup standards may be appropriate based on CERCLA Section 121(d)(4)(b), which allows an ARAR to be waived where the harm to the environment is greater because of the implementation of the remedial action than from the contamination itself. Alternative 11M also includes *in situ* treatment for some AOIs, but not Honeymoon Heights. Alternative 11M would have a permanent, adverse impact to habitat over an area of 75 acres or more following removal of waste rock and contaminated soils from Honeymoon Heights. Alternative 13M does not accomplish any cleanup to reduce risk to terrestrial receptors from soils in the Honeymoon Heights Waste Rock Piles, the DSHH, Lower West Area, Holden Village, and the Wind-Blown Tailings Area.

- Alternative 11M would have a greater risk of surface water quality exceedances associated with discharge from the groundwater treatment facility compared to Alternatives 13M and 14. Although all three alternatives would use similar pH adjustment and precipitation methods to remove hazardous substances during treatment, Alternative 11M relies on pumping, whereas Alternatives 13M and 14 are proposed to be gravity flow-through systems. Alternative 11M could produce surface water quality exceedances if there is a pump or generator failure during the life of the remedy, and would also have higher fuel consumption requirements and, hence, greater risk of a fuel spill compared to Alternatives 13M and 14.

- Alternatives 13M and 14 involve permanent destruction of the wetland habitat east of Tailings Pile 3 for construction of a groundwater treatment facility; whereas, the Alternative 11M treatment system would occupy a portion of the Wind-Blown Tailings Area that is forested. Wetland habitat in the Railroad Creek valley is much less common that forest habitat, so Alternatives 13M and 14 would have greater negative impacts compared to Alternative 11M, in this regard.

The three alternatives also differ in the **time required until protection is achieved**. Time to achieve proposed cleanup levels through *in situ* treatment under Alternatives 11M and 14 will not be known until completion of treatability studies as part of implementing the remedy but it is expected to take longer than in the areas where soil is removed and/or capped. However, Alternative 13M would not be fully protective of the environment since it relies on natural recovery to protect terrestrial receptors in the Honeymoon Heights Waste Rock Piles, DSHH, Lower West Area, Holden Village, and the Wind-Blown Tailings AOIs.

All three alternatives would protect human health at the time the remedy is implemented.

Overall, Alternative 14 has better short-term effectiveness compared to the Alternatives 11M and 13M.

9.1.2.4 Implementability

Implementability is evaluated under CERCLA considering technical feasibility; administrative feasibility; and availability of services and materials. All three Alternatives are considered to be implementable.

- Alternatives 14, 11M, and 13M are all technically feasible and could be implemented using conventional construction equipment and methods.

- All three alternatives are administratively feasible. The land subject to the cleanup is under the control of the Forest Service and Holden Village, Inc.'s private ownership. Since the State of Washington and the Yakama Nation have assisted or consulted in the evaluation of the remedies along with the other Agencies, the Agencies do not foresee any administrative barriers to implementation of Alternatives 14, 11M, or 13M.

- The services and materials to implement Alternatives 14, 11M, and 13M are readily available.

9.1.2.5 Cost

Costs for all three alternatives in 2010 dollars (rounded to three significant figures) are summarized below.[18]

	Alternative 11M	Alternative 13M	Alternative 14
Estimated Capital Cost	$88,500,000	$56,400,000	$76,100,000
Net Present Value of Long-Term Operations, Maintenance and Monitoring	$31,800,000	$23,400,000	$30,700,000
Total Estimated Cost:	$120,000,000	$79,800,000	$107,000,000

Alternative 11M would cost more than Alternative 14, primarily because of the cost associated with using a geomembrane as part of the cap for tailings and waste rock piles, and the cost of removing the Honeymoon Heights Waste Rock Piles and impacted soils in the DSHH. Additional differences in cost are discussed in Appendix A of the ASFS.

Alternative 13M would cost less than Alternatives 11M and 14, as discussed in the ASFS. However, Alternative 13M omits remedy components necessary to satisfy the threshold criteria under CERCLA (or MTCA), so its relative cost would be misleading in selecting a remedy. Alternative 13M costs less than Alternatives 11M and 14 because it does not achieve the same degree of protectiveness as Alternatives 11M and 14, and does not meet ARARs. Alternative 13M would represent an interim step toward a final remedy. It does not take into account the costs of the remaining steps to achieve a final remedy.

9.1.3 Modifying Criteria

Two additional criteria, referred to as modifying criteria, are also considered for remedy selection under CERCLA. These are state acceptance and community acceptance. CERCLA uses the modifying criteria, along with the primary balancing criteria, to determine what is the most practicable among alternatives that are both protective and ARAR-compliant.

[18] The Agencies prepared cost estimates for all three alternatives in order to provide a consistent basis for comparison. The Agencies estimate for Alternatives 11M or 13M differ from those prepared by Intalco for Alternatives 11 and 13M (URS 2009a) and are presented in Appendix A of the ASFS. The net present value for long-term costs was calculated using a discount rate of 7 percent and a period of 50 years.

The State of Washington provided input throughout the RI/FS process. Intalco and Holden Village, Inc. also provided input throughout the FS process. Additional public input will include an opportunity to comment on the draft Proposed Plan and supporting documentation.

9.2 Evaluation of Alternatives under MTCA

The State of Washington is also exercising its independent cleanup authority for this Site under MTCA, which is applicable to the Site according to state law [RCW 70.105D]. Under MTCA, the following criteria are used to evaluate remedial alternatives:

Threshold Requirements

1) Protect human health and the environment;
2) Comply with cleanup standards;
3) Comply with applicable state and federal laws;
4) Provide for compliance monitoring;

Other Requirements

1) Use permanent solutions to the maximum extent practicable;
2) Provide a reasonable restoration time frame;
3) Consider public concerns;

Action-Specific Requirements ("pertaining to" requirements)

1) Groundwater;
2) Soils at current or potential future residential areas and child care centers;
3) Institutional Controls;
4) Releases and Migration;
5) Dilution and Dispersion; and
6) Remediation Levels.

As with CERCLA, the MTCA threshold requirements must be met for an alternative to be considered further. The remaining nine requirements, along with the threshold requirements, are used to evaluate alternatives that satisfy the threshold criteria.

9.2.1 Threshold Requirements

9.2.1.1 Protect Human Health and the Environment

For the same reasons that Alternative 14 and Alternative 11M provide for "overall protection of human health and the environment" under CERCLA (see Section 9.1.1.1), Alternative 14 and Alternative 11M satisfy MTCA's requirement that the remedy protect human health and the environment. Alternative 13M would not protect terrestrial receptors in many areas of the Site, and the Agencies do not have sufficient information to show that proposed surface water cleanup levels would be met in groundwater that discharges to surface water downstream of Tailings Piles 2 and 3 without a barrier wall.

9.2.1.2 Comply with Cleanup Standards

As presented in the ASFS Sections 6.3.1 and 6.3.3, Ecology concludes that Alternatives 11M and 14 would comply with cleanup standards. Under Alternative 11M, contaminated groundwater would be contained and treated before entering the surface water. Alternative 14 also includes a barrier wall for this purpose, but the barrier wall need not be constructed if Intalco can demonstrate that monitoring data show groundwater concentrations that would protect aquatic life and comply with ARARs. Alternatively, the barrier wall design could be modified upon that some other approach will be protective and comply with ARARs. Groundwater downstream from the groundwater containment would be expected to meet cleanup standards at a conditional point of compliance along the groundwater-surface water interface of Railroad Creek.

However, Ecology concludes that Alternative 13M does not satisfy cleanup standards under MTCA, as discussed in ASFS Section 6.3.2. MTCA requires that for a cleanup action to qualify for a groundwater conditional point of compliance, groundwater discharges must receive all known available and reasonable methods of treatment (AKART) before release to surface water. Alternative 13M does not constitute AKART, because this remedy does not include containment of groundwater underneath Tailings Piles 2 and 3 and information provided to date does not indicate that groundwater discharging to surface water downstream of Tailings Piles 2 and 3 will be protective of aquatic life. As a result, Ecology would not approve a conditional point of compliance along the groundwater-surface water interface of Railroad Creek for Alternative 13M.

9.2.1.3 Comply with State and Federal Law

For the same reasons that Alternative 14 and Alternative 11M comply with ARARs under CERCLA (see Section 9.1.1.3), Alternative 14 and Alternative 11M satisfy MTCA's requirement that the remedy comply with applicable state and federal laws, and Alternative 13M may not.

9.2.1.4 Provide for Compliance Monitoring

Alternatives 11M, 13M, and 14 would each provide for compliance monitoring.

9.2.1.5 Summary of MTCA Threshold Requirements

As noted in Sections 9.2.1.1 through 9.2.1.4, Alternatives 14 and 11M would satisfy all the MTCA threshold requirements for selection of a permanent remedy, but Alternative 13M would not.

9.2.2 MTCA Other Requirements

Alternatives 11M and 14 would both satisfy the Other Requirements for remedy selection under MTCA, but with some differences as summarized below.

Overall, the Agencies consider Alternative 14 to better satisfy the MTCA requirements than Alternative 11M because it relies on permanent solutions to the maximum extent practicable.

Although the removal of waste rock and impacted soils on Honeymoon Heights under Alternative 11M is more permanent than *in situ* treatment under Alternative 14; Alternative 14, overall, relies on permanent solutions more than Alternative 11M. Alternative 11M would rely more on mechanical systems that require more maintenance for water treatment (compared to a gravity flow-through system for Alternative 14), would require more maintenance and more difficult maintenance of the cap over the tailings and waste rock piles compared to Alternative 14; and on balance Alternative 11M would be less protective than Alternative 14, all at a greater overall cost.

Alternative 11M would have a shorter restoration time frame compared to Alternative 14 for cleanup of the Honeymoon Heights Waste Rock Piles and DSHH. However, this would only be achieved by measures more intrusive than *in situ* treatment, and such measures appear likely to cause more adverse impact than the existing hazardous substance concentrations in these AOIs. The restoration time frame for the remaining AOIs would be the same under both alternatives.

Public concerns will be considered based on comments on the Proposed Plan when it is released for public comment.

9.2.3 MTCA Action-Specific Requirements

9.2.3.1 Non-Permanent Groundwater Cleanup Actions

As discussed in the ASFS, a permanent groundwater cleanup is not practicable throughout the entire Site within a reasonable restoration time frame. Therefore, the selected alternative must meet MTCA's requirements for non-permanent cleanup actions.

Alternatives 11M and 14 include the removal, containment, or *in situ* treatment of the sources of hazardous substances at the Site. These alternatives also include groundwater containment to the maximum extent practicable to avoid lateral and vertical expansion of the groundwater affected by the hazardous substances. As a result, Alternatives 11M and 14 meet the MTCA requirements for a non-permanent groundwater cleanup action.

Alternative 13M includes the removal or containment of some sources of hazardous substances but does not address all soils at the Site that exceed proposed cleanup levels. Also, Alternative 13M does not include groundwater containment to the maximum extent to avoid expansion of the plume. As a result, Alternative 13M does not satisfy the MTCA requirements for non-permanent groundwater cleanup actions.

9.2.3.2 Cleanup of Soils for Residential and School Areas

All three alternatives would satisfy requirements to clean up soils affecting residential and school areas. Although Alternative 13M does not include any actions to remediate soils above proposed direct contact and ingestion-based cleanup levels in the Lower West Area and on Honeymoon Heights other than to rely on institutional controls, these AOIs are probably not a significant source of wind-blown dust.

9.2.3.3 Institutional Controls

Ecology concludes that Alternatives 11M and 14 each satisfies requirements for institutional controls to protect human health that are specified in WAC 173-340-440. However, Alternative 13M relies on institutional controls instead of more permanent cleanup actions to protect human health for a portion of the Site (i.e., in the Ballfield Area and Lower West Area AOIs).

9.2.3.4 Releases and Migration/Dilution and Dispersion

Ecology concludes that Alternatives 11M and 14 do not rely primarily on dilution and dispersion to clean up groundwater and surface water above proposed cleanup levels. However, it appears that Alternative 13M relies on dilution and dispersion east of Tailings Pile 3, to prevent the discharge of groundwater to surface water that exceeds proposed cleanup levels.

9.2.3.5 Remediation Levels

Alternatives 11M and 14 do not propose the use of remediation levels.

Intalco refers to remediation levels in discussing Alternative 13M, but the Agencies believe Intalco is using this term to refer to proposed site-specific risk-based cleanup levels, as discussed in the ASFS.

10.0 THE PREFERRED ALTERNATIVE

10.1 Identification of the Preferred Alternative

Alternatives 11M and 14 both satisfy the threshold criteria for selection of a remedy under CERCLA and MTCA, but differ in their ability to satisfy some of the primary balancing criteria. Overall, Alternative 14 provides a better balance among all the criteria and is identified by the Agencies as the Preferred Alternative.[19]

The following summary focuses on the key differences between Alternative 11M and the Preferred Alternative and explains why, overall, the Preferred Alternative provides a better balance among the criteria.

The main advantages of Alternative 11M over the Preferred Alternative are as follows:

[19] The Agencies have identified the Preferred Alternative based on current information. The Agencies will review comments at the close of the public comment period and may modify the Preferred Alternative or select another cleanup action based on new information or public comments. Following consideration of and response to public comments, the Agencies will document selection of a cleanup action in a record of decision (ROD) for the Site. Ecology intends to adopt the ROD as a cleanup action plan (CAP) under MTCA, pursuant to WAC 173-340-380(4).

- Alternative 11M would quickly achieve soil cleanup at the Honeymoon Heights Waste Rock Piles and the DSHH, but at the cost of eliminating existing, minimally-impacted habitat in the DSHH, and causing long-term habitat damage on the estimated 70-acre area downslope of the Honeymoon Heights access road needed to remove the waste rock and impacted soils. The Preferred Alternative uses *in situ* treatment, which could take several years to achieve protection from the hazardous substances, but without the long-term damage associated with removal of the waste rock and impacted soils.

- Alternative 11M would more effectively address human health risk from exposure to waste rock at Honeymoon Heights and soils DSHH. Alternative 11M involves removal and capping of impacted materials to prevent visitor exposure to these materials. The Preferred Alternative would, instead, establish administrative restrictions and warnings to limit human contact with impacted waste rock and soil.

- Alternative 11M preserves wetland habitat (which is relatively rare in the Railroad Creek valley) by locating the water treatment plant in an upland area north of Railroad Creek. The Preferred Alternative involves locating the treatment system in the wetland east of Tailings Pile 3. The Preferred Alternative would require mitigation for the loss of the wetland and the riparian forest impacted by creek relocation by establishing or improving wetland and riparian forest habitat elsewhere.

The main advantages of the Preferred Alternative over Alternative 11M are as follows:

- The Preferred Alternative avoids long-term, potentially permanent habitat loss in the vicinity of the Honeymoon Heights Waste Rock Piles and the DSHH area, and for construction of the access road to accomplish removal on Honeymoon Heights. The Preferred Alternative would, therefore, avoid long-term, possibly permanent, habitat degradation to an estimated 70 acres downslope of the Honeymoon Heights access road and waste rock piles, caused by changes in drainage and instability. Unlike Alternative 11M, the Preferred Alternative uses *in situ* treatment of soil in these areas, which would not require heavy equipment access or involve soil disturbance.

- The water treatment system under the Preferred Alternative would be easier to maintain and would be less susceptible to mechanical failure that would potentially result in exceedances of surface water quality standards, because the Preferred Alternative system does not rely on electrically driven pumps to convey water to the treatment system.

- The Preferred Alternative would involve less long-term risk of fuel spills because it relies on gravity flow rather than pumping all the groundwater collected for treatment. Conversely, Alternative 11M does rely on pumping and would require substantial electrical power, likely supplied by a diesel generator. The fuel would need to be loaded, unloaded, and transported to the site via barge and truck.

- The Preferred Alternative involves less risk of tailings releases to surface water during construction than Alternative 11M. Unlike Alternative 11M, the Preferred Alternative does not involve regrading and excavation immediately adjacent to Railroad Creek to relocate the toe of the tailings piles.

- The Preferred Alternative involves less risk of sedimentation or bentonite/cement release to surface water during construction because barrier walls would not be constructed immediately adjacent to Railroad Creek as they would under Alternative 11M.

- The soil caps used on the tailings piles and East and West Waste Rock Piles would be easier to maintain and repair than the membrane liner systems used in Alternative 11M.

- The Preferred Alternative would cost less than Alternative 11M, primarily because it does not involve a geomembrane as part of the cap for tailings and waste rock piles and removal of the Honeymoon Heights Waste Rock Piles and impacted soils in the DSHH area.

The Agencies believe that the advantages of Alternative 11M are more than offset by the advantages of the Preferred Alternative and that, on balance, the Preferred Alternative is the better alternative.

The advantages to terrestrial organisms of removing waste rock and soil at Honeymoon Heights under Alternative 11M would be outweighed by the disadvantages of the accompanying long-term destruction of habitat. Similarly, the advantage of removing the waste rock and soil to limit human exposure to hazardous substances would be outweighed by the accompanying long-term destruction of terrestrial habitat, especially in light of the expected effectiveness of institutional controls to control human exposure.

The loss of the wetland east of Tailings Pile 3 under the Preferred Alternative would be outweighed by the benefits of using a low-energy water treatment system. The low-energy system would be easier to maintain than the system proposed for Alternative 11M, would be less likely to fail (potentially resulting in

exceedances of surface water quality standards), and would not involve as great a need for reliance on a diesel generator, along with its associated impacts to air quality and risk of fuel spills. The disadvantage of wetland loss under the Preferred Alternative would be further offset by required mitigation measures that would involve the establishment and/or improvement of wetland habitat elsewhere in the Lake Chelan drainage.

As listed above, other advantages of the Preferred Alternative that offset those of Alternative 11M include a reduced risk of tailings, bentonite/cement, or sediment releases to surface water during construction; easier maintenance and repair of the tailings and waste rock caps; and lower overall life cycle cost.

As described in the preceding paragraphs, the Preferred Alternative and Alternative 11M both satisfy the threshold criteria; however, the Preferred Alternative satisfies the primary balancing criteria to a greater degree overall than does Alternative 11M.

Based on the information currently available, the Agencies believe that the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs among other alternatives with respect to the balancing and modifying criteria. The Forest Service and EPA expect the Preferred Alternative to satisfy the following statutory requirements of CERCLA Section 121(b): 1) be protective of human health and the environment; 2) comply with ARARs except where a waiver is justified; 3) be cost-effective; 4) utilize permanent solutions and alternative treatment technologies to the maximum extent practicable; and 5) satisfy the preference for treatment as a principal element or justify why the preference is not satisfied.

10.2 Sequence of Events for Implementing the Preferred Alternative

The Agencies anticipate that implementation of Alternative 14 would include the following general sequence of events in two principal phases (see Table 16 and Figure 15). First, Intalco will develop a baseline monitoring plan for Agency approval as soon as possible, so that additional data collection could begin with the fall 2010 monitoring, and continue concurrently with remedial design and remedial action.[20] During preparation of the ROD and Consent Decree, Intalco

[20] Monitoring in 2010 is anticipated to be accomplished under the RI/FS Administrative Order on Consent, and would continue under the RD/RA Consent Decree.

is also likely to continue the investigations it has already begun (pilot tests for treating impacted groundwater and investigating the feasibility of constructing hydraulic bulkheads in one or more mine portals). Remedial design and preparation of construction plans and specifications is expected to be accomplished over a period of about 2 years, including Agency review. Intalco has indicated it would like to proceed with some early remedial actions during this period, including addressing the portal drainage. The Agencies are supportive of these and other early actions.

Remedial construction will likely follow a two-phased approach. Phase I remedial construction is likely to require 2 years, according to Intalco. The remedial design will determine which construction components would be accomplished concurrently or sequentially. Since *in situ* treatment to reduce terrestrial risk in some AOIs is likely to be based on pilot tests, the final stages of Phase I remedy implementation may include this or other activities after the main part of the Phase I remedy construction. Phase II remedial construction includes collection trench and barrier wall construction adjacent to Tailings Piles 2 and 3. Down time between the end of Phase I construction and the beginning of Phase II construction is expected to be 5 years. This allows for 3 years of post-Phase I data to be collected, and 2 years for decision and design.

Intalco has proposed to postpone building the groundwater containment barrier downstream of Tailings Pile 2 and 3. Intalco believes natural attenuation is ongoing, and this, along with the anticipated benefits of other remedy components will, over time, eliminate the need for this barrier.[21] The Agencies are prepared to modify Alternative 14 if the data collected by Intalco show that the groundwater barrier system could be modified in design, does not need to be built, or a more desirable technology that achieves remedial action objectives is identified. However, there is currently no demonstration that proposed aquatic life cleanup levels would be met without the barrier wall. **Therefore, it is necessary for Intalco to make this demonstration within 3 years after completion of the first phase of remedy implementation, in order to avoid constructing a groundwater barrier downgradient of Tailings Piles 2 and 3 as**

[21] The components that Intalco refers to in this context include: diversion trenches upgradient of the tailings piles, regrading and capping the tailings piles, collection and treatment of groundwater in the Lower West Area and below Tailings Pile 1, and collection and treatment of groundwater northwest of Tailings Pile 2. These components are common to both Alternatives 13M and 14.

part of the remedial action.[22] A sufficient investigation and statistical demonstration of monitored natural attenuation mechanisms and decreasing contaminant trends will be required. The baseline monitoring plan will discuss monitoring requirements and statistical methodology. Phase II remedial actions will be required if monitoring data do not demonstrate groundwater concentrations that would protect aquatic life and comply with ARARs. At this Site, the most stringent groundwater cleanup levels are based on protection of surface water before it discharges into Railroad Creek.

The Agencies understand that Holden Village, Inc. has concerns for the viability of its operations if remedial construction results in closure or significantly constrains operations of the Village for more than two consecutive years, or if there is a second closure within five years of the conclusion of the first construction period. Intalco will develop a proposed remedy construction schedule, subject to Agency approval. The Agencies will strive to ensure that the schedule is consistent with the expressed preferences of Holden Village. Circumstances, such as fire or weather-related delays, may interfere with achieving this goal.

Intalco has already indicated a willingness to accomplish some work ahead of, or following, the period of major construction, and the Agencies believe this approach will mitigate impacts on Holden Village. While the Agencies do not expect that it will be necessary for Holden Village to suspend operations during remedial construction, the Agencies understand a large construction project does not lend itself to the usual expected Holden Village experience. Through review, input, and approval of remedial design, the Agencies are prepared to assist Holden Village to mitigate impacts of construction to the extent possible. The Agencies will also take into account Holden Village's request for a five-year gap between the conclusion of the first phase of construction and the initiation of any second phase, as is reflected in the Preferred Alternative.

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[22] However even if new data show the barrier and collection system is not currently needed downgradient of Tailings Piles 2 and 3, the Agencies recognize the DFFS demonstrated there is considerable uncertainty in the rate of hazardous substances being released over time to groundwater below Tailings Piles 2 and 3, and the barrier wall could be needed at a future date.

11.0 STATE ENVIRONMENTAL POLICY ACT (SEPA) MITIGATION FACTORS

The Preferred Alternative would be implemented under MTCA, as well as CERCLA. For MTCA purposes only, Ecology must ensure that the action is implemented in compliance with SEPA. Appendix A to this Proposed Plan is a SEPA checklist that is included to satisfy state requirements, but is not part of the CERCLA process.

12.0 COMMUNITY PARTICIPATION

The April 1998 Community Relations Plan was revised in 2007 and again in 2010 to provide a framework for informing the public about this draft Proposed Plan and other Site activities. The Agencies will consider comments received during the public comment period before issuing a ROD to document selection of the cleanup action for the Site. The public is encouraged to review and comment on all of the alternatives presented. The Agencies may elect to modify the Preferred Alternative based on comments received. The Agencies will respond to significant comments on the Proposed Plan in the Responsiveness Summary, which will be included in the ROD.

Documents considered or relied on in selecting the final remedy, including public comments on the Proposed Plan, will be available to the public in the Administrative Record File. The Administrative Record File is available at the Okanogan-Wenatchee National Forest Headquarters in Wenatchee, at Ecology's Central Regional Office in Yakima, and EPA's Region 10 office in Seattle. Contact addresses and phone numbers are provided at the beginning of this document.

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TABLES

Table 1 - Summary of Constituents of Concern and Proposed Cleanup Levels

Media of Concern and Area of Interest	Constituent of Concern	Proposed Cleanup Level	Basis
Groundwater and Surface Water Used for Drinking Water: All Areas (ug/L)	Aluminum	16,000	a
	Cadmium	5.00	
	Copper	592	
	Lead	15.0	
	Zinc	4,800	
Surface Water and Groundwater Discharging to Surface Water: All Areas (ug/L)	Aluminum	152	b
	Cadmium (e)	0.090	
	Copper (e)	1.17	
	Iron	1,000	
	Lead (e)	0.540	
	Zinc (e)	11.0	
Soil: Tailings Piles 1, 2, & 3 (mg/kg)	Barium	330	h
	Cadmium	5.5	h
	Copper	85	h
	Lead	161	h
	Molybdenum	18.6	h
	Silver	18.5	h
	Thallium	0.36	g
	Zinc	136	g
Soil: East and West Waste Rock Piles (mg/kg)	Barium	164	g
	Cadmium	14	h
	Chromium	29	h
	Copper	46	h
	Lead	118	h
	Molybdenum	8.8	g
	Silver	3.9	h
	Thallium	0.36	g
	Zinc	136	g
Soil: Honeymoon Heights Waste Rock Piles (mg/kg)	Barium	164	g
	Copper	46	h
	Lead	118	h
	Mercury	0.93	g
	Molybdenum	8.8	g
	Silver	3.9	h
	Thallium	0.36	g
	Zinc	136	g
Soil: Ballfield Area (mg/kg)	Chromium	29	h
	Copper	46	h
	Lead	201	h
	Silver	16.5	h
	Thallium	0.36	g
	Zinc	136	g

Table 1 - Summary of Constituents of Concern and Proposed Cleanup Levels

Media of Concern and Area of Interest	Constituent of Concern	Proposed Cleanup Level	Basis
Soil: Holden Village (mg/kg)	Aluminum	18200	g
	Barium	164	g
	Chromium	29	h
	Copper	112	h
	Lead	124	h
	Silver	3.9	h
	Zinc	136	g
Soil: Windblown Tailings Area (mg/kg)	Barium	232	h
	Copper	85	h
	Lead	139	h
	Molybdenum	8.8	g
	Silver	11.9	h
	Zinc	136	g
Soil: Downslope from Honeymoon Heights (mg/kg)	Aluminum	17600	g
	Arsenic	16	c
	Barium	133	g
	Cadmium	14	h
	Copper	288	h
	Lead	201	h
	Mercury	0.43	g
	Molybdenum	5.5	h
	Selenium	1.4	g
	Silver	3.9	h
	Thallium	0.13	g
	Zinc	177	g
Soil: Lower West Area-East (mg/kg)	Aluminum	17600	g
	Arsenic	16	c
	Barium	133	g
	Cadmium	12	h
	Copper	110	g
	Lead	121	h
	Mercury	0.43	g
	Molybdenum	2.9	g
	Selenium	1.4	g
	Silver	8.5	h
	Thallium	0.13	g
	Zinc	177	g
Soil: Lower West Area-West (mg/kg)	Arsenic	16	c
	Silver	3.9	h

Table 1 - Summary of Constituents of Concern and Proposed Cleanup Levels

Media of Concern and Area of Interest	Constituent of Concern	Proposed Cleanup Level	Basis
Soil: Lagoon (mg/kg)	Aluminum	17586	g
	Barium	133	g
	Cadmium	14	h
	Copper	110	g
	Lead	118	h
	Molybdenum	2.9	g
	Silver	360	f
	Thallium	1	h
	Zinc	177	g
	TPH-Diesel	200	h
	TPH-Heavy Oil	200	h
Soil: Maintenance Yard (mg/kg)	Aluminum	18157	g
	Arsenic	4.8	c
	Barium	164	g
	Cadmium	14	h
	Chromium	42	h
	Copper	70	h
	Lead	118	h
	Molybdenum	8.8	g
	Silver	360	f
	Zinc	136	g
	TPH-Gasoline	100	h
	TPH-Diesel	200	h
	TPH-Heavy Oil	200	h
Soil: SRA (mg/kg)	Aluminum	18157	g
	Barium	164	g
	Cadmium	14	h
	Chromium	42	h
	Copper	70	h
	Lead	118	h
	Molybdenum	8.8	g
	Silver	360	f
	Thallium	1	h
	Zinc	136	g

Table 1 - Summary of Constituents of Concern and Proposed Cleanup Levels

Media of Concern and Area of Interest	Constituent of Concern	Proposed Cleanup Level	Basis
Sediment (mg/kg)	Aluminum	58,000	
	Cadmium	1.10	
	Chromium	95.0	
	Copper	80.0	
	Iron	40,000	
	Lead	340	i
	Manganese	1,800	
	Mercury	0.280	
	Nickel	60.0	
	Silver	2.00	
	Zinc	130	

Notes:

(a) Proposed cleanup level based on state or federal drinking water standards or cleanup levels protective of the drinking water pathway; see Table 6.

(b) Proposed cleanup level based on state or federal surface water quality criteria or background, if higher; see Table 4.

(c) Proposed cleanup level based on human health risk (MTCA Method B) (set at background); see Table 8

(d) Proposed cleanup level based on human health risk (MTCA Method A); see Table 8.

(e) Proposed cleanup based on hardness-dependent ARAR assuming 7 mg/L; see Table 4.

(f) Proposed cleanup level based on human health risk (MTCA Method B); see Table 8.

(g) Proposed cleanup level based on ecological risk (set at background); see Table 9.

(h) Proposed cleanup level based on ecological risk; see Table 9.

(i) Proposed cleanup level based on freshwater sediment TBCs; see Table 11

(j) Sampling data not currently available for Former Mill Building area; constituents of concern and cleanup levels will be identified by Agencies when data are available.

(k) Proposed cleanup levels for soil were identified using data from Tables 8 and 9 as follows: The proposed human health-based cleanup level for each constituent and AOI is the lowest human-health-based potential chemical-specific ARAR or TBC or the background level of the corresponding background area, whichever is greater. The proposed ecological-based cleanup level for each constituent and AOI is the site-specific ecological risk-based level or the background level of the corresponding background area, whichever is greater. For media/areas with both human health and ecological exposure pathways, the cleanup level is based on the lower of the lowest ecological or human health criteria identified as described above, or background, if higher.

(l) Cleanup levels presented for soil do not include those constituents whose concentrations are less than background.

(m) Proposed cleanup levels for published and calculated values typically shown to two or three significant figures. Final cleanup levels will be determined at the time of the Record of Decision.

Table 2 - Areas of the Site with Groundwater Concentrations that Exceed Drinking Water Criteria

Constituents of Concern (ug/L)	Drinking Water Criteria (c)	Ballfield Area		Honeymoon Heights Waste Rock Piles		Mine Portal		Lower West Area		East and West Waste Rock Piles (including Mill Building Area)		Tailings Pile 1		Tailings Pile 2		Tailings Pile 3		Windblown Tailings Area		Downstream From Tailings Pile 3		Holden Village	
		Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Aluminum	16,000	nd	nd	16,800	4,580	6,065	nd	5,140	1,290	6,890	1,790	61,600	43,500	804,000	3,960	17,300	6,760	nd	60.0	3,040	14,300	50.0	100
Cadmium	5.00	3.20	0.400	38.3	22.4	48.5	8.00	32.6	35.1	73.4	63.0	32.3	11.7	2,030	3.08	11.3	3.73	nd	nd	0.915	0.940	0.300	nd
Copper	592	10.0	nd	7,370	4,600	2,960	28.0	2,860	2,140	5,690	7,560	944	179	4,050	24.9	465	29.1	nd	1.00	24.9	64.2	3.00	3.20
Iron	--	nd	nd	130	480	202	nd	3,670	2,810	196	710	917,700	836,000	741,000	146,000	83,700	198,000	50.0	nd	781	16,700	330	80.0
Lead	15.0	nd	nd	7.25	8.92	28.2	1.00	7.11	8.00	8.27	13.0	3.07	nd	42.3	52.0	37.8	66.7	--	--	0.212	nd	nd	2.60
Zinc	4,800	30.0	11.0	4,800	2,530	8,840	2,980	4,720	4,900	9,270	8,960	4,940	5,500	510,000	294	823	278	18.0	34.0	131	167	77.3	10.0

Notes:

(a) Constituent concentrations from Table 7.

(b) Shaded cells indicate exceedance of drinking-water based criteria (does not include exceedance of non-health-based secondary MCLs)

(c) Drinking water-based criteria presented in Table 6.

(d) Arsenic and nickel concentrations in groundwater were identified in the SFS as exceeding drinking water criteria in some areas of the Site. Updated statistical analyses (see Table 7, footnote d), along with additional groundwater data collected through spring 2009, indicate that these constituents do not exceed drinking water standards.

-- Not analyzed or not applicable

nd = Non-detect.

Table 3 - Areas of the Site with Soil Concentrations That Exceed Human Health Criteria

Constituents of Concern (mg/kg)	Tailings Piles 1, 2, & 3	East & West Waste Rock Piles	Honeymoon Heights Waste Rock Piles	Ballfield Area	Holden Village	Windblown Tailings Area	Area Downslope of Honeymoon Heights	Lower West Area--East	Lower West Area--West	Lagoon	Maintenance Yard	Surface Water Retention Area
Aluminum	15,900	16,400	18,100	17,900	20,300	15,700	18,400	20,100	16,300	33,500	23,900	20,234
Arsenic	--	--	--	--	--	--	**20.0**	**20.0**	**26.0**	5.00	**60.0**	--
Barium	459	409	344	82.0	185	192	238	352.0	66.0	343	717	660
Cadmium	**19.5**	**4.77**	3.00	1.40	1.60	0.690	**5.30**	**130**	1.70	**184**	**21.6**	**8.03**
Chromium	14.7	56.9	17.0	26.0	32.0	18.0	21.0	24.0	26.0	21.0	33.0	26.9
Copper	**865**	**1,350**	**1,450**	72.0	260	118	**1,680**	**6,230**	80.0	**24,100**	**3,160**	**1,980**
Lead	65.1	224	1,910	16.0	52.0	37.0	77.0	644	13.0	746	1,070	141
Mercury	0.303	0.499	**3.40**	0.320	0.042	0.310	1.90	1.10	0.320	--	--	0.530
Molybdenum	20.0	17.0	22.0	2.30	2.90	19.0	17.0	53.0	2.20	74.0	16.0	21.1
Selenium	6.64	4.67	6.90	0.450	0.780	1.90	2.40	**10.0**	0.360	--	--	6.83
Silver	3.59	3.25	8.20	0.720	0.860	1.30	3.30	11.0	0.700	**27.0**	5.00	7.31
Thallium	0.81	0.631	1.50	0.600	0.160	0.240	0.730	0.970	0.100	**3.00**	nd	1.20
Zinc	2,070	934	522	155	225	138	1,010	**17,300**	132	**23,700**	3,240	736
Gasoline-Range Hydrocarbons	--	--	--	--	--	--	--	--	--	nd	**1,200**	--
Diesel-Range Hydrocarbons	--	--	--	--	--	--	--	--	--	917	**12,000**	--
Heavy Oil-Range Hydrocarbons	--	--	--	--	--	--	--	--	--	1,120	**9,800**	--

Notes:

(a) Constituent concentrations from Table 10.

(b) Shaded cells indicate that value exceeds site-specific background concentration and human health-based soil criteria for the direct contact and/or ingestion pathway.

(c) Bolded values indicate that value exceeds site-specific background concentration and human health-based soil criteria for protection of groundwater.

(d) Site-specific background concentrations and soil criteria used for comparison are presented in Table 8.

-- Not analyzed or not applicable

nd = Non-detect.

Table 4 - Potential Chemical-Specific ARARs and Background Concentrations for Surface Water

Constituents of Concern (ug/L)	Water Quality Standards For Surface Waters of The State of Washington WAC 173-201A		Section 304 of the Clean Water Act National Recommended Water Quality Criteria (EPA 2006)				National Toxics Rule 40 CFR 131.36(b)(1)				State of Washington Model Toxics Control Act Method B Cleanup Levels WAC 173-340-730	Maximum Contaminant Levels (f)	Background Concentrations (d)
	Protection of Aquatic Organisms		Protection of Aquatic Organisms		Protection of Human Health		Protection of Aquatic Organisms		Protection of Human Health		Protection of Human Health	Protection of Human Health	
	Acute	Chronic	Acute	Chronic	Consumption of Water and Organism	Consumption of Organism Only	Acute	Chronic	Consumption of Water and Organism	Consumption of Organism Only	Fish Ingestion	Drinking Water	
Aluminum	--	--	750	87	--	--	--	--	--	--	--	--	152
Cadmium	0.206	0.143	0.151	0.038	--	--	0.206	0.143	--	--	20.0	5.00	0.08
Copper	1.39	1.17	(c)	(c)	1,300	--	1.39	1.17	--	--	2,660	1,300	1.14
Iron			--	1,000	300(e)	--	--	--	--	--	--	--	154
Lead	3.26	0.127	3.26	0.127		--	3.26	0.13	--	--	--	15.0	0.47
Zinc	12.0	11.0	12.3	12.4	7,400	26,000	12.0	11.0	--	--	16,500	--	12.3

Notes:

(a) Values represent dissolved concentrations for cadmium, copper, lead, zinc, and total concentrations for aluminum and iron.

(b) Underlined values require hardness correction specific to the sample data. The values presented in this table are based on a hardness of 7 mg/L CaCO3.
This value represents 10th percentile of fall sampling data from background stations RC-6 and RC-11 per Water Quality Program Permit Writer's Manual,
Ecology Publication Number 92-109, Revised July 2008.

(c) The Aquatic Life Ambient Freshwater Quality Criteria—Copper 2007 Revision (EPA 2007), was published in the Federal Register on February 22, 2007, but to date there are insufficient data to provide a basis for predicting acute and chronic copper concentrations for Railroad Creek. The Agencies anticipate that additional information will be available to establish cleanup levels at the time of the ROD. Proposed cleanup levels are set at background levels.

(d) Background values determined using data from all years and seasons in a URS database query on 9/1/09 from the following stations: CC-1, Company Creek, HC-1, HC-2, HC-3, HC-4, Holden Creek, RC-6, RC-11, SF Agnes Creek, and Tenmile Creek. Following WAC 173-340-709(2), for lognormally distributed data sets, background was defined as the upper 90th percentile or four times the 50th percentile, whichever was lower. For normally distributed data sets, background was defined as the upper 80th percentile or four times the 50th percentile, whichever was lower. Background datasets were assumed to be lognormally distributed unless it could be demonstrated otherwise. Calculations were performed using MTCAStat.

(e) This value based on secondary MCL (aesthetics). According to the SFS (Table 4, footnote [g]), surface water criteria based on secondary MCLs will not be enforced. Secondary MCLs are not used to develop cleanup levels.

(f) Values shown are lowest values of state or federal Maximum Contaminant Levels (MCLs) or non-zero MCL Goals from Table 6.

(g) Shaded cells identify lowest potential chemical-specific ARAR, *or* background concentration (if higher).

-- Not established or not applicable

Table 5 - Concentrations of Constituents of Concern in Surface Water

Constituents of Concern (ug/L)	Proposed Cleanup Levels	Railroad Creek Upstream from Site RC-6		Railroad Creek Adjacent to Lower West Area-East RC-4		Copper Creek Diversion at Confluence with Railroad Creek CC-D1		Copper Creek at Confluence with Railroad Creek CC-2		Railroad Creek at Downstream Margin of Tailings Pile 3 RC-2		Railroad Creek Downstream from Site at Confluence of Tenmile Creek RC-5		Railroad Creek Mouth at Lake Chelan RC-3	
		Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
Aluminum	152	121	60.0	185	50.0	nd	--	153	30.0	190	96.0	246	120	198	70.0
Cadmium	0.090	0.055	0.080	0.625	0.140	2.57	nd	nd	nd	0.381	0.130	0.580	0.120	0.206	0.100
Copper	1.17	0.920	0.500	34.4	3.90	155	nd	0.397	1.20	16.9	1.40	22.9	1.60	8.82	1.20
Iron	1,000	138	120	117	100	nd	--	84.6	50.0	720	1,180	2,300	1,440	471	440
Lead	0.540	0.256	0.900	0.365	0.400	0.200	nd	0.300	0.300	0.284	0.300	0.314	nd	0.252	0.200
Zinc	11.0	9.13	16.0	67.1	20.0	372	nd	13.0	nd	67.3	30.0	98.0	30.0	36.4	20.0

Notes:

(a) Values of aluminum and iron represent total concentrations.

(b) Values for cadmium, copper, lead, and zinc represent dissolved concentrations.

(c) Data to create this table obtained from URS database query on 09/01/09.

(d) Spring data represent samples collected in May, June, or July; fall data represent all other months.

(e) Consistent with the statistical approach for evaluating compliance with cleanup levels for groundwater presented in WAC 173-340-720(9), concentrations shown represent the upper one-sided 95 percent confidence limit (95 UCL) on the mean constituent concentration. In cases where the 95 UCL exceeds the maximum detected concentration, or where existing data are insufficient to calculate the 95 UCL, the maximum detected constituent concentration is shown. The 95 UCL was calculated using EPA's ProUCL statistical software package, version 4.00.04, using both censored and uncensored data. In order to obtain 95 percent coverage of the mean on some sample sets, ProUCL recommended percentile is greater than 95 percent due to high percentage of non-detects and/or high skewness of data distribution.

(f) Data represent sampling rounds conducted from 1996 through spring of 2009; not all stations were sampled during each round and not all constituents were analyzed during each round.

(g) Shaded cells indicate that value exceeds surface water cleanup levels identified in Table 1.

nd = All sample results were non-detect.

-- Not analyzed

Table 6 - Potential Chemical-Specific ARARs for Groundwater

Constituents of Concern (ug/L)	Federal MCLGs (b)	Federal MCLs (c)	State MCLs (d)	MTCA Method A (e)	MTCA Method B (f)
Aluminum	--	--	--	--	16,000 (g)
Cadmium	5.00	5.00	5.00	5.00	8.00
Copper	1,300	1,300	1,300	--	592
Iron	--	--	--	--	--
Lead	zero	15.0	15.0	15.0	--
Zinc	--	--	--	--	4,800

Notes:

(a) Sufficient data are not available to calculate groundwater background.

(b) Maximum Contaminant Level Goals (MCLGs) for non-carcinogens. Non-zero MCLGs are potentially relevant and appropriate. 40 CFR 141.50 and 141.51 and Drinking Water Standards and Health Advisories Office.

(c) Maximum Contaminant Levels (MCLs). 40 CFR 141.62 and Drinking Water Standards and Health Advisories, Office of Water, US EPA, EPA 822-B-00-001, Summer 2000.

(d) WAC 246-290-310. State of Washington Primary MCLs.

(e) WAC 173-340-900, Table 720-1. MTCA Method A.

(f) WAC 173-340-720. MTCA Method B Groundwater cleanup levels. For carcinogenic constituents, the value presented is the lower of the non-carcinogenic and carcinogenic level calculated using Equations 720-1 and 720-2. Information from CLARC 3.1 was used unless otherwise noted.

(g) Calculated using reference dose (RfD) from EPA Region 9 Preliminary Remediation Goals table, October 2004.

(h) Shaded cells identify lowest potential chemical-specific ARAR.

-- Not established or not applicable.

Table 7 - Concentrations of Constituents of Concern in Groundwater

Constituents of Concern (ug/L)	Proposed Cleanup Levels	Monitoring Wells/Seeps	Honeymoon Heights Waste Rock Piles		Mine Portal		Combined Lower West Area		East and West Waste Rock Piles (including Mill Building Area)		Tailings Pile 1	
			Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
			A-1, SP-12, SP-14, SP-23	SP-14, SP-23	P-5	P-5	MW-1, MW-2, MW-3, MW-4, MW-4D, MW-4S, SP-9, SP-11, HBKG-1, SP-10, SP-16, SP-22, SP-24, SP-25	MW-1, MW-3, MW-4D, MW-4S, SP-16, HBKG-1	SP-15, SP-28, SP-6, SP-7, SP-8	SP-7, SP-15	CC-1D, CC-1S, PW-1, SP-1, SP-19, SP-2, TP1-1A, TP1-1D, TP1-2A, TP1-2D, TP1-4A, TP1-4B, TP1-5A, TP1-6A	SP-2, TP1-1A, TP1-1D, TP1-2A, TP1-2D, TP1-3A, TP1-4A, TP1-5A, TP1-6A
Aluminum	152		16,800	4,580	6,070	nd	5,140	1,290	6,890	1,790	61,600	43,500
Cadmium	0.090		38.3	22.4	48.5	8.00	32.6	35.1	73.4	63.0	32.3	11.7
Copper	1.17		7,370	4,600	2,960	28.0	2,860	2,140	5,690	7,560	944	179
Iron	1,000		130	480	202	nd	3,670	2,810	196	710	918,000	836,000
Lead	0.540		7.25	8.92	28.2	1.00	7.11	8.00	8.27	13.0	3.07	nd
Zinc	11.0		4,800	2,530	8,840	2,980	4,720	4,900	9,270	8,960	4,941	5,500

Table 7 (continued) - Concentrations of Constituents of Potential Concern in Groundwater

Constituents of Concern (ug/L)			Tailings Pile 2		Tailings Pile 3		Downstream From Tailings Pile 3	
			Spring	Fall	Spring	Fall	Spring	Fall
	Proposed Cleanup Levels	Monitoring Wells/Seeps	PZ-1A, PZ-1B, PZ-3A, SP-3, SP-4, TP2-04A, TP2-07A, TP2-08A, TP2-11A, TP2-11B, TP2-1D, TP2-4A, TP2-4B, TP2-5A, TP2-8A, TP2-8B	PZ-1B, PZ-2A, PZ-3A, SP-3, TP2-11A, TP2-1D, TP2-4A, TP2-8A	PZ-6A, SP-17, SP-18, SP-5, TP3-10, TP3-11, TP3-4, TP3-6A, TP3-8, TP3-9	PZ-4B, PZ-5A, PZ-6A, TP3-10A, TP3-6A, TP3-8, TP3-9	DS-1, DS-10, DS-2, DS-3D, DS-3S, DS-4D, DS-4S, DS-5, DS-6D, DS-6S, DS-7D, DS-7S, DS-8S, DS-9D, DS-9I, DS-9S, NRC-3D, NRC-3I, NRC-3S, SP-21	DS-1, DS-2, DS-3D, DS-3S, DS-4D, DS-4S, DS-5, DS-6D, DS-6S, DS-7D, DS-7S, NRC-3D, NRC-3I, NRC-3S, SP-21
Aluminum	152		804,000	3,960	17,300	6,760	3,040	14,300
Cadmium	0.090		2,030	3.08	11.3	3.73	0.915	0.940
Copper	1.17		4,050	24.9	465	29.1	24.9	64.2
Iron	1,000		741,000	146,000	83,700	198,000	781	16,700
Lead	0.540		42.3	52.0	37.8	66.7	0.212	nd
Zinc	11.0		510,000	294	823	278	131	167

Notes:

Groundwater includes data from monitoring wells, springs/seeps, and mine portal drainage. Sampling stations for each area and season are listed.

(a) Values represent dissolved concentrations.

(b) Data to create this table obtained from URS database query on 09/01/09.

(c) Spring data represents samples collected in May, June, or July; fall data represents all other months.

(d) Consistent with the statistical approach for evaluating compliance with cleanup levels for groundwater presented in WAC 173-340-720(9), concentrations shown represent the upper one-sided 95 percent confidence limit (95 UCL) on the mean constituent concentration. In cases where the 95 UCL exceeds the maximum detected concentration, or where existing data are insufficient to calculate the 95 UCL, the maximum detected constituent concentration is shown. The 95 UCL was calculated using EPA's ProUCL statistical software package, version 4.00.04, using both censored and uncensored data. In order to obtain 95 percent coverage of the mean on some sample sets, ProUCL recommended percentile is greater than 95 percent due to high percentage of non-detects and/or high skewness of data distribution.

(e) Data represent sampling rounds conducted from 1996 through spring of 2009; not all stations were sampled during each round and not all constituents were analyzed during each round.

(f) Shaded cells indicate that value exceeds groundwater cleanup levels identified in Table 1.

nd = All sample results were non-detect.

-- Not analyzed.

Table 8 - Potential Chemical-Specific ARARs and Background Concentrations for Soil

Constituents of Concern (mg/kg)	Human Health-Based Levels				Site-Specific Background Concentrations (g)	
	MTCA Method A Soil Cleanup Levels (a)	MTCA Method B Soil Cleanup Levels				
		Soil Ingestion (b)	Soil Ingestion and Dermal Contact (b)	Groundwater Protection (c)	Mixed Conifer Background Area (BGMC)	Riparian Background Area (BGR)
Aluminum	--	--	--	--	18,200	17,600
Arsenic	20.0	0.670	0.620	0.034	4.80	16.0
Barium	--	5,600	5,000	925	164	133
Cadmium	2	80.0	74.0	0.69	3.30	1.80
Chromium (f)	2,000	120,000	110,000	2,000	24.0	38.0
Copper	--	2,960	2,700	260	45.0	110
Lead	250	--	--	3,000	14.0	25.0
Mercury	2	24.0	18.0	2.1	0.930	0.430
Molybdenum	--	400	360	--	8.80	2.90
Selenium	--	400	360	5.3	12.0	1.40
Silver	--	400	360	13.7	0.650	0.600
Thallium	--	5.60	5.00	1.6	0.360	0.130
Zinc	--	24,000	22,000	6,000	136	177
Gasoline-Range Hydrocarbons	30.0/100 (d)	--	--	30/100 (d)	--	--
Diesel-Range Hydrocarbons	2,000	--	--	2,000	--	--
Heavy Oil-Range Hydrocarbons	2,000	--	--	2,000	--	--

Notes:

(a) WAC 173-340-740(2), WAC 173-340-900 (Table 740-1). Model Toxics Control Act (MTCA) Method A.

(b) WAC 173-340-740(3). MTCA Method B unrestricted land use soil cleanup standards. The values presented are from Table 8 of the SFS and represent the lower of the non-carcinogenic and carcinogenic level calculated using Equations 740-1 and 740-2 for ingestion only and Equations 740-4 and 740-5 for ingestion and dermal contact.

(c) WAC 173-340-747 provides for the derivation of soil concentrations for groundwater protection that may be used to establish Method B soil cleanup levels. These values are from Table 8 of the SFS, except for gasoline-, diesel- and heavy oil-range hydrocarbons, which are from WAC 173-340-900, Table 740-1. As described in Section 2.4 of the SFS, these values would not form the basis of proposed cleanup levels at the Site, in accordance with WAC 173-340-740(6)(f).

(d) 100 mg/kg is applicable when no benzene is present in soil and the total of BTEX is less than 1 percent of the gasoline mixture, otherwise 30 mg/kg is applicable.

(e) Based on total PCBs.

(f) Regulatory values for chromium based on total or trivalent form. Background concentrations based on total chromium.

(g) Site-specific background soil concentrations from draft TEE. BGR values are applicable to soils in Lower West Area (East & West), Lagoon, and Areas Downslope of Honeymoon Heights. BGMC values are applicable to all other areas.

-- Not established or not applicable

Table 9 - Ecological Risk-Based Soil Concentrations Protective of Terrestrial Receptors

Constituents of Concern (mg/kg)	Tailings Piles 1, 2, & 3	East & West Waste Rock Piles	Honeymoon Heights Waste Rock Piles	Ballfield Area	Holden Village	Windblown Tailings Area	Area Downslope from Honeymoon Heights	Lower West Area East	Lower West Area West	Lagoon	Maintenance Yard	Surface Water Retention Area	Site Specific Background Concentrations	
													Mixed Conifer Background Area (BGMC) (f)	Riparian Background Area (BGR) (f)
Aluminum	4,369	69	69	4,600	4,571	4,666	4,822	4,694	4,767	50 (c)	50 (c)	50 (c)	18,200	17,600
Arsenic	18 (a)	18 (a)	18 (a)	18 (a)	18 (a)	18 (a)	18 (a)	18 (a)	18 (a)	18 (a)	18 (a)	18 (a)	4.80	16.0
Barium	330 (b)	102	102	227	131	232	106	122	49	102 (e)	102 (e)	102 (e)	164	133
Cadmium	5.5	14	14	8	16	9	14	12	5	14 (e)	14 (e)	14 (e)	3.30	1.80
Chromium	29	29	29	29	29	42 (c)	29	29	29	42 (c)	42 (c)	42 (c)	24.0	38.0
Copper	85	46	46	46	112	85	288	39	24	70 (a)	70 (a)	70 (a)	45.0	110
Lead	161	118	118	201	124	139	201	121	201	118 (e)	118 (e)	118 (e)	14.0	25.0
Mercury	0.1 (d)	0.1 (d)	0.1 (d)	0.1 (d)	0.1 (d)	0.1 (d)	0.1 (d)	0.1 (d)	0.1 (d)	0.1 (d)	0.1 (d)	0.1 (d)	0.930	0.430
Molybdenum	18.6	2.3	2.3	0.3	0.7	6	5.5	1.2	0.8	2 (c)	2 (c)	2 (c)	8.80	2.90
Selenium	0.5 (a)	0.31	0.31	0.44	0.5 (a)	0.5 (a)	0.5 (a)	0.5 (a)	0.5 (a)	0.3 (e)	0.3 (e)	0.3 (e)	12.0	1.40
Silver	18.5	3.9	3.9	16.5	3.9	11.9	3.9	8.5	3.9	560 (a)	560 (a)	560 (a)	0.650	0.600
Thallium	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1 (c)	1 (c)	1 (c)	0.360	0.130
Zinc	120 (b)	120 (b)	120 (b)	120 (b)	120 (b)	120 (b)	120 (b)	120 (b)	120 (b)	120 (b)	120 (b)	120 (b)	136	177
TPH-Gasoline	100 (d)	100 (d)	100 (d)	100 (d)	100 (d)	100 (d)	100 (d)	100 (d)	100 (d)	100 (d)	100 (d)	100 (d)	--	--
TPH-Diesel	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	--	--
TPH-Heavy Oil	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	200 (d)	--	--

Notes:

See Appendix E for development of terrestrial risk-based values.

Values derived using literature-based TRVs and site-specific bioconcentration factors, except where footnoted (See Section 2.4.1 and Appendix E).

(a) Value based on EPA Eco-SSL plant value.

(b) Value based on EPA Eco-SSL invertebrate value.

(c) Value based on MTCA plant EISC (WAC 173-340, Table 749-3)

(d) Value based on MTCA invertebrate EISC (WAC 173-340, Table 749-3).

(e) Value based on MTCA wildlife EISC (WAC 173-340, Table 749-3).

(f) Site-specific background soil concentrations from draft TEE. BGR values are applicable to soils in Lower West Area (East and West), Lagoon, and Areas Downslope of Honeymoon Heights. BGMC values are applicable to all other areas.

Table 10 - Concentrations of Constituents of Concern in Soil

Constituents of Concern (mg/kg)	Tailings Piles 1, 2, & 3	East & West Waste Rock Piles	Honeymoon Heights Waste Rock Piles	Ballfield Area	Holden Village	Windblown Tailings Area	Area Downslope from Honeymoon Heights	Lower West Area East	Lower West Area West	Lagoon	Maintenance Yard	Surface Water Retention Area
Aluminum	15,900	16,400	18,100	17,900	20,300	15,700	18,400	20,100	16,300	33,500	23,900	20,200
Arsenic	--	--	--	--	--	--	20.0	20.0	26.0	5.00	60.0	--
Barium	459	409	344	82.0	185	192	238	352	66.0	343	717	660
Cadmium	19.5	4.77	3.00	1.40	1.60	0.690	5.30	130	1.70	184	21.6	8.03
Chromium	14.7	56.9	17.0	26.0	32.0	18.0	21.0	24.0	26.0	21.0	33.0	26.9
Copper	865	1,350	1,450	72.0	260	118	1,680	6,230	80.0	24,100	3,160	1,980
Lead	65.1	224	1,910	16.0	52.0	37.0	77.0	644	13.0	746	1,070	141
Mercury	0.303	0.499	3.40	0.320	0.042	0.310	1.90	1.10	0.320	--	--	0.530
Molybdenum	20.0	17.0	22.0	2.30	2.90	19.0	17.0	53.0	2.20	74.0	16.0	21.1
Selenium	6.64	4.67	6.90	0.450	0.780	1.90	2.40	10.0	0.360	--	--	6.83
Silver	3.59	3.25	8.20	0.720	0.860	1.30	3.30	11.0	0.700	27.0	5.00	7.31
Thallium	0.810	0.631	1.50	0.300	0.160	0.240	0.730	0.970	0.100	3.00	nd	1.20
Zinc	2,070	934	522	155	225	138	1,010	17,300	132	23,700	3,240	736
Gasoline-Range Hydrocarbons	--	--	--	--	--	--	--	--	--	nd	1,200	--
Diesel-Range Hydrocarbons	--	--	--	--	--	--	--	--	--	917	12,000	--
Heavy Oil-Range Hydrocarbons	--	--	--	--	--	--	--	--	--	1,120	9,800	--

Notes:
-- Not analyzed
nd = All sample results were non-detect.

(a) Data to create this table obtained from Appendix A of the draft TEE (ERM 2009) except for petroleum hydrocarbon data for the Lagoon and Maintenance Yard which is from URS database query dated 09/01/09.

(b) Consistent with the statistical approach for evaluating compliance with cleanup levels for soil presented in WAC 173-340-740(7), concentrations shown represent the upper one-sided 95 percent confidence limit (95 UCL) on the mean constituent concentration. In cases where the 95 UCL exceeds the maximum detected concentration, or where existing data are insufficient to calculate the 95 UCL, the maximum detected constituent concentration is shown. The 95 UCL was calculated using EPA's ProUCL statistical software package, version 4.00.04, using both censored and uncensored data.

(c) No soil data are available for the Former Mill Building area.

(d) Shaded cells indicate concentrations exceed proposed cleanup levels (See Table 1). Non-shaded cells indicate concentrations that do not exceed proposed cleanup levels or analyte is not a constituent of concern for particular area.

Table 11 - Potential To Be Considered Chemical-Specific Criteria for Sediments

Constituent (mg/kg)	Northwest Regional Sediment Evaluation Framework (d, e)		Literature Sediment Quality Values
	SL1	SL2	
Aluminum	--	--	58,000 (a)
Beryllium	--	--	--
Arsenic	20.0	51.0	--
Cadmium	1.10	1.50	--
Chromium	95.0	100	--
Copper	80.0	830	--
Iron	--	--	40,000 (b)
Lead	340	430	--
Manganese	--	--	1,800 (c)
Mercury	0.280	0.750	--
Nickel	60.0	70.0	--
Silver	2.00	2.50	--
Zinc	130	400	--

Notes:

-- Not established or not applicable.

Shaded cells identify lowest potential TBC.

(a) Ingersoll et al., 1996.

(b) Persaud et al., 1993.

(c) Cubbage et al., 1997.

(d) US Army Corps of Engineers et al., 2006.

(e) Interim freshwater sediment quality guidelines. Lower screening level (SL1) corresponds to a concentration below which adverse effects to benthic organisms would not be expected. Upper screening level (SL2) corresponds to a concentration at which minor adverse effects may be observed in the more sensitive groups of benthic organisms.

Table 12 - Concentrations of Constituents of Concern in Sediments

Constiuents of Concern (mg/kg)	Railroad Creek Sediment Stations																Range of Concentrations in Lucerne Bar Sediments
	355	356	367	RC-1	347	BKG 1/2	350	RC-2	345	DG-1	351	352	353	MP-7	354	RC-3	
Aluminum	86,000	87,000	78,000	10,400	83,000	11,300	34,000	8,540	78,000	9,380	89,000	75,000	88,000	13,300	76,000	7,890	9,400 to 19,000
Beryllium	1.0	1.0	1.0		1.0	0.08	1 U		1.0	0.07	1.0	1.0	1.0		1.0		--
Cadmium	0.5	0.09	2.0	nd	2.0	0.9	nd	nd	0.6	1.1	0.06	0.5	nd	0.9	0.6	0.5	0.4 to 3.9
Chromium	79	36	97		85	17	18		70	4.4	44	93	52		74		--
Copper	74	12	37	29	240	77	200	101	140	184	26	130	13	147	150	59	46 to 308
Iron	63,000	47,000	99,000	15,700	71,000	17,000	150,000	19,000	50,000	20,600	66,000	71,000	40,000	26,300	60,000	14,800	15,400 to 52,800
Silver	nd	nd	nd		nd	0.64	1.2		0.17	0.73	0.067	0.11	0.45		0.01		--
Zinc	180	110	130	62	270	110	250	113	280	126	110	230	82	216	330	144	131 to 580

Notes:
(a) Values are from Table 11 in SFS.
(b) Shaded cells indicate concentrations exceed proposed cleanup levels (See Table 1).
-- indicates constituent was not analyzed in the sample.
nd = Non-detect

Table 13 - Proposed Points of Compliance

Media	Proposed Points of Compliance (a)
Soil	Under MTCA, soil cleanup levels and points of compliance are established separately for human exposure via direct contact, the protection of groundwater, and the protection of terrestrial ecological receptors [WAC 173-340-740]. The MTCA point of compliance for soil based on human exposure via direct contact is from the surface of the soil to 15 feet below the ground surface. However, capping and/or institutional controls will be established at various locations at the Site to prohibit excavation and other activities to eliminate the direct contact exposure pathway for humans. For the terrestrial receptors, a point of compliance for soils will be established based on risk to terrestrial ecological receptors. This point of compliance will be the biologically active zone, which is assumed to extend to a depth of 6 feet, or a site-specific depth based on a demonstration that an alternative depth is appropriate per WAC 173-340-7490(4)(a). Soil cleanup to protect downgradient groundwater, surface water, and sediment is required wherever soils exceed criteria and are not within a groundwater containment area [WAC 173-340-740(1)(d)].
Surface Water	The point of compliance for surface water cleanup levels is the point or points where the release enters the surface waters, unless Ecology has authorized a mixing zone [WAC 173-340-730(6)]. MTCA does not allow a mixing zone for groundwater discharges into surface water [WAC 173-340-720(8)(d)(i)(C)].
Groundwater	CERCLA and the NCP provide that groundwater should be returned to its beneficial use within a reasonable timeframe whenever practicable. When restoration of groundwater is not practicable, it is necessary to prevent further migration of the plume and to prevent exposure to the contaminated groundwater [40 CFR 300.430(a)(2)]. The NCP provides that groundwater cleanup levels should generally be attained throughout the contaminated plume. However, the NCP recognizes that groundwater may remain contaminated within a waste management area, and groundwater cleanup levels attained at and beyond the edge of the waste management area (55 Fed Reg 8712, 8753, March 8, 1990). MTCA requires the point of compliance for groundwater be throughout the Site, from the uppermost level of the saturated zone to the lowest depth that could potentially be affected. MTCA requires that groundwater cleanup levels be attained in all groundwater from the point of compliance to the outer boundary of the hazardous substance plume [WAC 173-340-720(8)]. MTCA allows a conditional point of compliance for groundwater for limited circumstances where it is not practicable to meet the cleanup level throughout the site within a reasonable restoration time frame (see note b). MTCA requires that the conditional point of compliance shall be as close as practicable to the source, and may be in surface water as close as technically possible to the point(s) where groundwater flows into the streams all across the Site. MTCA does not allow a mixing zone for groundwater discharges into surface water [WAC 173-340-720(8)(d)(i)(C)].

Notes:
(a) Points of compliance refer to the locations at the Site where proposed cleanup levels must be met.
(b) The DFFS found that it is not practicable to meet the proposed groundwater cleanup levels throughout the Site within a reasonable restoration time frame.

Table 14 - Terrestrial Ecological Hazard Quotients for Soil

Constituents of Concern	Receptor	Tailings Piles 1, 2, & 3	East & West Waste Rock Piles	Honeymoon Heights Waste Rock Piles	Ballfield Area	Holden Village	Windblown Tailings Area	Area Downslope from Honeymoon Heights	Lower West Area East	Lower West Area West	Lagoon	Maintenance Yard	Surface Water Retention Area
Aluminum	Plants					3		3	3		650	500	400
	Invertebrates					-		-	-		-	-	-
	Wildlife					4		4	4		-	-	-
Arsenic	Plants							1	1	1		3	
	Invertebrates							0.3	0.3	0.4		1	
	Wildlife							0.2	0.3	0.1		0.5	
Barium	Plants	1	1	1		0.4	0.4	0.5	1		1	1	1
	Invertebrates	1	1	1		1	1	1	1		1	2	2
	Wildlife	1	4	3		1	1	2	3		3	7	6
Cadmium	Plants	1	0.1					0.2	4		6	1	0.3
	Invertebrates	0.1	0.03					0.04	1		1	0.2	0.1
	Wildlife	4	0.3					0.4	10		10	2	1
Chromium	Plants		1		1	1						1	1
	Invertebrates		1		1	1						1	1
	Wildlife		2		1	1						0.5	0.4
Copper	Plants	8	2	3	1	2	1	6	200		300	50	30
	Invertebrates	10	30	30	2	2	1	6	50		300	40	30
	Wildlife	4	6	7	0.4	1	1	5	70		100	20	9
Lead	Plants	0.1	0.03	4	0.002	0.1	0.1	0.01	1		7	9	1
	Invertebrates	0.1	2	20	0.01	0.05	0.02	0.02	0.3		0.5	1	0.1
	Wildlife	0.4	2	20	0.1	0.4	0.3	0.4	5		7	9	1
Mercury	Plants			1				1	0				
	Invertebrates			30				20	10				
	Wildlife			1				0	0				
Molybdenum	Plants	1	7	10			3	3	40		40	8	
	Invertebrates	-	-	-			-	-	-		-	-	
	Wildlife	0.4	2	3			1	1	10		10	2	
Selenium	Plants							5	20				
	Invertebrates							1	2				
	Wildlife							1	6				
Silver	Plants	0.006	0.006	0.015	0.001	0.002	0.002	0.006	0.02	0.001	0.05	0.009	0.01
	Invertebrates	-	-	-	-	-	-	-	-	-	-	-	-
	Wildlife	0.2	1	2	0.04	0.2	0.1	1	1	0.2	-	-	-
Thallium	Plants	0.07	0.06	0.14				0.1	0.1		3		1
	Invertebrates	-	-	-				-	-		-		-
	Wildlife	40	60	200				70	100		-		-
Zinc	Plants	10	6	3	1	1	1	6	100		100	20	5
	Invertebrates	20	8	4	1	2	1	8	100		200	30	6
	Wildlife	5	3	1	0.3	1	0.4	1	50		70	9	2
TPH-Gasoline	Plants											-	
	Invertebrates											10	
	Wildlife										-	0.2	
TPH-Diesel	Plants										-	-	
	Invertebrates										5	60	
	Wildlife										0.2	2	
TPH-Heavy Oil	Plants										-	-	
	Invertebrates										6	50	
	Wildlife										0.2	2	

Notes:
Blank cells indicate that EPC of constituent is less than background value and/or is not a constituent of concern for the particular area of interest; HQ not calculated.
– No ecological screening level available for this receptor.
(a) Shaded cells indicate hazard quotient is greater than 1. Hazard quotients (HQs) were calculated by dividing constituent concentrations (see Table 10) by levels considered protective of terrestrial ecological receptor (see Appendix E). HQs are reported to one significant figure as suggested by EPA (2004).

Table 15 - Summary Comparison of Alternatives 11M, 13M, and 14[1]

Alternative 11M	Alternative 13M	Alternative 14
Groundwater Containment and Collection for Treatment		
Use fully penetrating barrier for containment and collection for treatment all groundwater below WMAs: a) the Lower West area and Tailings Pile 1: and b) Tailings Piles 2 and 3.	Use fully penetrating barrier for containment and collection for treatment all groundwater below the Lower West area and Tailings Pile 1. Collect for treatment a portion of groundwater below Tailings Pile 2 that flows into the former Railroad Creek Channel. No containment or collection for treatment of the remainder of impacted groundwater below Tailings Pile 2 or Tailing Pile 3, except as part of an unspecified future contingent action.	Use fully penetrating barrier for containment and collection for treatment all groundwater below WMAs: a) the Lower West area and Tailings Pile 1; and b) Tailings Piles 2 and 3. The groundwater containment barrier around Tailings Pile 2 and Tailings Pile 3 could be modified or may not need to be constructed if Intalco can demonstrate that contaminated groundwater will remain contained within the WMA and that an alternative approach, such as monitored natural attenuation, is effective at reducing groundwater concentrations to below proposed cleanup levels at the point(s) where groundwater discharges to Railroad Creek.
Railroad Creek		
Remove ferricrete, enhance existing rip rap, and monitor sediment quality over time.	Realign a portion of the channel to the north to avoid having to move the toe of the tailings piles, thus isolating ferricrete in the former channel. Use the former channel to be used for collection or conveyance of groundwater to treatment.	Similar to or the same as Alternative 13M. The extent of realignment may be extended farther west to avoid the need to move the toe of Tailings Pile 1.

[1] Summary does not include institutional controls which are similar for all alternatives.

Alternative 11M	Alternative 13M	Alternative 14
Copper Creek		
Modify channel to improve resistance to erosion and scour.	Modify channel to improve resistance to erosion and scour, and extend to intersect relocated Railroad Creek channel.	Similar to or the same as Alternative 13M.
Copper Creek Diversion		
Replace existing hydroelectric outfall channel with lined channel or culvert to Railroad Creek to avoid contact with tailings.	Similar to or the same as Alternative 11M.	Similar to or the same as Alternative 11M.
Wetland East of Tailings Pile 3		
Wetlands could be restored following elimination of groundwater impacts from Tailings Pile 3.	Wetlands would become the site of a new groundwater treatment system, than would require mitigation under various ARARs.	Similar to or the same as Alternative 13M.
Tailings Piles 1, 2, and 3		
Close and cap in accordance with the presumptive requirements of Limited Purpose Landfill regulations and other ARARs. Regrade all slopes for stability, including moving toe of slope away from Railroad and Copper Creeks as needed for construction of: ■ Groundwater barrier; ■ Groundwater collection trench; ■ Maintenance access road; and ■ Toe buttress. Cap (2-feet of soil with geomembrane assumed for cost estimating). Cap would require long-term maintenance to protect integrity of membrane.	Close and cap in accordance with the performance requirements of Limited Purpose Landfill regulations. Regrade north-facing slopes for stability, including construction of a toe buttress. Relocate Railroad Creek to avoid moving toe of slope adjacent to creek. Cap (6 to 12-inches of soil, gravel, slash, and/or amended tailings), and revegetated.	Close and cap in accordance with the performance requirements of Limited Purpose Landfill regulations and other ARARs. Regrade all slopes for stability, including moving toe of slope away from Copper Creek as needed for construction of: ■ Groundwater barrier; ■ Groundwater collection trench; ■ Maintenance access road; and ■ Toe buttress. Cap (2-feet of soil assumed for cost estimating) and revegetate.

Alternative 11M	Alternative 13M	Alternative 14
Tailings Piles 1, 2, and 3 (Continued)		
Construct upgradient diversion swale/french drain to divert stormwater run-on. Limited purpose landfill on top for sludge.	Construct upgradient diversion swale/french drain to divert stormwater run-on. Limited purpose landfill on top for sludge.	Construct upgradient diversion swale/french drain to divert stormwater run-on. Limited purpose landfill on top for sludge.
East and West Waste Rock Piles		
Close and cap in accordance with the presumptive requirements of Limited Purpose Landfill regs and other ARARs. Regrade slopes for stability. Excess waste rock would be placed on top of piles or relocated to tailings piles. Cap (2-feet of soil with geomembrane assumed for cost estimating). Cap would require long-term maintenance to protect integrity of membrane. Construct upgradient diversion swale/french drain to divert stormwater run-on.	Close and cap in accordance with the performance requirements of Limited Purpose Landfill regs. Regrade slopes for stability. Excess waste rock would be relocated to former mill building site or tailings piles. Cap with 6- to 12-inches of soil and revegetate. Construct upgradient diversion swale/french drain to divert stormwater run-on.	Close and cap in accordance with the performance requirements of Limited Purpose Landfill regs and other ARARs. Regrade slopes for stability. Excess waste rock would be placed on top of piles or relocated to tailings piles. Cap (2-feet of soil assumed for cost estimating) and revegetate. Construct upgradient diversion swale/french drain to divert stormwater run-on.
Honey Moon Heights Waste Rock Piles		
Remove waste rock for consolidation into tailings piles prior to capping. Collect and treat seeps SP-12 and SP-23 downslope of waste rock piles. Monitor groundwater to determine if additional groundwater collection for treatment is needed.	No action on waste rock piles. Collect and treat seeps SP-12 and SP-23 downslope of waste rock piles.	Use *in situ* treatment to raise pH to reduce mobility and bioavailability of hazardous substances. Collect and treat seeps SP-12 and SP-23 downslope of waste rock piles. Monitor groundwater to determine if additional groundwater collection for treatment is needed.
Impacted Areas Downslope of HHWRP		
Remove impacted soils and consolidate into tailings piles prior to capping.	No action.	Use *in situ* treatment to raise pH to reduce mobility and bioavailability of hazardous substances.

Alternative 11M	Alternative 13M	Alternative 14
Ballfield Area		
Remove impacted soils from areas with low habitat value and consolidate into tailings piles prior to capping. Use *in situ* treatment to raise pH to reduce mobility and bioavailability of hazardous substances.	No action.	Similar to or the same as Alternative 11M.
Holden Village		
Use *in situ* treatment to raise pH to reduce mobility and bioavailability of hazardous substances.	No action.	Similar to or the same as Alternative 11M.
Lower West Area		
Remove impacted soils from areas with low habitat value and consolidate into tailings piles prior to capping. Use *in situ* treatment to raise pH to reduce mobility and bioavailability of hazardous substances.	No action.	Similar to or the same as Alternative 11M.
Lagoon Area		
Remove impacted soils and consolidate into tailings piles prior to capping, and backfill excavation.	Remove impacted soils and consolidate into tailings piles prior to capping. Incorporate excavation into groundwater treatment facility.	Similar to or the same as Alternative 13M.
Windblown Tailings Area		
Use *in situ* treatment to raise pH to reduce mobility and bioavailability of hazardous substances.	Remove (or cap) impacted soils in area of creek realignment. No action in remainder of area.	Remove impacted soils in area of creek realignment. Use *in situ* treatment to raise pH to reduce mobility and bioavailability of hazardous substances.
Maintenance Yard		
Cap with concrete or asphalt paving.	Cap with concrete or an impermeable liner & gravel	Cap with concrete or asphalt paving.

Alternative 11M	Alternative 13M	Alternative 14
Former Mill Building		
Demolish building as needed to remove soils and processing residuals for consolidation in Tailings Piles prior to capping. The disturbed area would be stabilized to prevent long-term erosion, and revegetated. Construct upgradient diversion swale/french drain to divert stormwater run-on.	Demolish building superstructure. Remove contaminated materials and/or cap with waste rock and 6-inches of soil, and revegetate. Construct upgradient diversion swale/french drain to divert stormwater run-on.	Demolish building as needed to remove soils and processing residuals for consolidation in Tailings Piles prior to capping. The disturbed area would be stabilized to prevent long-term erosion, and revegetated. Construct upgradient diversion swale/french drain to divert stormwater run-on.
Ventilator Portal Surface Water Retention Area		
Remove impacted soils and consolidate into tailings piles prior to capping, and backfill excavation.	Similar to or the same as Alternative 11M.	Similar to or the same as Alternative 11M.
Groundwater Treatment Facilities		
Single treatment facility located north of Railroad creek and east of tailings Pile 3 would rely on mechanical pumping influent. Treatment accomplished by pH adjustment and sedimentation, subject to enhancement based on treatability and performance testing.	Two treatment systems, one in Lower West Area and the other east of Tailings Pile 3 and south of Railroad creek, both rely on gravity flow. Treatment accomplished by pH adjustment and sedimentation, subject to enhancement based on treatability and performance testing.	Similar to or the same as Alternative 13M.

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Table 16 - Anticipated Sequence of Events for Implementing the Preferred Alternative

Remedy Implementation Components *	Notes
Prepare and implement baseline monitoring plan	
Prepare Record of Decision (ROD) and Consent Decree or Unilateral Order	
Design and preparation of construction plans and specifications	
Possible early actions (otherwise included within Phase I)	• Pilot tests for treating impacted groundwater; • Investigating the feasibility of constructing hydraulic bulkheads in the mine; • Construction of the mine bulkheads; • Treatment system preparation; and/or • Infrastructure improvements
Phase I remedial actions (see ASFS for complete description)	• Diversion trenches upgradient of the tailings piles; • Regrading and capping the tailings and waste rock piles; • Containment, collection, and treatment of groundwater in the Lower West Area and below Tailings Pile 1; • Collection and treatment of groundwater northwest of Tailings Pile 2; • Collect and treat mine portal drainage; • Perform source removal actions and consolidate waste into tailings pile; and • Railroad Creek and Copper Creek improvements and diversions.
Performance Monitoring of Phase I & Potential Decision to Modify Design or not install Barrier Wall for Tailings Piles 2 and 3 groundwater containment.	• Intalco may present alternative innovative design and/or justification for elimination of the Tailings Pile 2 and 3 groundwater containment system.
Possible Phase II remedial actions	• Containment, collection, and treatment, of groundwater below Tailings Piles 2 and 3
Possible additional follow-up actions	• pH adjustment of soils (repeated lime applications)
* Refer to the Proposed Plan for additional information on remedial actions.	

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FIGURES

Site Location and Project Vicinity Map

4769l5PP-AA.cdr EAL 06/08/10

Note: Base map prepared from Microsoft Streets and Trips 2005.

WASHINGTON

N

0 7.5 15

Approximate Scale in Miles

HARTCROWSER

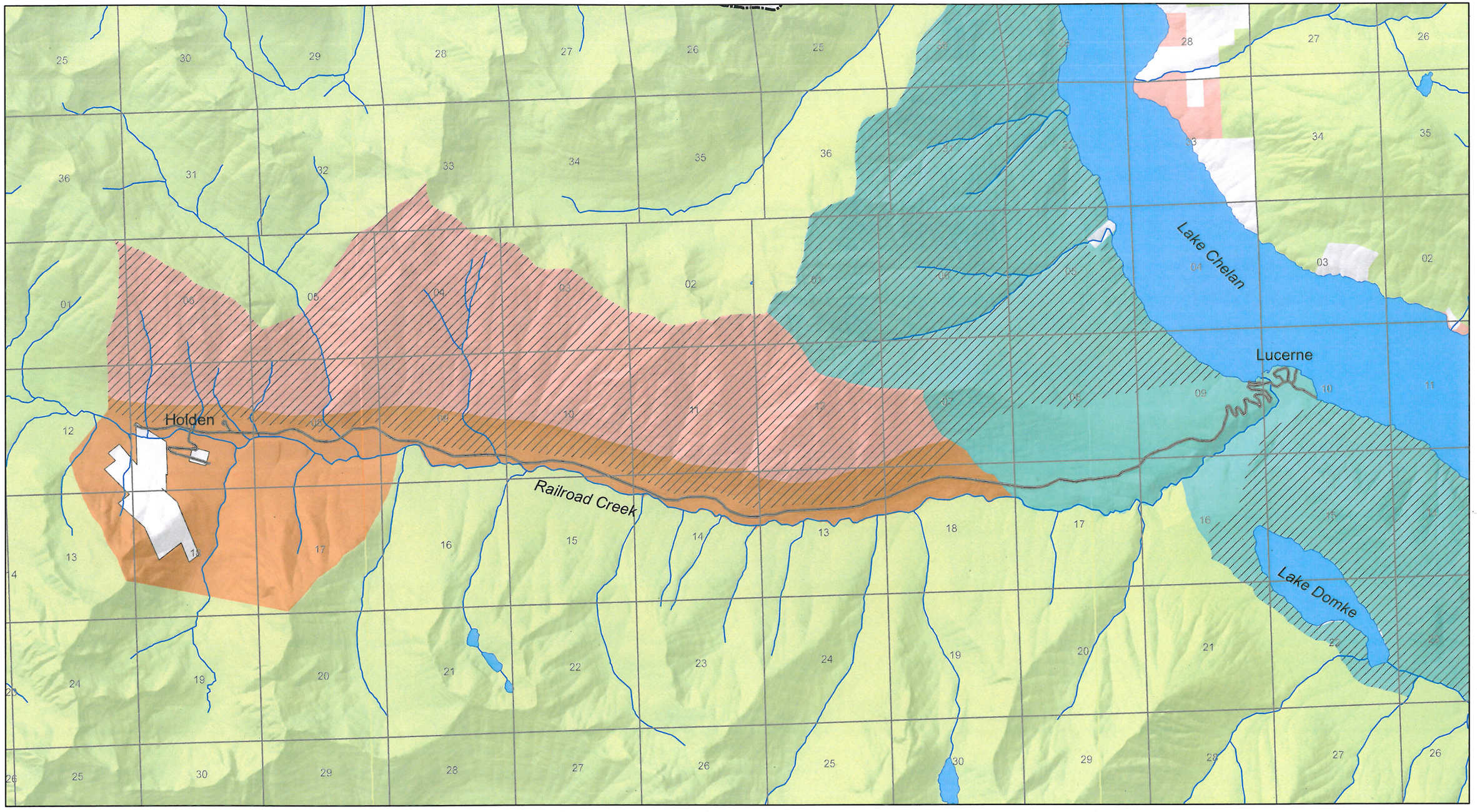
4769-15 ***6/10***

Figure 1

Proposed Plan

Land Use Map

Northwest Forest Plan Allocations for Holden Mine Area



476915PP-AB.mxd EAL 03/30/10

- Administratively Withdrawn
- Congressionally Withdrawn (Glacier Peak Wilderness Area)
- Late Successional Reserve (LSR)
- Matrix
- Private and Other (Including Patented Mining Claims)
- Roadless Area

Note: Matrix area includes other areas administratively withdrawn from mineral entry.

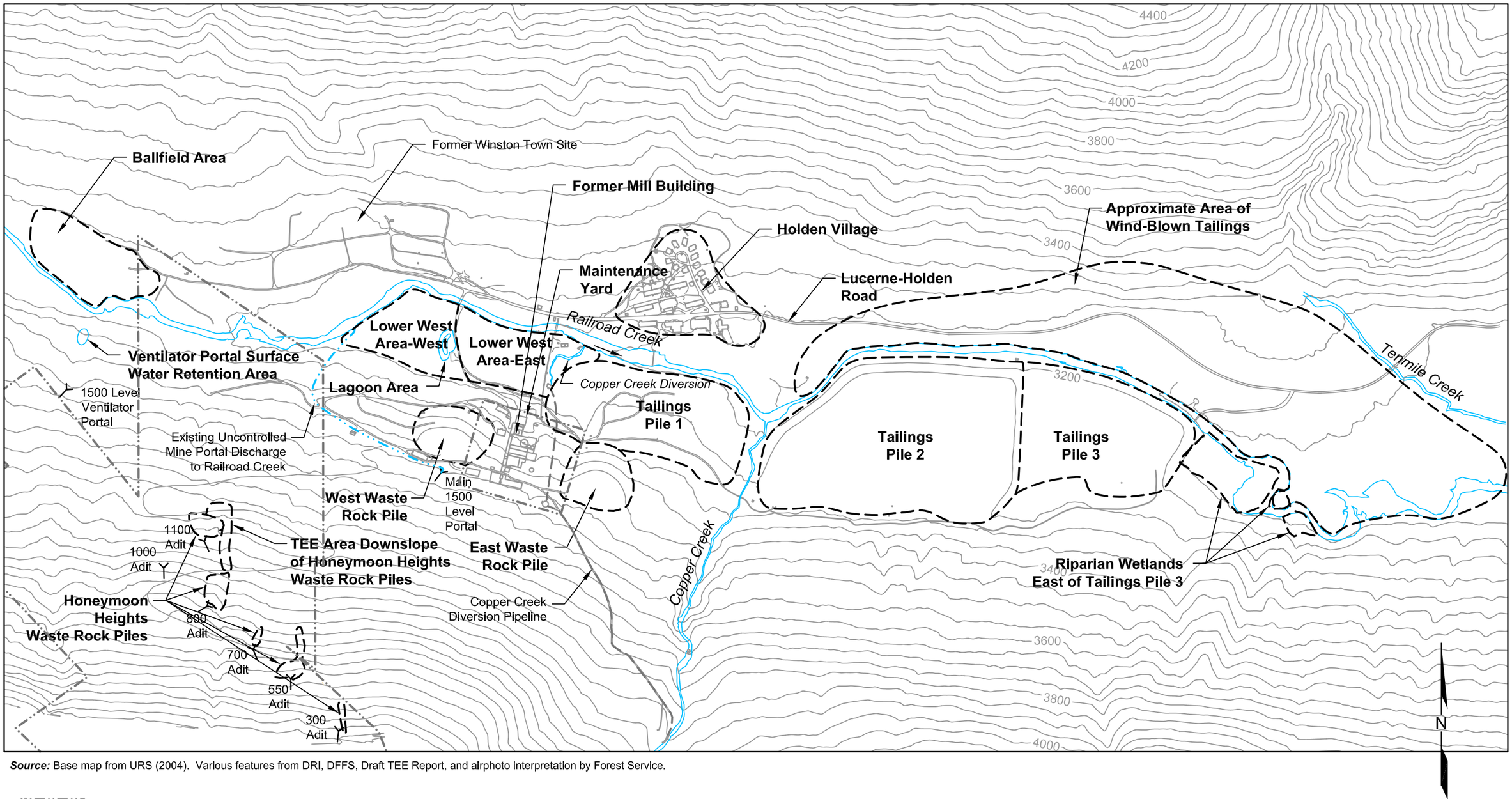
0 0.75 1.5
Scale in Miles

N

HARTCROWSER

4769-15 *6/10*
Figure 2
Proposed Plan

Principal Site Features



Source: Base map from URS (2004). Various features from DRI, DFFS, Draft TEE Report, and airphoto interpretation by Forest Service.

Patented Mining Claim

Note: Contour interval is 50 feet.

0 660 1320
Scale in Feet

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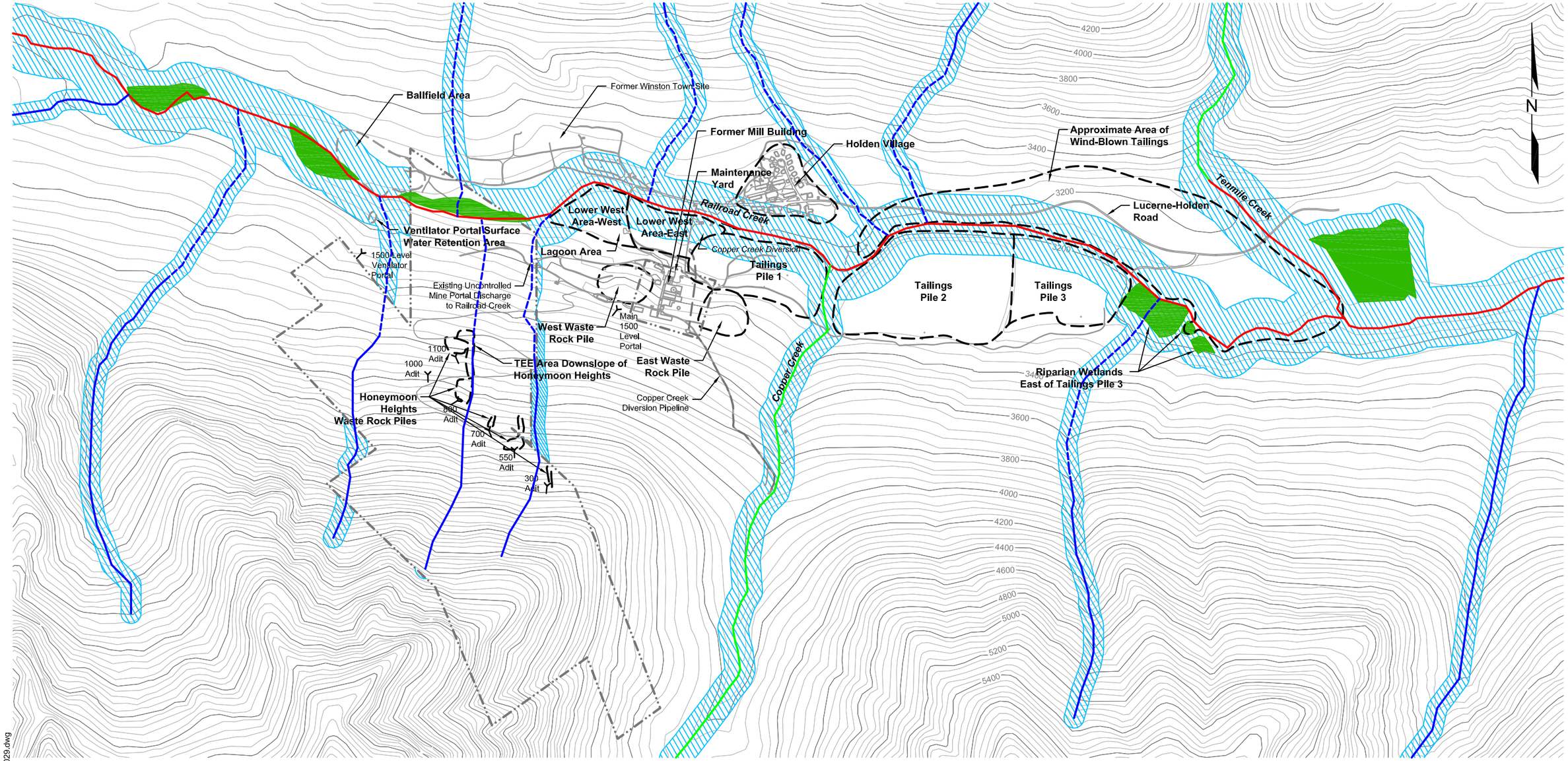
4769-15 ***6/10***

Figure 3

Proposed Plan

EAL 06/8/10 4769915PP-027.dwg

Riparian Reserve Map



Source: Streams and wetlands from Forest Service GIS Data (2010) and airphoto interpretation by Forest Service.

- Fish Bearing - 300-Foot Buffer
- Permanenetly Flowing NON Fish Bearing - 150-Foot Buffer
- Intermittent NON Fish Bearing - 100-Foot Buffer
- Subsurface Stream?
- Riparian Reserve
- Wetlands >1 Acre - 150-Foot Buffer Each Bank
- Patented Mining Claim

0 1000 2000
Scale in Feet

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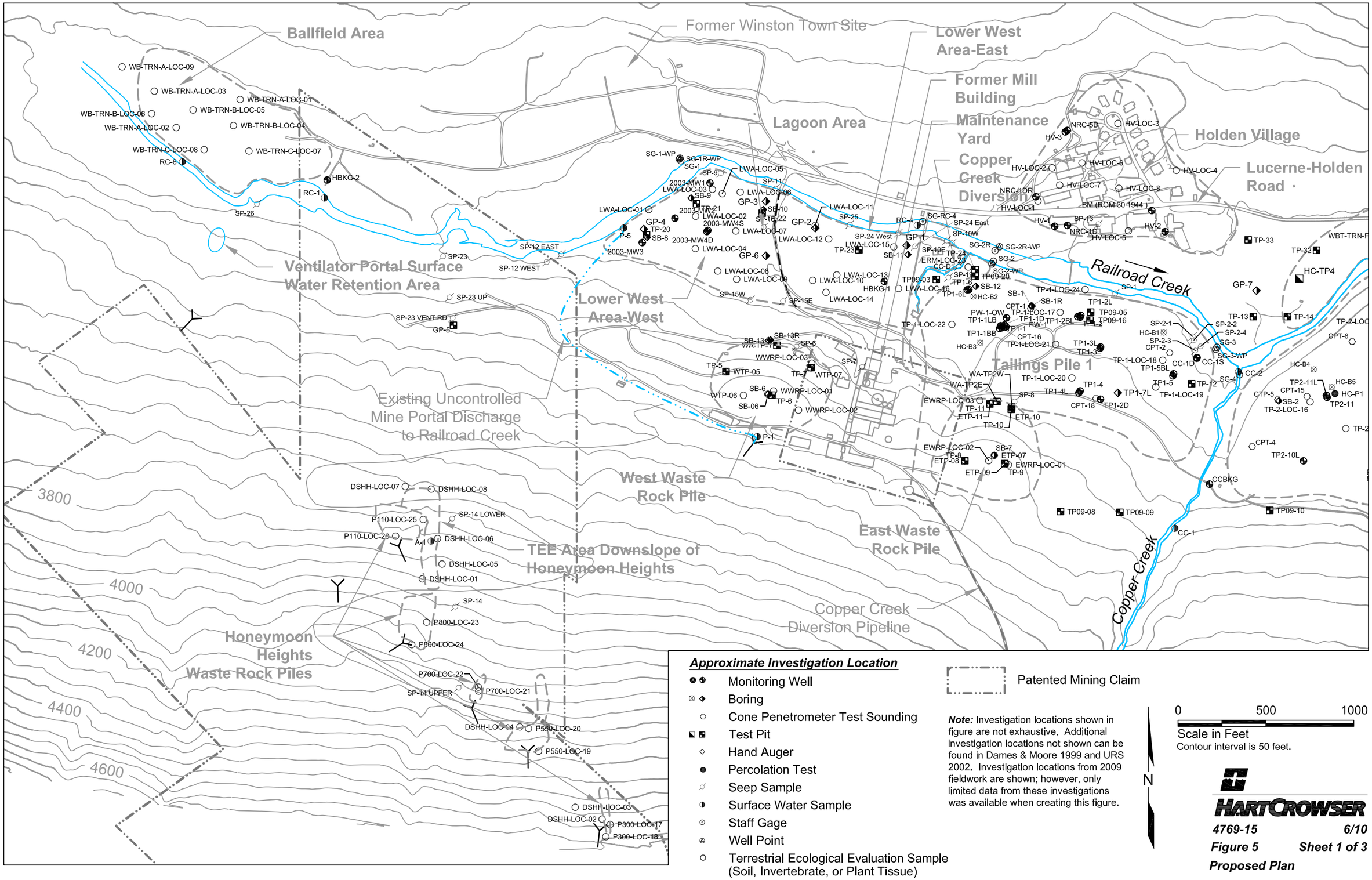
4769-15 *4/10*

Figure 4

Proposed Plan

EAL 06/8/10 4769915PP-029.dwg

Investigation Locations - Area West of Copper Creek



Approximate Investigation Location

- Monitoring Well
- Boring
- Cone Penetrometer Test Sounding
- Test Pit
- Hand Auger
- Percolation Test
- Seep Sample
- Surface Water Sample
- Staff Gage
- Well Point
- Terrestrial Ecological Evaluation Sample (Soil, Invertebrate, or Plant Tissue)

Patented Mining Claim

Note: Investigation locations shown in figure are not exhaustive. Additional investigation locations not shown can be found in Dames & Moore 1999 and URS 2002. Investigation locations from 2009 fieldwork are shown; however, only limited data from these investigations was available when creating this figure.

N

0 500 1000

Scale in Feet

Contour interval is 50 feet.

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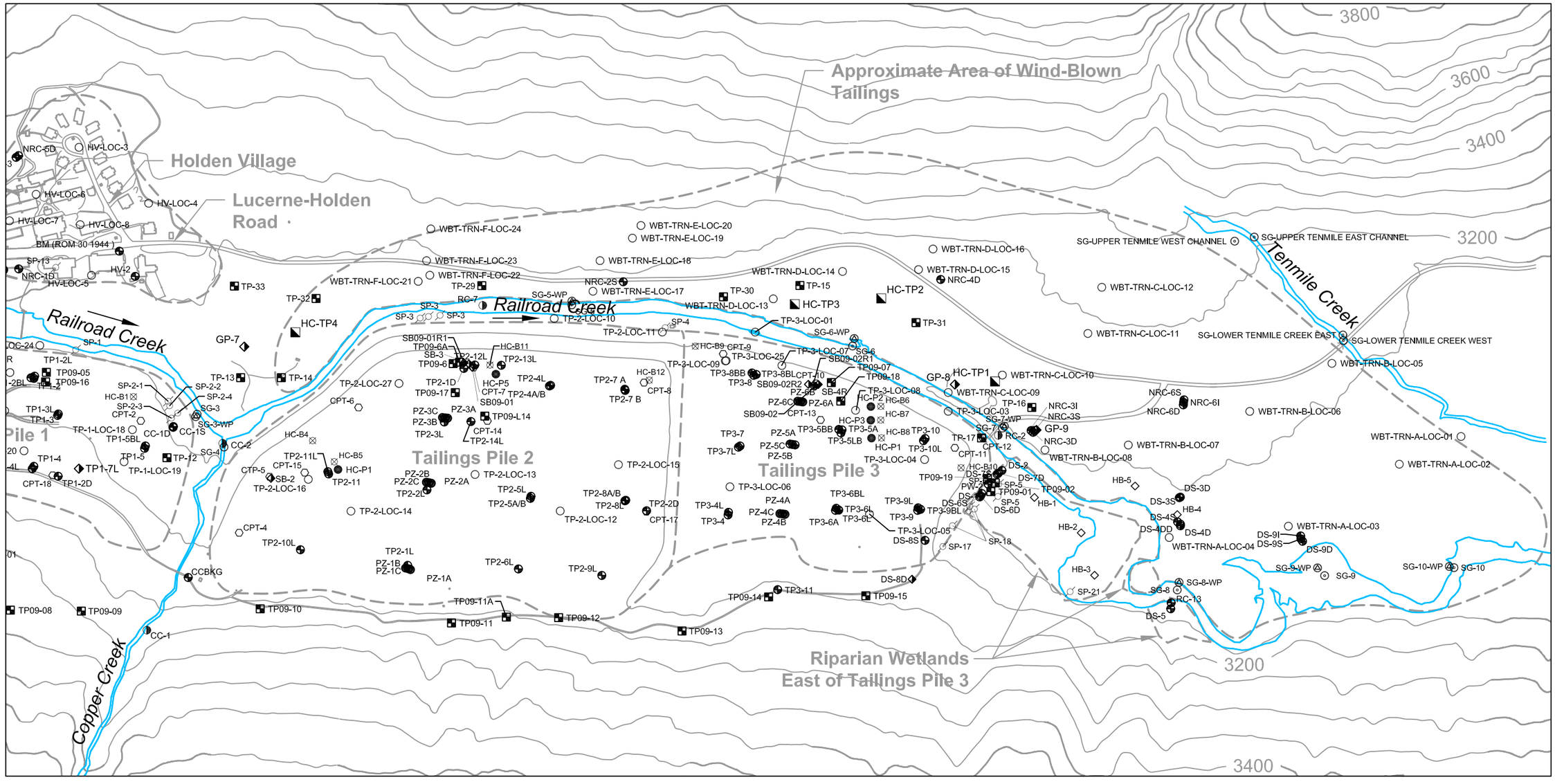
4769-15 ***6/10***

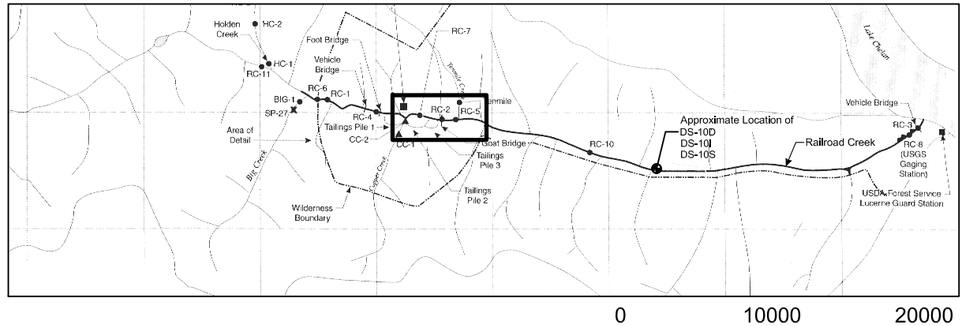
Figure 5 ***Sheet 1 of 3***

Proposed Plan

EAL 06/8/10 4769915PP-007.dwg

Investigation Locations - Area East of Copper Creek





Approximate Investigation Location

- Monitoring Well
- Boring
- Cone Penetrometer Test Sounding
- Test Pit
- Hand Auger
- Percolation Test
- Seep Sample
- Surface Water Sample
- Staff Gage
- Well Point
- Terrestrial Ecological Evaluation Sample (Soil, Invertebrate, or Plant Tissue)

Note: Investigation locations shown in figure are not exhaustive. Additional investigation locations not shown can be found in Dames & Moore 1999 and URS 2002. Investigation locations from 2009 fieldwork are shown; however, only limited data from these investigations was available when creating this figure.

N

0 500 1000

Scale in Feet

Contour interval is 50 feet.

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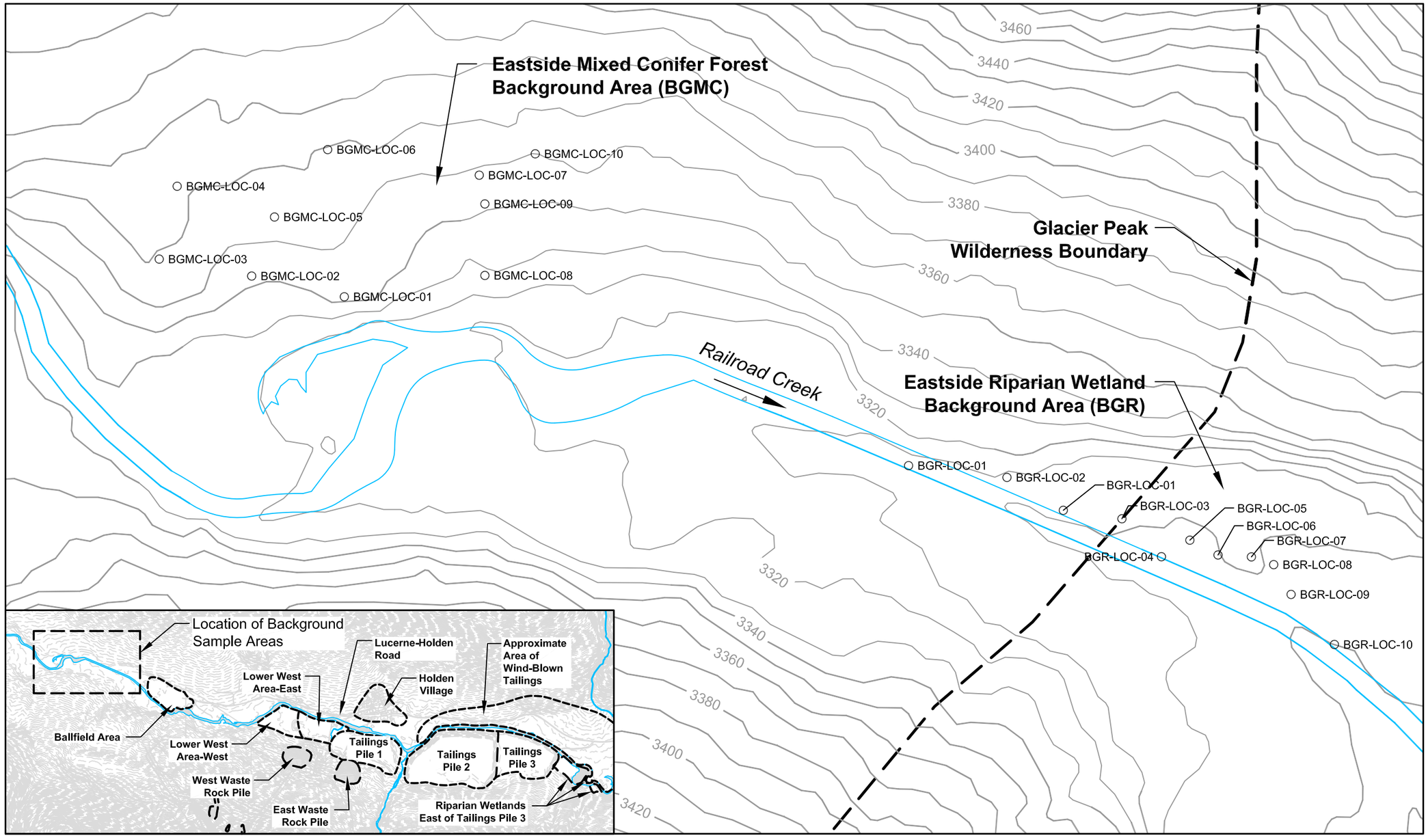
Figure 5 Sheet 2 of 3

Proposed Plan

EAL 06/8/10 4769I5PP-007.dwg

Investigation Locations - TEE Background Samples



Source: Base map from URS (2008).

BGR-LOC-01 ○ Background Sample Location and Number

Note: Contour interval is 10 feet.

N

0 150 300
Scale in Feet

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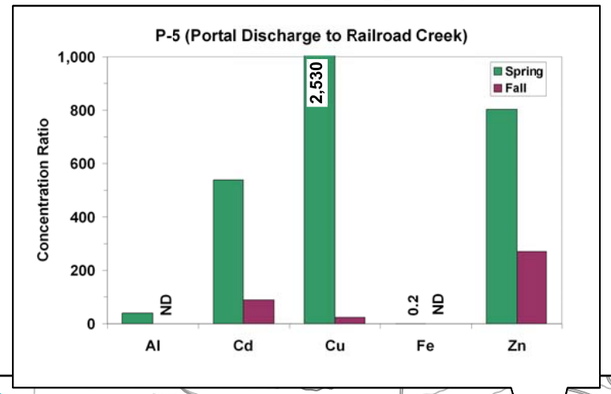
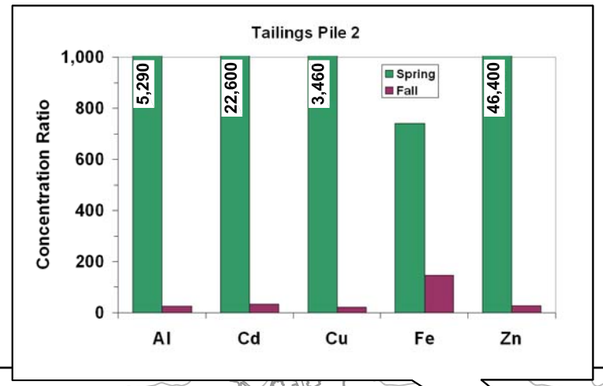
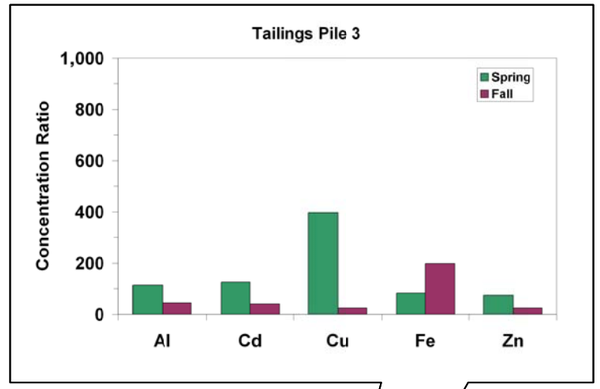
4769-15 *6/10*
Figure 5 *Sheet 3 of 3*
Proposed Plan

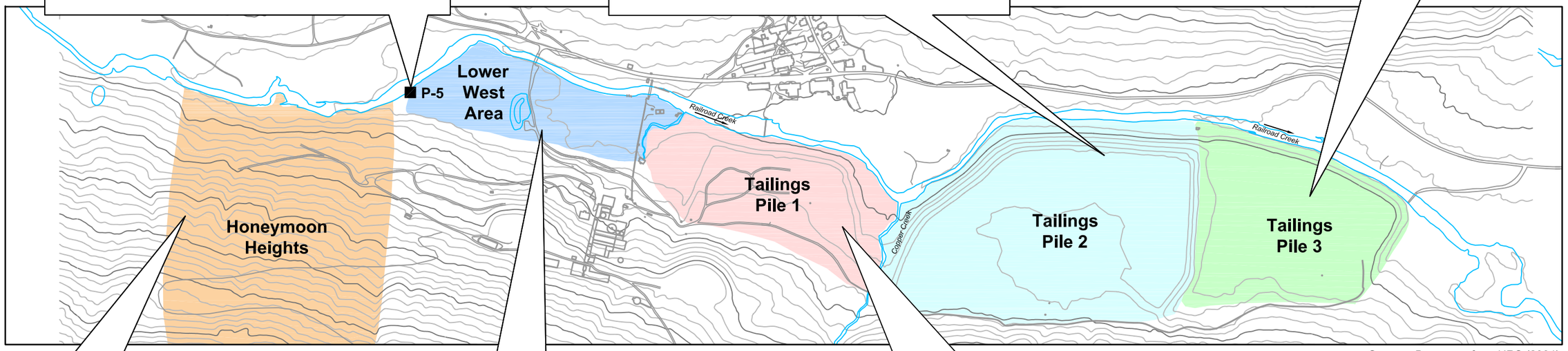
EAL 06/8/10 476915PP-003.dwg

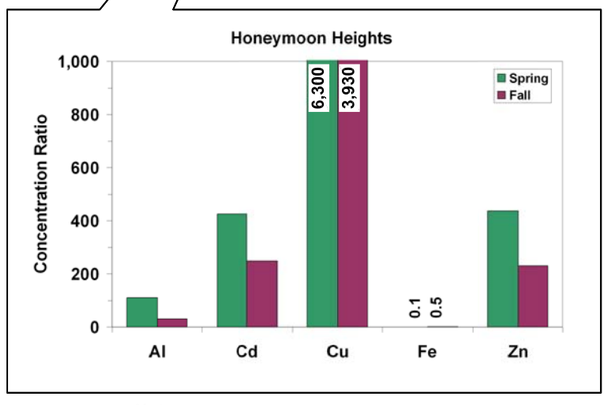
Ratio of Groundwater (Including Seep) Concentrations to Proposed Cleanup Levels for Major Source Areas

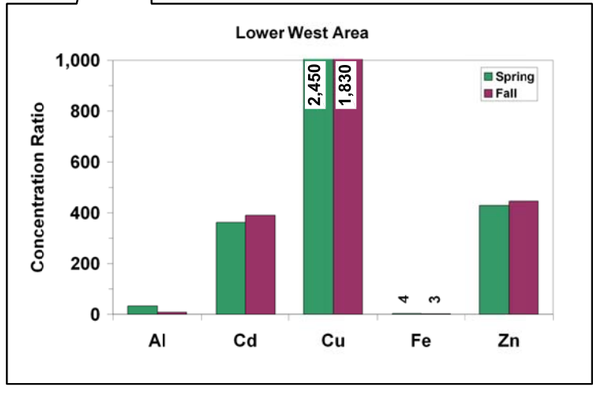


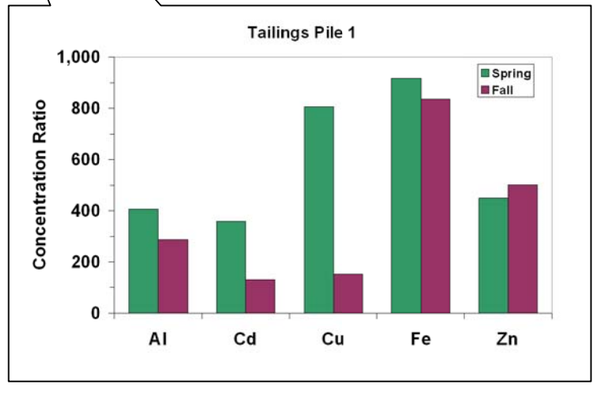












Source: Base map from URS (2004).

Proposed Cleanup Level in ug/L (See Table 1)	
Aluminum	152
Cadmium	0.09
Copper	1.17
Iron	1000
Zinc	11

N

0 600 1200
Scale in Feet

Notes:

1. Plots show the ratio of the constituent concentrations shown in Table 7 to the proposed cleanup levels shown in Table 1. Concentration Ratio = Constituent Concentration/Proposed Cleanup Level.
2. Additional details on the determination of constituent concentrations are noted on Table 7.
3. Additional details on proposed cleanup levels are provided in the text and noted on Table 1.
4. Vertical scales of plots vary. The numerical values of any ratios that exceed the vertical scale of the plot are noted.
5. "ND" indicates all sample results were non-detect.
6. Al = Aluminum, Cd = Cadmium, Cu = Copper, Fe = Iron, and Zn = Zinc.
7. Lead data is not shown because available data may not be representative due to inconsistent analyses for lead concentrations.

EAL 06/8/10 4769915PP-005.dwg

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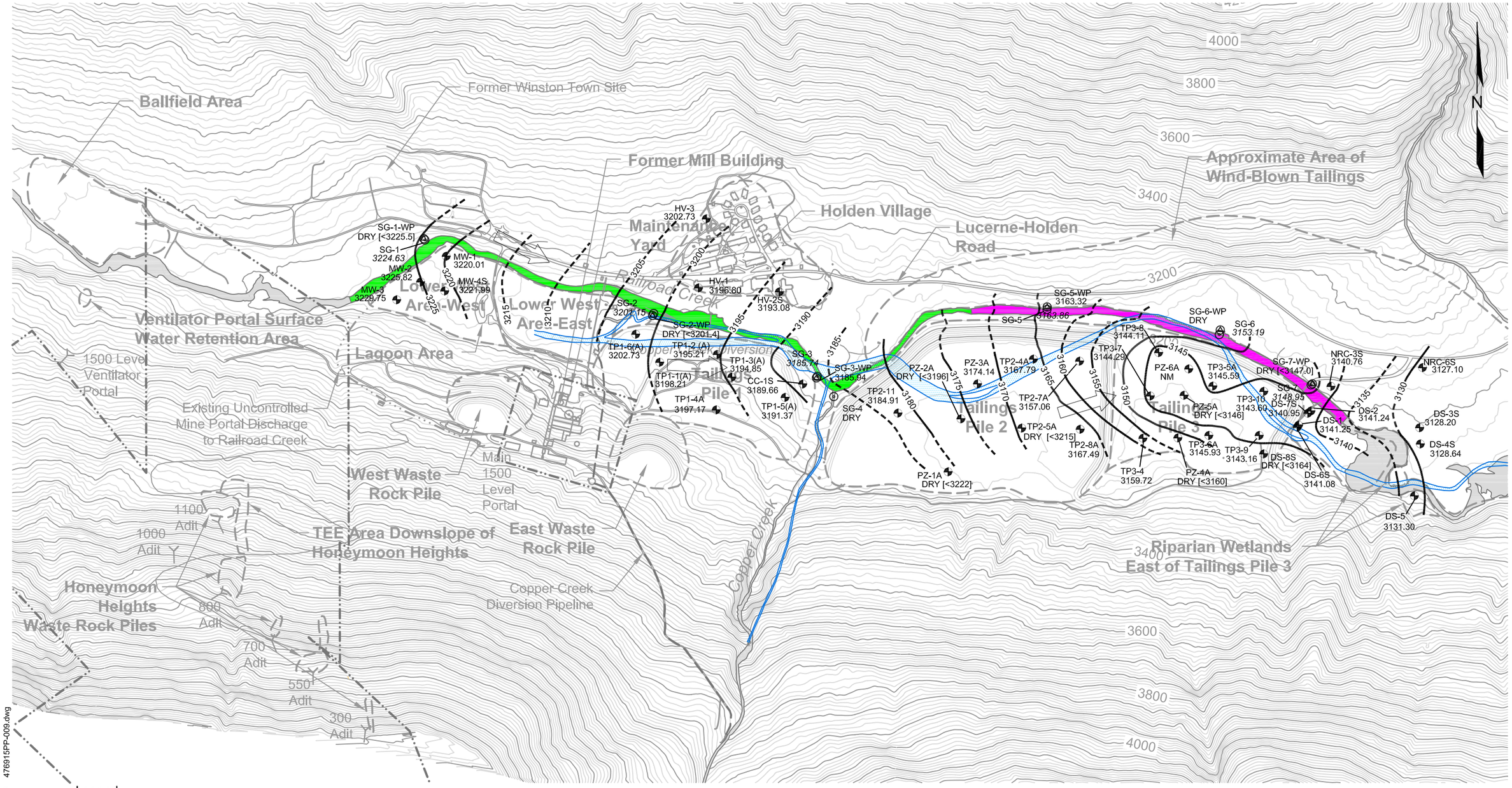
Figure 6

Proposed Plan

Groundwater Elevations and Generalized Flow Map - October 2008



EAL 06/15/10 476915PP-009.dwg

Legend

- Monitoring Well
- Well Point
- 3190.9 Groundwater Elevation, feet above mean sea level
- Groundwater Contour, feet above mean sea level (Dashed Where Inferred)
- Staff Gage
- *3125.52* Surface Water Elevation, feet above mean sea level
- NM Not Measured
- Estimated Extent of Gaining Reach of Railroad Creek
- Estimated Extent of Losing Reach of Railroad Creek
- Creek Channels in 1937 Based on Howe Sound Map
- Groundwater Flow Direction

0 600 1200
Scale in Feet

Source: Prepared from Figures E2-16 and D3-1, Draft Alternative 13M Evaluation Report, ERM and URS, 2009.

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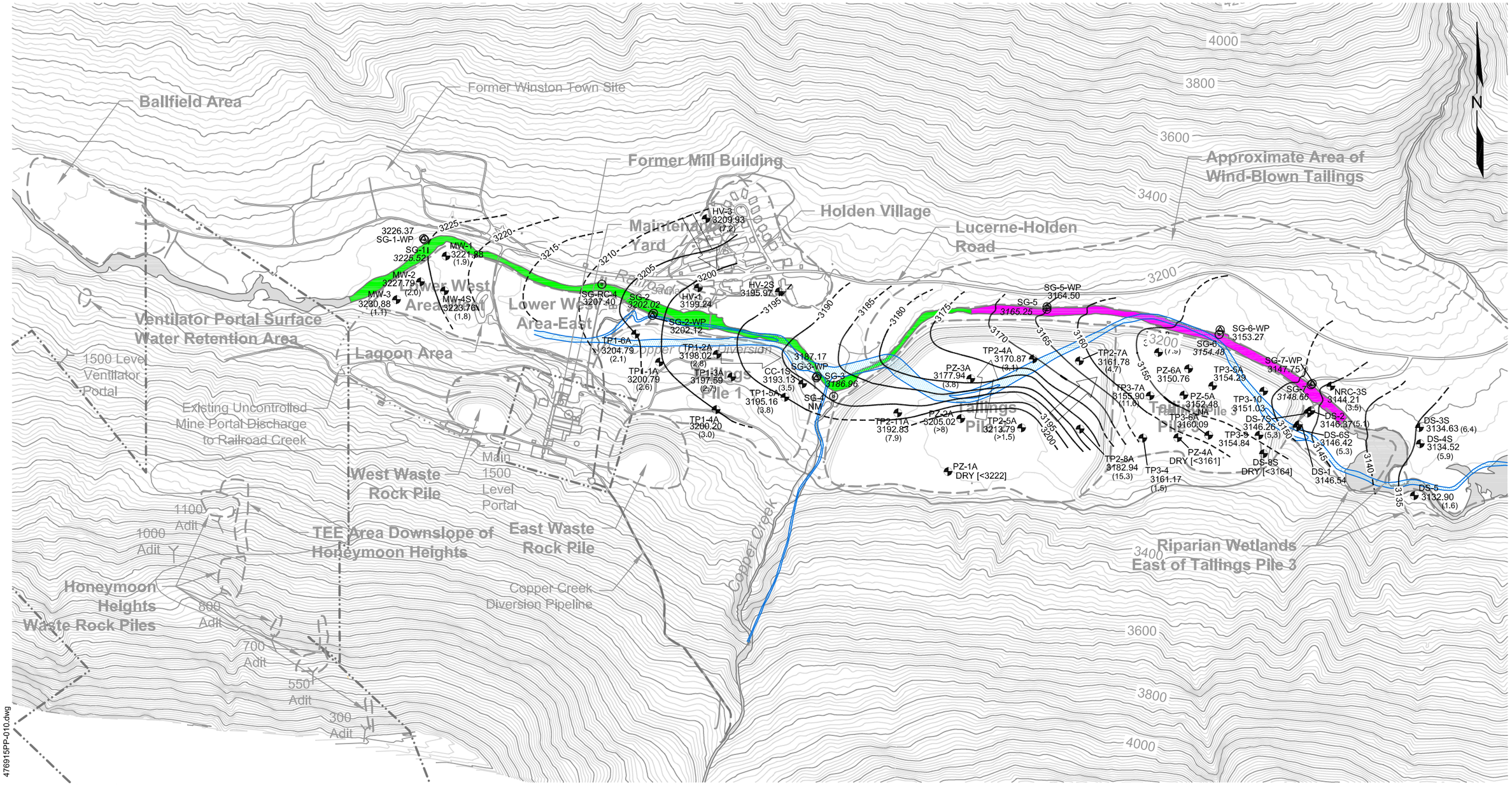
4769-15 ***6/10***
Figure 7 ***Sheet 1 of 2***
Proposed Plan

Groundwater Elevations and Generalized Flow Map - July 2008



EAL 06/15/10 476915PP-010.dwg

Legend

- Monitoring Well
- Well Point
- 3190.9 Groundwater Elevation, feet above mean sea level
- Groundwater Contour, feet above mean sea level (Dashed Where Inferred)
- Staff Gage
- *3125.52* Surface Water Elevation, feet above mean sea level
- NM Not Measured
- Estimated Extent of Gaining Reach of Railroad Creek
- Estimated Extent of Losing Reach of Railroad Creek
- Creek Channels in 1937 Based on Howe Sound Map
- Groundwater Flow Direction

0 600 1200
Scale in Feet

Source: Prepared from Figures E2-16 and D3-1, Draft Alternative 13M Evaluation Report, ERM and URS, 2009.

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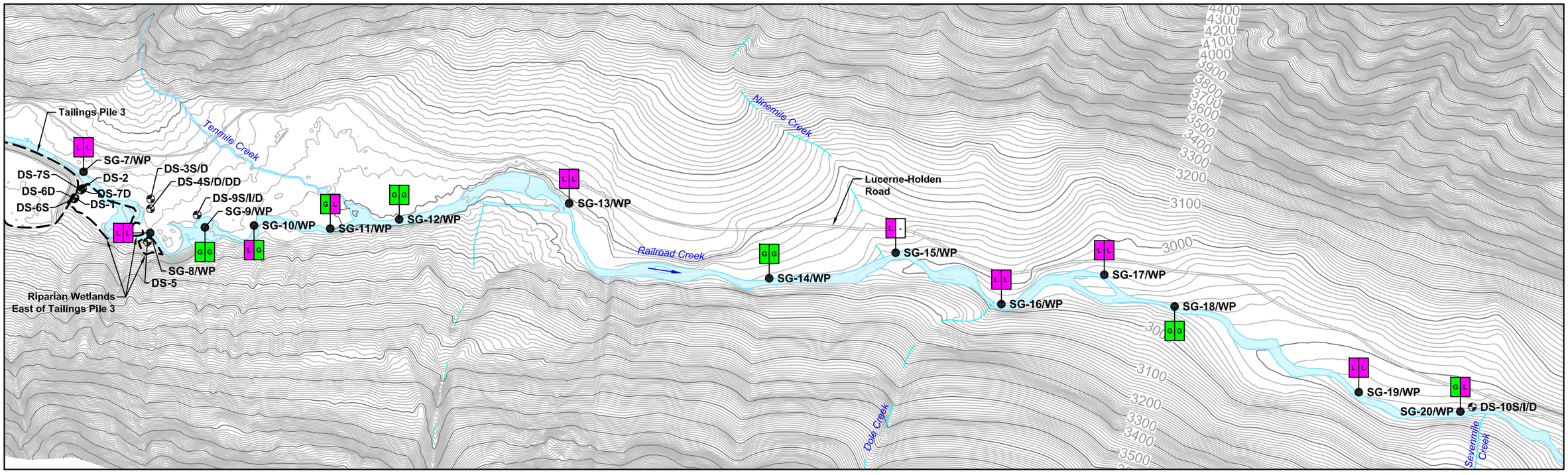
4769-15 *6/10*
Figure 7 *Sheet 2 of 2*
Proposed Plan

Groundwater Concentrations and Railroad Creek Stream Conditions East of Tailings Pile 3



Stream Conditions at Stream Gage/Well Point Pair

G Gaining

L Losing

\- N/A (See Note 7)

Spring (G) — Fall (L)

DS-10S/I/D Monitoring Well/Well Cluster

SG-7/WP Stream Gage/Well Point Pair

Source: Base map from URS (2009).

N

	Constituent (ug/L)	DS-1	DS-2	DS-3S	DS-3D	DS-4S	DS-4D	DS-4DD	DS-5	DS-6S	DS-6D	DS-7S	DS-7D	DS-9S	DS-9I	DS-9D	DS-10S	DS-10I	DS-10D	SG-9-WP	SG-10-WP	SG-11-WP	SG-12-WP	SG-13-WP	SG-18-WP	SG-20-WP
Spring 2009	Aluminum	50 U	10,900	50 U	50 U	50 U	50 U	--	50 U	50 U	50 U	1,940	50 U	50 U	9,730	50 U	50 U	50 U	50 U	--	--	--	--	--	--	--
	Cadmium	0.3	1.7	0.2 U	0.2	0.2 U	0.2 U	--	0.2 U	0.3	0.4	1.2	0.2 U	0.2 U	3	0.2 U	0.2 U	0.2 U	0.2 U	--	--	--	--	--	--	--	--
	Copper	3.2	42.2	0.5	0.5 U	0.5 U	0.5 U	--	0.5 U	0.3	0.5 U	19.7	0.5 U	0.5 U	16.5	0.5 U	0.5 U	0.5 U	0.5 U	--	--	--	--	--	--	--	--
	Iron	50 U	100	50 U	50 U	50 U	50 U	--	50 U	50 U	50 U	50 U	50 U	50 U	10,800	50 U	50 U	50 U	50 U	--	--	--	--	--	--	--	--
	Zinc	36	168	12	15	11	13	--	4 U	4 U	4 U	125	4 U	4 U	440	13	4 U	4 U	4 U	--	--	--	--	--	--	--	--
Fall 2009	Aluminum	50 U	33,700	50 U	50 U	50 U	70	50 U	50 U	410	50 U	630	50 U	50 U	4,860	50 U	50 U	50 U	50 U	50 U	1,500	60	50 U	200	50	50 U
	Cadmium	0.3	2.5	0.2	0.2	0.2 U	0.2 U	0.2 U	0.2 U	1.9	0.4	0.2 U	0.2 U	0.2 U	1.4	0.2 U	0.2 U	0.2 U	0.2 U	2.03	4.45	1.64	4.8	3.1	0.87	0.26
	Copper	3	104	0.5 U	0.5 U	0.5 U	0.5	0.5 U	0.5 U	13.4	0.5 U	0.5 U	0.5 U	0.5 U	9.5	0.5 U	0.5 U	0.5 U	0.5 U	2.3	10.2	0.7	2.7	3	0.9	0.5
	Iron	50 U	117,000	50 U	50 U	50 U	50 U	50	50 U	22,400	50 U	356,000	50 U	50 U	240	50 U	270	50 U	50 U	50 U	50 U	20,100	4,460	160	330	90
	Zinc	40	258	17	15	24	17	39	9	46	4 U	53	4 U	12	180	4 U	4 U	4 U	4 U	22.5	138	6.5	5	6	3	2

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Notes:

1. Stream conditions determined from paired well points and stream gages measured in June 2009 (spring) and October 2009 (fall), as reported by URS in the draft Hydrogeological Technical Memorandum Addendum, dated February 24, 2010.
2. S/I/D indicate monitoring well clusters screened at shallow, intermediate, and deep relative depths, respectively.
3. -- Data not available.
4. U - Constituent not detected; reporting limit shown.
5. Shaded cells indicate detected concentration exceeds proposed cleanup level.
6. No groundwater concentration data available for SG-7-WP, SG-8-WP, SG-14-WP through SG-17-WP, and SG-19-WP.
7. N/A - Stream gaining/losing condition could not be determined because water elevations below field instrument measurement elevations.
8. Lead data is not shown because available data may not be representative due to inconsistent analyses for lead concentrations.

Proposed Cleanup Level in ug/L (see Table 1)	
Aluminum	152
Cadmium	0.09
Copper	1.17
Iron	1,000
Zinc	11

0 1000 2000

Scale in Feet

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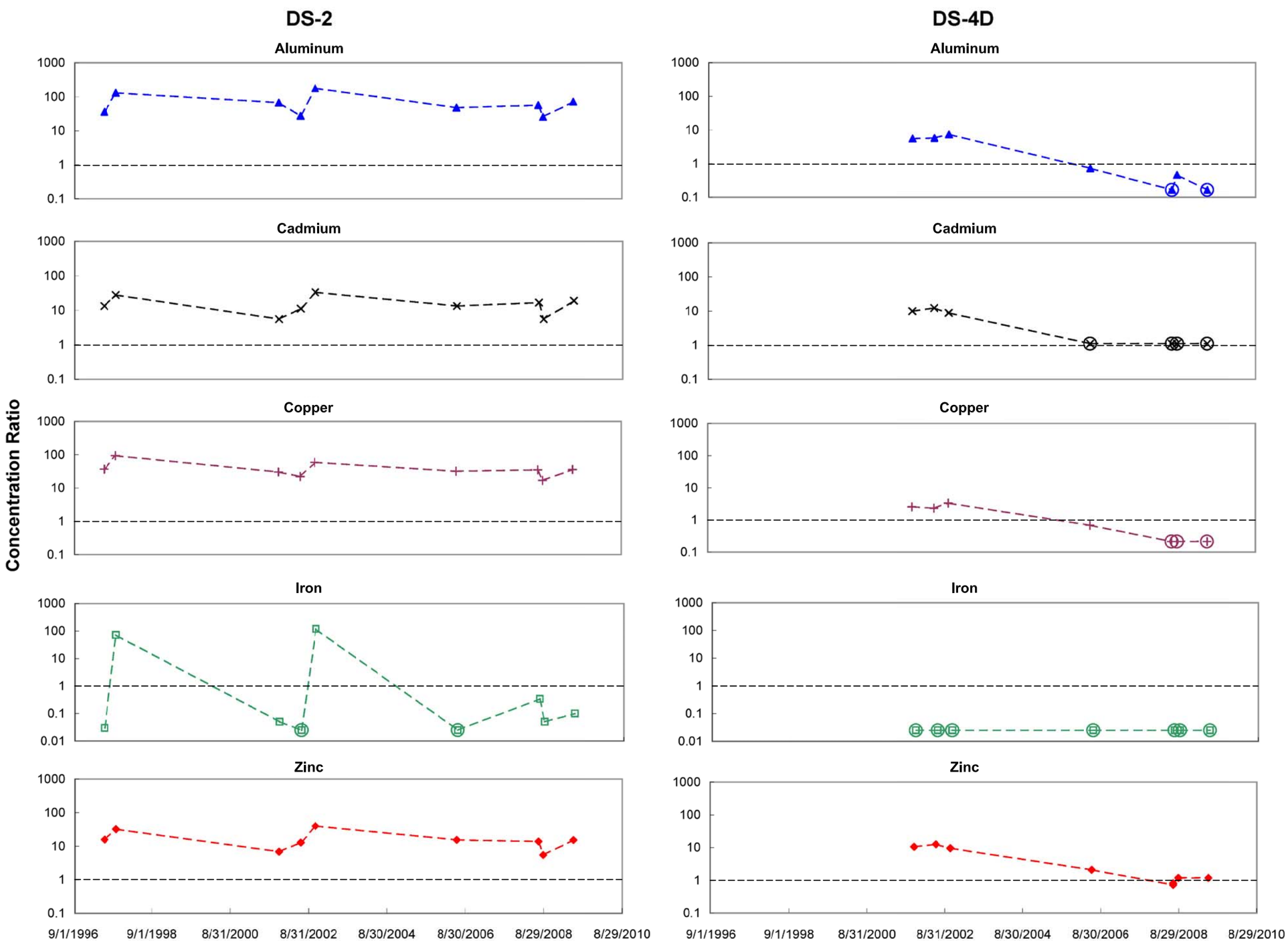
Figure 8

Proposed Plan

Ratio of Groundwater Concentrations to Proposed Cleanup Levels Over Time in Wells DS-2 and DS-4D



Proposed Cleanup Level in ug/L (See Table 1)	
Aluminum	152
Cadmium	0.09
Copper	1.17
Iron	1000
Zinc	11

Notes:

1. Plots show the ratio of the constituent concentrations to the proposed cleanup level. Concentration Ratio = Constituent Concentration/Proposed Cleanup Level.
2. Dissolved constituent concentrations measured in groundwater were used to calculate concentration ratios.
3. Circled data points indicate the constituent was not detected in the sample, and a concentration of one-half the detection limit is shown.
4. Constituent concentration data obtained from URS data base query on 9/1/09.
5. Lead data is not shown because available data may not be representative due to inconsistent analyses for lead concentrations.

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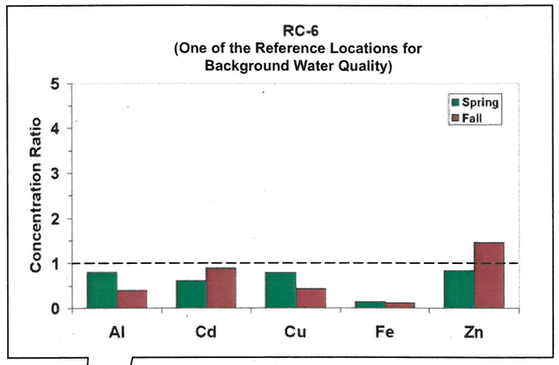
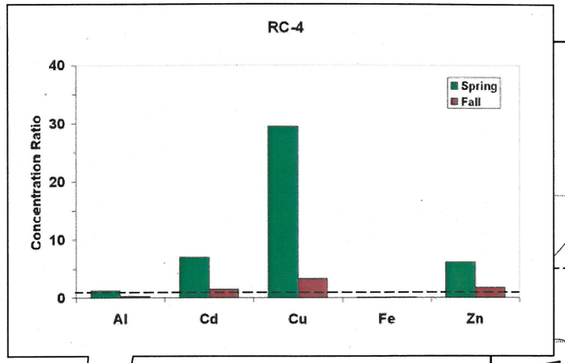
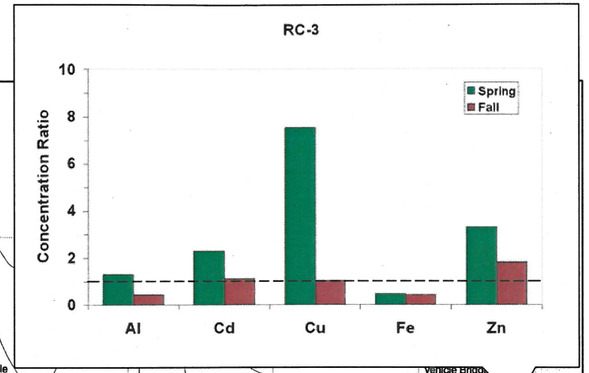
Figure 9

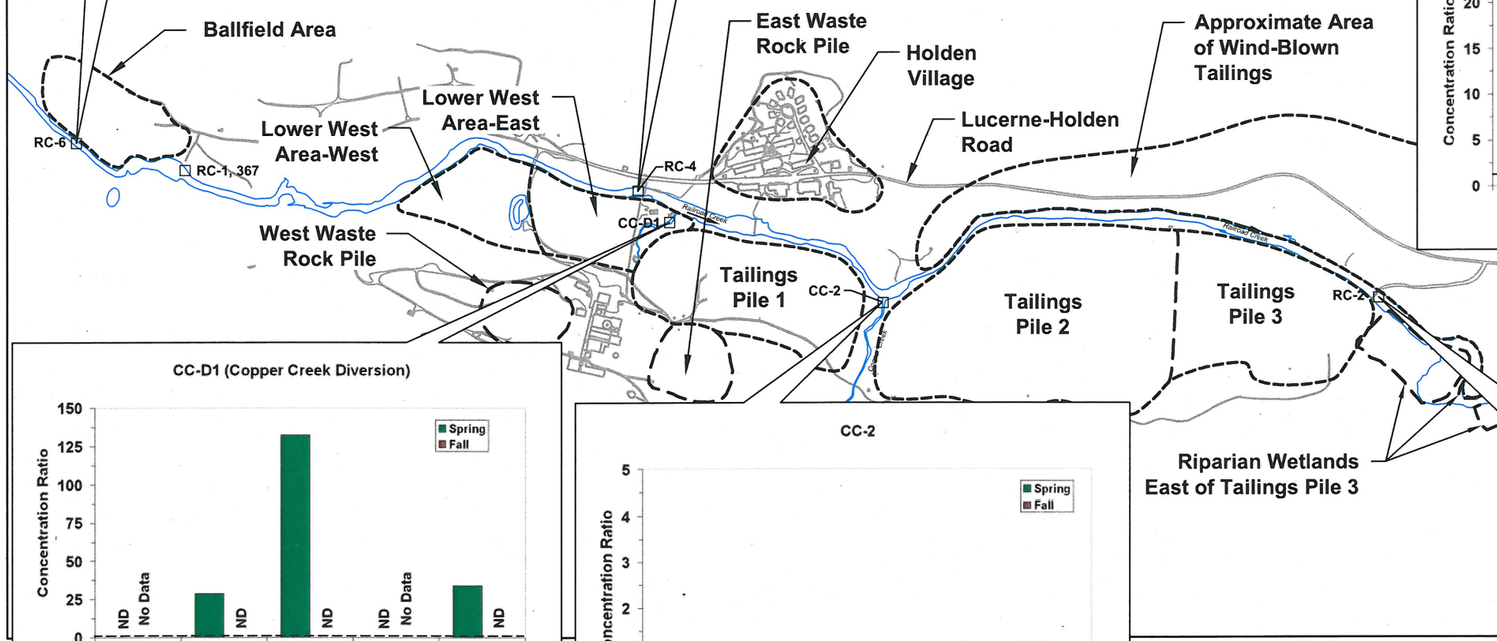
Proposed Plan

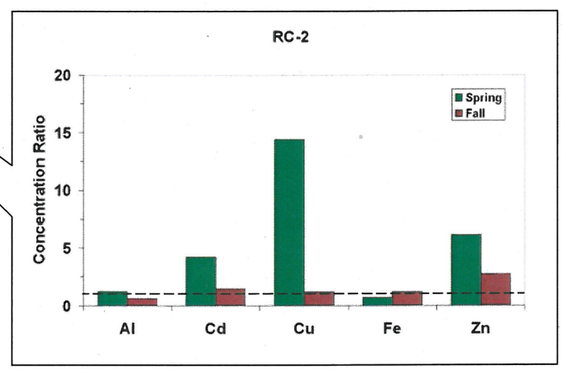
Ratio of Surface Water Concentrations to Proposed Cleanup Levels











RC-6 □ Railroad Creek Sampling Location and Number

Notes:

1. Plots show the ratio of the constituent concentrations shown in Table 5 to the proposed cleanup levels shown in Table 1. Concentration Ratio = Constituent Concentration/Proposed Cleanup Level.
2. Additional details on the determination of constituent concentrations are noted on Table 5.
3. Additional details on proposed cleanup levels are provided in the text and noted on Table 1.
4. Vertical axis scales of plots vary. Horizontal dashed line identifies a concentration ratio of one in all plots.
5. "ND" indicates all samples were non-detect. "No Data" indicates samples were not analyzed for constituent.
6. Plots reflect constituent concentrations in grab samples taken from surface water under fully or partially mixed conditions and do not represent conditions at MTCA-defined conditional point(s) of compliance.
7. Al = Aluminum, Cd = Cadmium, Cu = Copper, Fe = Iron, and Zn = Zinc.
8. Lead data is not shown because available data may not be representative due to inconsistent analyses for lead concentrations.

Proposed Cleanup Level in ug/L (See Table 1)	
Aluminum	152
Cadmium	0.09
Copper	1.17
Iron	1000
Zinc	11

N

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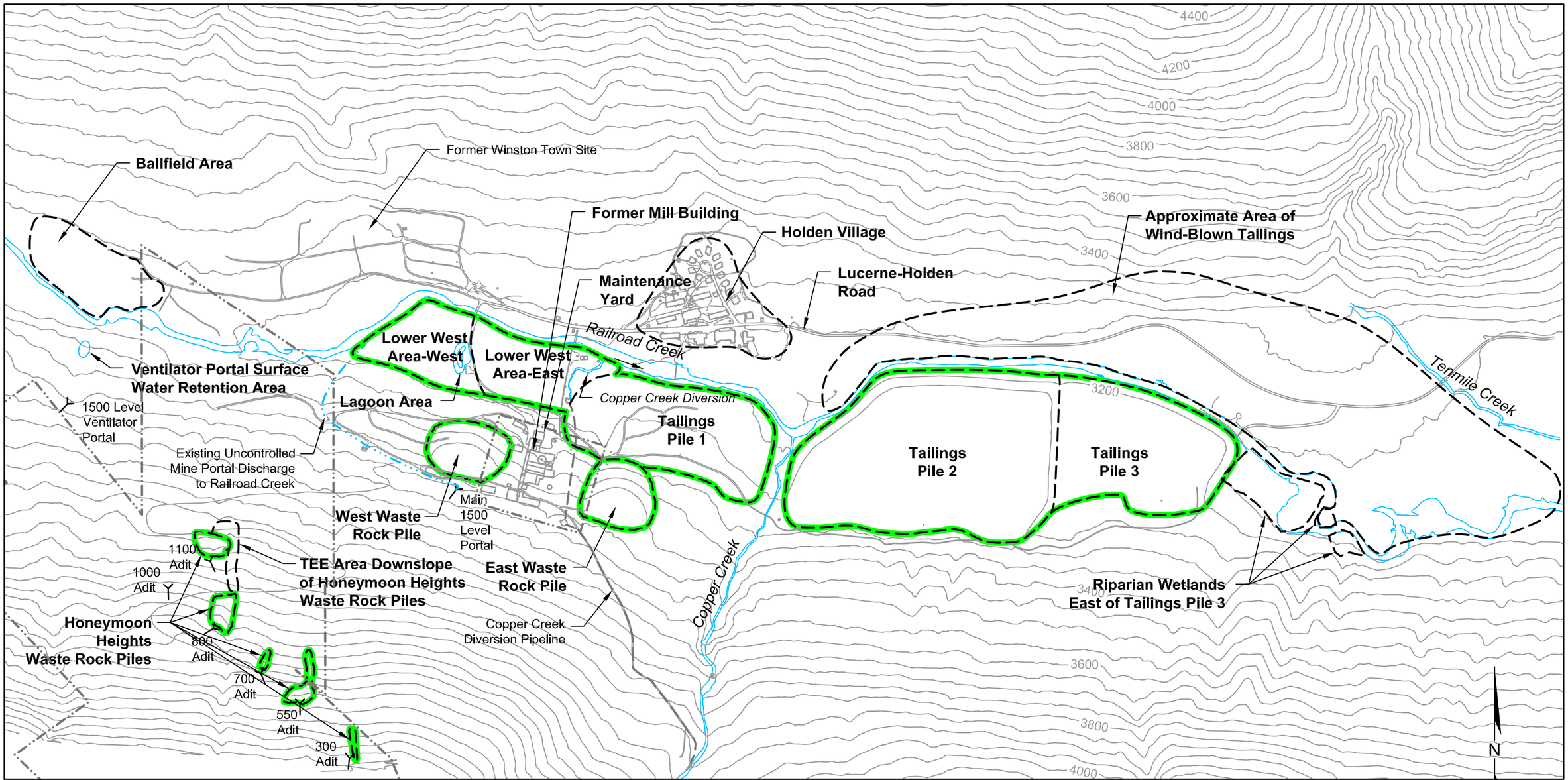
Figure 10

Proposed Plan

EAL 3/30/10 476915PP-004.dwg

Proposed Waste Management Areas



Source: Base map from URS (2004). Various features from DRI, DFFS, and Draft TEE Report.

Patented Mining Claim

Approximate Limits of Potential Waste Management Areas under Alternatives 11M and 14.

Note: Contour interval is 50 feet.

0 660 1320
Scale in Feet

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Figure 11

Proposed Plan

EAL 06/8/10 4769915PP-002.dwg

Principal Components of Alternative 11M

Other Remedy Components (not shown):

1. Institutional Controls
2. Hydraulic Bulkheads, Mine Access and Air Flow Restrictors
3. Stream Channel Riprap Improvement and Ferricrete Removal
4. Quarry(ies), as needed
5. Temporary Construction Facilities
6. Conveyance Pipeline from Portal Discharge and Seeps SP-23/SP-12 to Treatment Facility
7. Monitor SP-26 Water Quality
8. Remove soils above cleanup levels in portions of the Ballfield Area and Lower West Area based on further characterization during RD/RA. Remediate impacted soil with *in situ* treatment in additional areas, as discussed in text.
9. Sludge Disposal Landfill

Potential Temporary Construction Work Camp and/or Staging
Ballfield Area
Holden Village
Lucerne-Holden Road
Copper Creek Diversion Outfall Pipe
SP-26
SP-12
SP-23
Lower West Area-West
Lower West Area-East
Railroad Creek
Tailings Pile 1
Tailings Pile 2
Tailings Pile 3
Approximate Area of Wind-Blown Tailings
Remove Contaminated Soils in Ventilator Portal Surface Water Retention Area
1500 Level Ventilator Portal
1500 Portal (Discharge Collected for Treatment)
TEE Area Downslope of Honeymoon Heights
1100 Portal
1000 Portal
800 Portal
700 Portal
550 Portal
300 Portal
Maintenance Yard (Cap Contaminated Soils)
Former Mill Building (Demolition as Needed for Source Removal)
Riparian Wetlands East of Tailings Pile 3
Groundwater Treatment Facility

476915PP-011.dwg
EAL 6/8/10

Source: Base map prepared from LiDAR topographic survey provided by URS 2004

- Capping Contaminated Soils
- Regrade Tailings and Waste Rock Piles, and Cap with 2 Feet of Soil and Geomembrane
- Move Toe of Tailings Pile Slopes away from Creek as Part of Regrading
- Removal of Contaminated Soils or Waste Rock
- Waste Rock Piles
- Approximate Extent of *In Situ* Treatment Areas
- SP-4 ● Seep Sampling Location and Number
- ⊠ Portal to be Closed with Hydrostatic Bulkhead
- × Portal to be Closed with Air Flow Restrictions
- Groundwater Barrier Wall and Collection System
- Upgradient Runoff Diversion Ditch
- Discrete Seep Collection System

0 600 1,200
Scale in Feet

N

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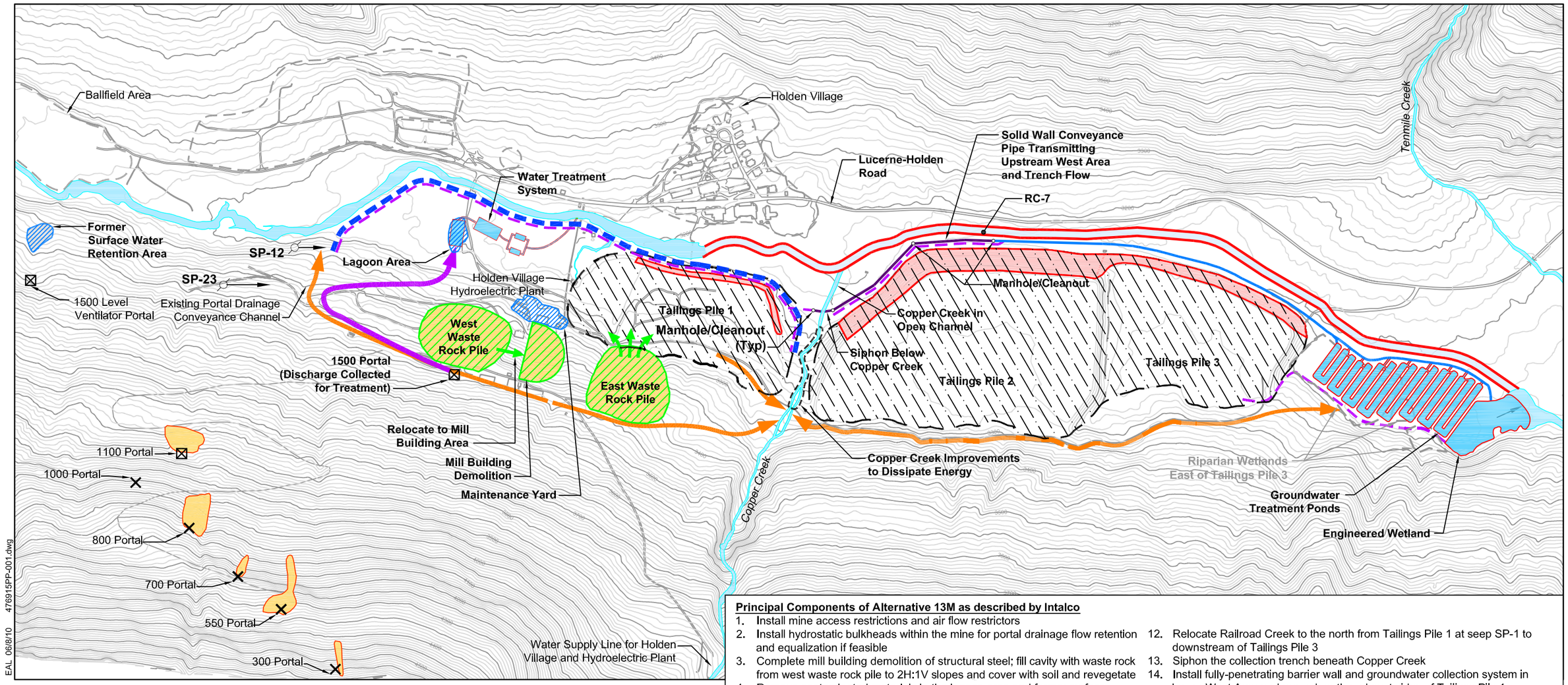
Figure 12

Proposed Plan

Principal Components of Alternative 13M



Principal Components of Alternative 13M as described by Intalco

1. Install mine access restrictions and air flow restrictors
2. Install hydrostatic bulkheads within the mine for portal drainage flow retention and equalization if feasible
3. Complete mill building demolition of structural steel; fill cavity with waste rock from west waste rock pile to 2H:1V slopes and cover with soil and revegetate
4. Remove contaminated materials in the lagoon area and former surface water retention area and pave maintenance yard
5. Construct landfill on top of tailings piles for disposal of excavated impacted soils
6. Bench and regrade Tailings Piles 1, 2, and 3 side slopes (2H:1V)
7. Cover top surfaces of tailings piles with gravel/soil/wood slash. Cover tailings pile side slopes with soil. Revegetate and install surface water drainage features
8. Regrade east and west waste rock pile side slopes (2H:1V), relocate waste rock removed during regrading to mill building area and tailings piles, cover remaining portions with soil and revegetate
9. Stabilize Copper Creek channel and improve channel to dissipate energy
10. Install water diversion swales upgradient of tailings and waste rock piles
11. Provide discrete collection of portal drainage and seeps SP-23 and SP-12
12. Relocate Railroad Creek to the north from Tailings Pile 1 at seep SP-1 to downstream of Tailings Pile 3
13. Siphon the collection trench beneath Copper Creek
14. Install fully-penetrating barrier wall and groundwater collection system in Lower West Area and around north and east sides of Tailings Pile 1
15. Collect near-surface groundwater and seeps in existing Railroad Creek channel in unlined collection trench from Copper Creek downstream to approximately RC-7
16. Construct two low energy water treatment systems: one in the west area to treat collected portal drainage and seeps SP-23 and SP-12; one in the east area to treat remaining collected site water
17. Construct landfill on top of tailings piles for disposal of sludge from water treatment system

Legend

- Waste Rock Piles
- Regrade and Cover Waste Rock Piles with Soil
- Removal or Covering of Contaminated Soils
- Regrade Tailings Pile Slopes
- Cover with Soil on Top of Surface and on Slope
- Waste Rock Pile Relocation
- Portal Drainage Conveyance Trench
- Upgradient Runoff Diversion Trench
- Fully-Penetrating Barrier Wall and Open Collection Trench
- Portal to be Closed with Hydrostatic Bulkhead
- Portal to be Closed with Air Flow Restrictors
- SP-23 — Discrete Seep Collected for Treatment Via Gravity Conveyance
- Existing Creeks
- Approximate Limits of Railroad Creek Realignment with Lining/Barrier System
- Unlined Collection or Conveyance Trench
- Lined Conveyance Channel or Treatment Trench with Drop Structures as needed
- Solid Wall Conveyance Pipe

Note:
Railroad Creek streambanks are based on U.S. Forest Service data provided March 1998, which appears to be consistent with aerial photograph interpretation of stream flood banks.

N

0 600 1200
Scale in Feet

Source: ERM and URS (2009).

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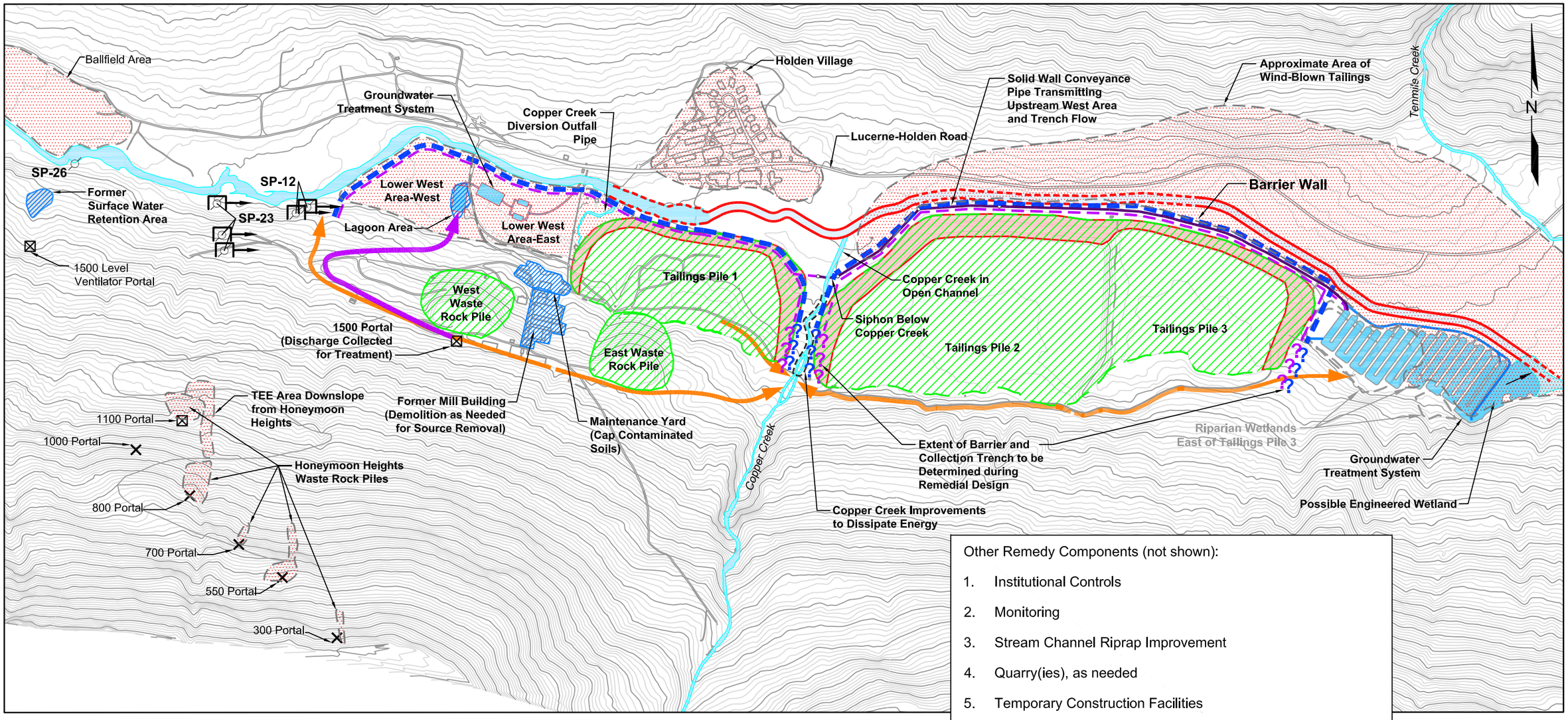
4769-15 *6/10*
Figure 13
Proposed Plan

Principal Components of Alternative 14



Other Remedy Components (not shown):

1. Institutional Controls
2. Monitoring
3. Stream Channel Riprap Improvement
4. Quarry(ies), as needed
5. Temporary Construction Facilities
6. Conveyance Pipeline from Portal Discharge and Seeps SP-23/SP-12 to Treatment Facility
7. Monitor SP-26 Water Quality
8. Remediate impacted soil with *in situ* treatment in additional areas, as discussed in the text.
9. Sludge Disposal Landfill

Legend

- Regrade and Cap Tailings and Waste Rock Piles
- Removal or Cap Contaminated Soils
- Regrade Tailings Pile Slopes
- Approximate Extent of *In Situ* Treatment Areas
- Upgradient Runoff Diversion Trench
- Fully-Penetrating Barrier Wall and Open Collection Trench
- Portal Discharge Conveyance Trench
- Portal to be Closed with Hydrostatic Bulkhead
- Portal to be Closed with Air Flow Restrictors
- SP-23 Seep Collection for Treatment
- Existing Creeks
- Railroad Creek Realignment (Actual limits to be determined during remedial design)
- Unlined Collection or Conveyance Trench
- Lined Conveyance Channel or Treatment Trench with Drop Structures as needed
- Solid Wall Conveyance Pipe

Source: Prepared from AutoCAD file "Alt 13M Contingent.dwg", created by URS, 06/24/09.

0 600 1200
Scale in Feet

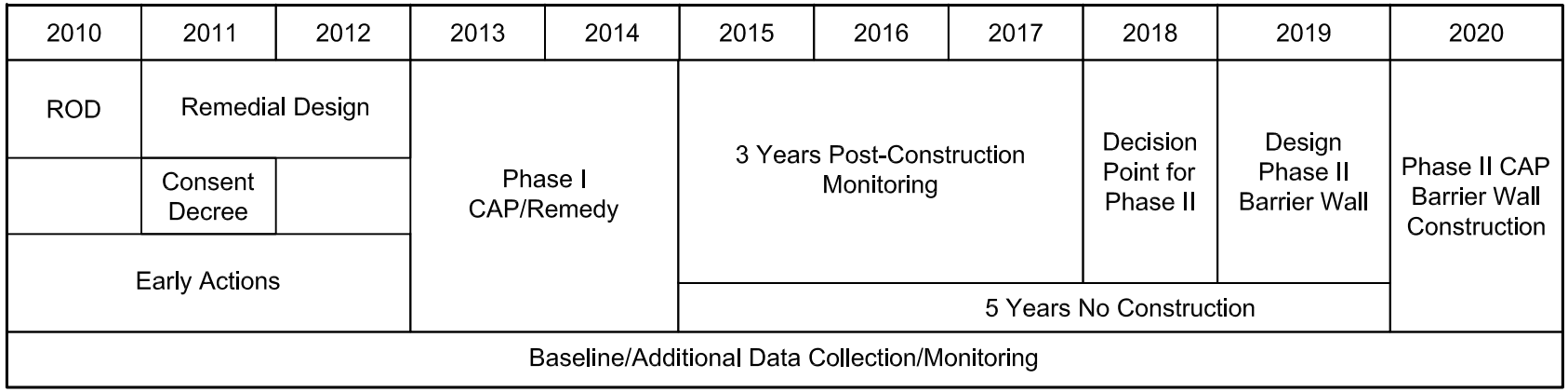
HARTCROWSER

4769-15 *6/10*

Figure 14
Proposed Plan

EAL 06/8/10 476915PP-008.dwg

Proposed Timeline for Holden Mine Cleanup (Alternative 14)



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4769-15

Figure 15

Proposed Plan

APPENDIX A
SEPA CHECKLIST

WAC 197-11-960 Environmental checklist.

ENVIRONMENTAL CHECKLIST

Purpose of checklist:

The State Environmental Policy Act (SEPA), chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply." Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of checklist for nonproject proposals:

Complete this checklist for nonproject proposals, even though questions may be answered "does not apply." IN ADDITION, complete the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D).

For nonproject actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

A. BACKGROUND

1. Name of proposed project, if applicable:

Holden Mine Cleanup Plan/Remedial Action

2. Name of applicant:

Washington State Department of Ecology
Central Regional Office

3. Address and phone number of applicant and contact person:

Valerie Bound
Section Manager, Toxics Cleanup Program
Washington State Department of Ecology
Central Regional Office
15 West Yakima Ave. Suite 200
Yakima, WA 98902-3452

The USDA Forest Service is the lead Agency responsible for the environmental cleanup of the Holden Mine Site (hereafter referred to as “the Site”). The USDA Forest Service (Forest

Service), in cooperation with the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology), have developed a proposed plan for cleanup.

The Forest Service, EPA, and Ecology are referred to collectively as "the Agencies."

4. Date checklist prepared:

June 02, 2010

5. Agency requesting checklist:

Ecology

6. Proposed timing or schedule (including phasing, if applicable):

The Site was an underground copper mine that was operated by the Howe Sound Mining Company (Howe Sound) from 1938 to 1957. Past mining operations at the Site have resulted in an ongoing release of hazardous substances (primarily metals), and an appropriate response action is required under both federal and state law.

Both a remedial investigation (RI) and feasibility study (FS) have been completed for the Site, and a Proposed Plan for Cleanup Action has been prepared and is being issued for public review and comment. The cleanup action will be carried out by Intalco (successor of Howe Sound). Remedial design and construction for the cleanup action is estimated to begin in 2011. Based on the remoteness of the Site and weather conditions, a typical work season spans approximately 5 to 6 months from spring until onset of winter conditions (October/November). Until further data and information is gathered, the exact timing of the construction seasons is unknown.

Remedial construction will likely follow a two-phased approach. It is anticipated that Phase I remedial construction will require approximately two years. Down time between the end of Phase I construction and the beginning of Phase II construction is expected to be five years. It is anticipated Phase II remedial construction, if necessary, will likely require an additional year.

One of the first components to be constructed is a wastewater treatment facility. Building this facility first allows it to be used to treat stormwater runoff as needed during the remaining construction work. Once construction is complete, the environmental cleanup remedy is anticipated to be in operation until the contaminant concentrations of groundwater and surface water are below the proposed cleanup levels.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

There are no specific plans for additions or expansions of the project. Extensive monitoring will take place to ensure the environmental cleanup remedy is protective of both human health and the environment. Additional cleanup actions and construction

would only be necessary at the Site if monitoring information demonstrates the remedy is **not** protective. In that case, a design change to the remedy may be necessary.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

a. Proposed Plan for Holden Mine Site, Chelan County, Washington. Prepared for Forest Service by Hart Crowser. 2010.
    - (This SEPA checklist is included as an attachment to the Proposed Plan).

b. Remedial Investigation
    - Draft Final Remedial Investigation Report, Holden Mine Site. Prepared for Alumet, Inc. by Dames and Moore. July 28, 1999.

c. Feasibility Study
    - Addendum to the Supplemental Feasibility Study (Forest Service, 2010)
    - Supplemental Feasibility Study (SFS), Holden Mine Site, Chelan County, Washington. Prepared by the Forest Service, Ecology, and EPA. September 2007.
    - Draft Final Feasibility Study, Holden Mine Site. Prepared for Intalco by URS Corporation. February 19, 2004, as modified by the Agencies (Forest Service, August 13, 2007)

d. Holden Mine Site Information Package, Chelan County, Washington. Prepared for EPA National Remedy Review Board by Hart Crowser, Inc. September 1, 2005.

The documents listed above summarize the relevant environmental information for this site. The complete Administrative Record for the Holden Project is available from both the Forest Service and Ecology at the addresses noted in the Proposed Plan.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.

None known.

10. List any government approvals or permits that will be needed for your proposal, if known.

The Holden Mine cleanup is being conducted under the joint authority of the Washington State Model Toxics Control Act (MTCA) [Chapter 173-340 WAC] and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended [CERCLA, 42 U.S.C. § 9601]. For cleanup actions, MTCA states that only the substantive requirements of federal, state, and local regulations that are potential applicable or relevant and appropriate requirements (ARARs) must be met. Cleanups are exempt from procedural requirements that normally are implemented as permits. CERCLA has a similar provision for federal, state, and/or local permits. Therefore, specific permits are not needed for the proposed Holden Mine cleanup action, which is expected to meet the substantive requirements of the potential ARARs.

Potential ARARs to be met by the proposed cleanup action fall into three categories:

1) chemical-specific
2) location-specific

3) action-specific

Potential ARARs have been identified in the Addendum to the Supplemental Feasibility Study; the key potential ARARs are summarized below:

Chemical-Specific

- National Recommended Water Quality Criteria [Federal Water Pollution Control Act (Clean Water Act) 33 USC § 1314(a), Section 304(a)].
- National Toxics Rule [40 CFR Part 131].
- Maximum Contaminant Levels and National Maximum Contaminant Level Goals [40 CFR Part 141].
- Washington State Drinking Water Standards [RCW 119A; Chapter 246-290 WAC].
- Washington State Water Quality Standards for Surface Water [RCW 90.48; Chapter 173-201A WAC].
- Washington State Model Toxics Control Act [RCW 70.105D; Chapter 173-340 WAC].

Location-specific

- Aquatic Lands Management - Washington State [RCW 79.90; Chapter 332-30 WAC].
- Clean Water Act (CWA), Section 401 and 404 [33 USC 1344, 40 CFR Part 230, 33 CFR §§ 320-330].
- Endangered Species Act [16 U.S.C. §§ 1531 - 1544].
- Executive Order 11990 - Protection of Wetlands.
- Executive Order 11988 - Protection of Floodplains.
- National Forest Management Act [16 USC §§ 1600 – 1614] (NFMA) and Land and Resource Management Plan for Wenatchee National Forest (LRMP, Forest Service 1990), as Amended by Pacific Northwest Forest Plan (NWFP 1994) and subsequent amendments of the NWFP (2001, 2004, and 2007).
- National Forest "Roadless Rule" [United States Department Of Agriculture Secretary's Memorandum 1042-154, *Authority to Approve Road Construction and Timber Harvesting in Certain Lands*, dated May 28, 2009].

Action-specific

- Washington Model Toxics Control Act [RCW 70.105D; Chapter 173-340 WAC].
- Resource Conservation and Recovery Act [42 USC § 6901], Subtitle C - Hazardous Waste Management [40 CFR Parts 260 to 279], and Subtitle D - Managing Municipal and Solid Waste [40 CFR Parts 257 and 258].
- Washington State Hazardous Waste Management Act and Dangerous Waste Regulations [RCW 70.105; Chapter 173-303 WAC].
- Washington State Solid Waste Handling Standards [RCW 70.95; Chapter 173-350 WAC].
- Federal Water Pollution Control Act--National Pollution Discharge Elimination System [Clean Water Act; 33 USC § 1342, Section 402].

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

The preferred cleanup action for the Site is presented in the Proposed Plan, of which this SEPA checklist is an appendix. The Proposed Plan was prepared by the Agencies acting in

accordance with CERCLA, 42 USC 9601 et seq., as amended, and the regulations promulgated thereunder at the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300; the MTCA, RCW 70.105D.010-.921, and the regulations promulgated thereunder at Chapter 173-340 WAC; and the State Environmental Policy Act (SEPA), Chapter 43.21C RCW.

The total area disturbed by historical mining activities is approximately 125 acres. The proposed cleanup action includes construction and operation of collection systems (ditches, groundwater barrier walls, drains, etc.) for treating metals-laden water discharging from the underground mine and groundwater impacted by the mine, mill tailings, and waste rock. The work also involves relocation of a segment of the Railroad Creek channel adjacent to the tailings piles. Groundwater at the Site would be collected using a barrier wall and collection system to reduce the amount of contaminated groundwater that would otherwise enter Railroad Creek. The Site waters collected would be treated by an acid neutralization process to remove metals. The metals removed would become a stable metal hydroxide sludge to be disposed of on the Site. The proposed cleanup action also includes regrading of tailings pile and waste rock piles, excavation and disposal of soils that exceed cleanup levels, capping some contaminated soils to isolate them from the environment, and permanent closure of the tailings and waste rock piles to limit potential for future releases.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The Site is located in Chelan County in north central Washington, occupying portions of Sections 7, 8, 17, and 18, T 31 N, R 17 E, and Sections 12 and 13, T 31 N, R 16E. The former mine is located in the Railroad Creek valley about 10 miles upstream (west) of Lake Chelan, on the eastern slopes of the Cascade Mountains. The Site is situated within the Wenatchee National Forest, and the Glacier Peak Wilderness generally bounds the Site to the west, north, and south. Please refer to Figure 1 of the Proposed Plan for a Vicinity Map of the Site.

The former mine operations area of the Site extends over an area of about 125 acres, not including some smaller, outlying areas that have also been impacted by historical mining (e.g., Honeymoon Heights). Principal features of the Site include the underground mine, remnants of the former mill building (the mill structure was largely destroyed by a fire after the mine closed), main east and west waste rock piles that extend over about 8 acres, and piles of tailings (sandy waste material left from the former mill operation) that extend over about 90 acres. Holden Village, Inc. (a not-for-profit corporation) has operated an interdenominational religious retreat community since the 1960s in the former miner's Village of Holden, just north of the former mine operations area. See Figure 3 of the Proposed Plan for principal Site features. See Figure 14 for the principal remedial components of the proposed cleanup action.

B. ENVIRONMENTAL ELEMENTS

1. **Earth**

a. General description of the site (circle one): Flat, rolling, hilly, steep slopes, **mountainous**, other . . . . . .

The Site is situated in the Railroad Creek Watershed. The watershed is generally oriented in an east-west direction within the Cascade Mountain Range, and is approximately 20 miles in length. The drainage is glacially carved and is generally U-shaped with relatively steep side slopes. The portion of the drainage near Lake Chelan is gently sloping at the mouth for about one-half mile, becoming relatively steep with several waterfalls for the first few miles. The drainage then transitions to a more moderate gradient past the Site.

b. What is the steepest slope on the site (approximate percent slope)?

The slope angle of a majority of the lower to mid-slopes facing Railroad Creek for Tailings Piles 1 and 3 were observed to range between 22 and 33 degrees (40 to 65 percent slope), with isolated portions of the upper slopes of Tailings Pile 1 in excess of 60 degrees (173 percent slope). The majority of the mid- to upper slopes of the Tailings Pile 2 facing Railroad Creek was observed to be greater than 44 degrees (97 percent slope). The slopes of the waste rock piles are also relatively steep, in some cases approaching 45 degrees (100 percent slope). The proposed cleanup actions include cutting back these steep tailings piles and waste rock slopes to improve stability.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.

Site geology generally consists of stream alluvium and glacial soil materials overlying bedrock within the valley bottom and lower valley walls of the Railroad Creek drainage. The alluvium ranges from silty, sandy gravel to relatively non-silty sand and gravel with cobbles. The glacial materials were interpreted to consist of glacial drift (silt- to boulder-sized material) and basal till (densified glacial silt- to boulder-sized material).

Mining-related materials at the Site consist of tailings from the processing of the ore-bearing bedrock. The tailings consist of fine-grained silt and sand. The Site also includes waste rock piles from development of the underground mine. The waste rock consists of coarse angular rock fragments that include sulfide minerals and some metals, but are generally less mineralized than the ore.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

Previous mass releases of tailings materials into Railroad Creek were reported to have occurred downstream of Copper Creek during a 1966 storm event; and earlier, in 1946, according to Forest Service reports. Another substantial release of tailings materials into the creeks occurred during a flood event in October 2003. During this flood, Copper Creek overflowed and eroded portions of Tailings Pile 1 leading to the release of an estimated 600 cubic yards of tailings material into Railroad Creek. During the same period, scour undermined a section of riprap along the base of the western slope of Tailings Pile 2. Emergency response activities were performed to address some of the conditions caused by the flooding, including increasing the flow capacity of Copper Creek south of the tailings

piles, armoring a portion of the Railroad Creek bank along Tailings Pile 2, removing log and debris jams, and contouring gullies that formed on Tailings Pile 1. In Spring 2006, tailings erosion was again noted along the east side of Copper Creek, located near the confluence of Copper Creek and Railroad Creek, where tailings material as well as native soils had been eroded. There is risk that additional undercutting by Copper Creek in this area could lead to slope failures of Tailings Pile 2, which in this area rises at a grade of about 80 percent to a height of more than 80 feet above creek level. Additionally, extensive erosion has continued on Tailings Pile 1, including some of the areas where gullies formed during the October 2003 flood.

As part of the proposed cleanup action, actions will be taken to minimize the potential for tailings pile slope failures, including surface water run-on and runoff controls; regrading and constructing slope toe buttresses to improve stability of the tailings pile slopes; erosion protection; relocating a segment of Railroad Creek; and moving the toe of the tailings pile slopes an appropriate distance away from Copper Creek and Railroad Creek (where not relocated). Following regrading, the tailings piles would be closed in accordance with Washington standards for limited purpose landfills [Chapter 173-350 WAC], which would include capping the tailings piles, and establishing a permanent self-sustaining vegetative cover to provide erosion protection. Following closure, the tailings piles would be subject to periodic observations to monitor for signs of potential slope failures and the need for any improvement in erosion protection over time. Similarly, the main east and west waste rock piles would also be regraded to improve stability, capped, revegetated, and monitored to assure stability over time.

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.

The proposed cleanup action includes permanent closure of the waste rock and tailings piles to meet Washington State limited purpose landfill requirements as described above.

Final slope inclinations (e.g., 2H:1V) and buttress configurations for waste rock and tailings piles stability needed to satisfy landfill stability requirements will be determined from engineering analyses during the remedial design stage of implementation. This slope inclination needs to account for the tailings pile and waste rock cover material that will be placed on these slopes and the requirement for the cover to be able to sustain native vegetation as part of the state design requirements for a limited purpose landfill. Earthquakes would also need to be considered in the final design of the tailings pile and waste rock slopes and buttresses. The proposed cleanup action involves regrading approximately 385,000 cubic yards (cy) of tailings and 134,000 cy of waste rock.

Tailings material removed from the slopes during regrading would be used as fill and graded to improve surface water runoff on top of the tailings piles. Regrading the waste rock piles would involve disposal of some waste rock on one of the tailings piles prior to closure. The final cover on the regraded waste rock and tailings piles would meet the performance standards for a limited purpose landfill [WAC 173-350-400(3)(e)(i)(A) through (D)], based on acceptable design analyses.

Soil for the cover on the tailing piles and waste rock piles would be obtained from the treatment facility pond excavations, other excavation for remediation (e.g., roadway and

ditch construction), and as needed from a borrow pit (e.g., Dan's Camp) established on National Forest land near the Site. The Agencies estimate that about 285,000 cy of soil would be used as cover for the tailings and waste rock piles. Removal of soil from Dan's Camp will potentially result in habitat impacts, including land disturbance, the removal of timber and other vegetation, over an area of several acres. Measures to mitigate the effects of this soil removal are discussed below in Section B.1.h. While soil removal from Dan's Camp would lead to some habitat impacts, soil placement on the tailings and waste rock piles will benefit terrestrial receptors at the Site by eliminating existing toxicity risks due to exposure to elevated metals concentrations in the tailings and waste rock.

Under the proposed cleanup action about 152,000 cy of riprap would be placed for remedial components including Railroad Creek relocation, Copper Creek channel extension, bank protection/creek stabilization of existing creek channels, and tailings pile buttresses. Potential quarry sites on National Forest land near the Site (e.g., Lightning Ridge) would be evaluated during remedial design to provide a source of the riprap. Mitigation measures for habitat impacts at the selected quarry site are discussed below in Section B.1.h. Additionally, some riprap would be generated during construction to relocate a segment of Railroad Creek.

Soil excavation would occur for the construction of a groundwater barrier wall and collection systems along Railroad Creek in the Lower West Area from the Main Portal discharge point into Railroad Creek to the Copper Creek Diversion and along Tailings Piles 1, 2, and 3. It is anticipated that the barrier wall and collection trench system would be about 8,000 feet in length and could extend as much as 100 to 125 feet below ground surface, depending on the depth of underlying glacial till or bedrock. The groundwater collection system (which includes collection of seeps) would consist of ditch(es), buried trench drain(s), and/or pumped wells, as determined during remedial design. The amount of material excavated for this system, and the suitability for reuse as fill will depend on the information developed during remedial design and construction. Excavated soil, which is unsuitable for reuse due to contamination or gradation, would be disposed of in a limited purpose landfill that would likely be constructed on top of one of the regraded tailings piles.

The east and west wastewater treatment plant sites will require grading and excavation for construction of the facilities, which would include the treatment ponds. Approximately 10 acres would be cleared and excavation would produce an estimated 86,500 cy of soil that would be placed on the tailings piles and waste rock piles as cover material. While the construction of the treatment plants would eliminate some forested habitat at the Site, the treatment of impacted water by the plant once it is operational would reduce toxicity risks to aquatic organisms and improve benthic habitat that is currently degraded by iron precipitation and ferricrete formation.

Excavations of an estimated total of 30,400 cy of soils, tailings, and mill residuals above proposed cleanup levels would occur at the former mill, lagoon area, ventilator portal detention area, ballfield area, and lower west area; and this soil or soil-like material would be relocated to a permanent containment area (limited purpose landfill) on the Site, likely on one of the tailings piles. In the maintenance yard area, soil exceeding proposed cleanup criteria would be capped with a concrete or asphalt slab covering an area of about

an acre. Additional cleanup of soil above proposed soil cleanup levels in other areas such as Holden Village, the Honeymoon Heights waste rock piles, areas downslope of the Honeymoon Heights waste rock piles, and areas of visible accumulations of wind-blown tailings north and east of the mine are also included in the proposed cleanup action. The extent of this additional soil cleanup will need to be determined by additional analyses during remedial design.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Erosion of soil could potentially occur during regrading of the tailings and waste rock piles and placement of the soil cover; during the excavations of the groundwater barrier wall and collection trench systems; during the excavation of contaminated soils in selected portions of the Site; during the excavation and construction of the treatment facility; during road or bridge construction; and during the demolition of the former mill building. All regrading, excavation, demolition, and construction work included in the proposed cleanup action will be performed in accordance with an approved SWPPP that includes best management practices (BMPs) for erosion and sediment control. Stormwater that is impacted by metals runoff would be treated prior to discharge to Railroad Creek.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Approximately one acre of the property will be covered with an asphalt or concrete cover in the area of the maintenance yard. This cover will prevent direct contact, erosion, and infiltration from causing further releases from impacted soils to groundwater, and allow continued use of this area by Holden Village for vehicle maintenance purposes.

Two treatment plants will be constructed at the Site for the treatment of impacted groundwater. The impervious area associated with the completed treatment plants footprint, including lined treatment ponds, will cover an area of approximately 5 acres.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

- Potential erosion during construction would be avoided by implementation of an approved construction stormwater pollution prevention plan (SWPPP) in accordance with Ecology regulations.
- An on-site water treatment facility would be constructed prior to any regrading or excavation of the tailings and waste rock, so the water treatment facilities could be used for detention and treatment of runoff impacted by subsequent earthwork.
- The tailings piles will be regraded and/or Railroad Creek relocated such that the tailings will be sloped and set back from the Railroad and Copper Creeks to reduce the potential for future loss of tailings to the creeks in case of slope failure or flooding.
- A soil cover would be placed on the tops and slopes of the waste rock and tailings piles and revegetated with self-sustaining vegetation to eliminate transport by wind or water erosion.
- Tailings pile and waste rock regrading work would occur concurrently with the placement of the soil cover. In this way, the area of unoxidized tailings that is exposed any time could be minimized, thus reducing risk of stormwater runoff conveying exposed tailings into Railroad or Copper Creeks.

- Dust generation on haul roads and in earthwork construction areas would be mitigated with water trucks.
- Additional riprap would be placed between the tailings piles and the creeks, where existing creek channels are to remain, for stream bank protection to mitigate potential erosion of the tailings piles, and possible other areas where channel migration would threaten the remedy.
- A runoff collection ditch would be installed along the base of the tailings piles, which would enable collection of runoff from the regraded slopes and conveyance to downstream detention and the treatment facility.
- Additional BMPs would be implemented as needed to manage erosion and sediment during construction activities.
- Soils with metals concentrations above proposed cleanup levels would be permanently contained in a limited purpose landfill, which is likely to be located on one of the tailings piles. It should be noted that a groundwater barrier and collection system will be located at the toe of the three tailings piles and will contain groundwater contaminated by the tailings that would otherwise discharge into Railroad Creek. Collected water will be treated prior to discharge to Railroad Creek.
- The release of bentonite or cement used during construction of the groundwater barrier walls, and sediment that might be produce during construction of pipeline stream crossings would be minimized by BMPs, including location of dry materials storage and mixing facilities away from the creek, good housekeeping to minimize spillage during slurry handling, and advance preparation of a spill management contingency plan.
- Habitat impacts at Dan's Camp and at the selected quarry site will be mitigated through pre-construction surveys; avoidance of impacts to mature forest; following National Forest Service weed prevention requirements (further discussed in Section 4.d); and reclamation of the borrow pit and quarry after excavation is completed.

2. **Air**

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

The use of large equipment, such as dozers, excavators, loaders, compactors, and trucks, during implementation of the proposed cleanup action for regrading, excavation, and construction work would result in dust and exhaust emissions. URS, the consultant for Intalco, provided some preliminary air emissions estimates in the DFFS. This information is also used in the Supplemental Feasibility Study and was extrapolated to determine an air emission estimate for the proposed cleanup action based on the total volume of tailings and waste rock that would be regraded. Emissions over the duration of construction are estimated to be on the order of 70 combined tons of particulate matter, nitrogen oxides, hydrocarbons, and carbon monoxide. BMPs will be followed to reduce air emissions during construction.

Once the proposed cleanup action has been constructed, the only likely source of air emissions would be from diesel generators used for the operation of the water treatment plant facility and pumping water and sludge. However, alternative means of producing electrical power will be evaluated during remedial design, and could include hydropower or possibly generators with other fuel sources. If diesel generators are used, is projected that approximately 8,800 gallons of diesel a year would be consumed.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

None known.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

- Water trucks will be used to minimize dust generated from regrading, excavation, and construction work. Additionally, water trucks will be used to minimize road dust.
- The regraded waste rock and tailings piles would be covered with a soil cover, and revegetated, thus reducing long-term wind-blown dust problems.
- Regrading the tailings will be performed in stages with concurrent placement of the soil cover to minimize the potential for wind-blown tailings during construction.
- Regular maintenance will be performed on heavy construction equipment, generators, and other vehicles used to control emissions during construction to assure proper operation, in accordance with state air quality regulations. Typically this would include requirements that gasoline and diesel equipment used on the Site will be less than 5 years old; the equipment will be properly maintained; diesel equipment will use low sulfur diesel (500 ppm or less); and construction measures will be implemented to reduce the idling time of construction equipment.
- Long-term energy requirements for the permanent water treatment system, and alternative sources, such as locally produced hydroelectric generating capacity, will be evaluated during remedial design, to minimize future emissions from the water treatment plant.

3. **Water**

a. Surface:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

There are two streams, Railroad and Copper Creeks, in the immediate vicinity of project activities, as well as multiple ephemeral streams (e.g., Honeymoon Heights area drainages). Copper Creek and the ephemeral streams are tributaries of Railroad Creek, which in turn flows into Lake Chelan. See Figure 4 in the Proposed Plan for the location of these creeks relative to the Site. The proposed cleanup actions will reduce releases of acid and metals from the Site into the two creeks. Wetlands are also located near or within the Site, e.g., just east of Tailings Pile 3. See Figure 4 in the Proposed Plan for the locations of USFS mapped wetlands relative to the Site.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

Refer to Figures 4 and 14 in the Proposed Plan for the location of the principal components of the cleanup action in relation to Railroad Creek, Copper Creek, ephemeral streams, and wetlands. Detailed construction plans will be prepared during remedial design after the Agencies issue the ROD.

There are portions of the Site where the toe of the existing tailings piles are immediately adjacent to or within the flood limits of Railroad and Copper Creeks. As part of the proposed cleanup action, the toe of the tailings will be set back from both creeks to reduce the potential for future erosion of the tailings through a combination of tailings regrading and creek relocation. This requires regrading work adjacent to and within portions of Copper Creek and Railroad Creek adjacent to the tailings piles and where the relocated creek channel will intersect the existing creek channel.

Between the regraded tailings piles and Railroad and Copper Creeks, a groundwater barrier wall and collection system will be constructed in the proposed cleanup action, which will intercept and prevent metals-laden groundwater from entering the creeks. A groundwater barrier wall and collection trench system will also be placed adjacent to Railroad Creek in the Lower West Area of the Site, between where the mine portal discharges into Railroad Creek and the Copper Creek Diversion. Pipeline crossings across Copper Creek will be constructed to convey the collected groundwater to the east water treatment facility. Additionally, between the tailings piles and Railroad Creek, a road will be constructed to provide access to monitoring wells, surface water runoff controls (such as a stormwater collection ditch), and the groundwater collection systems. The road would also allow access to riprap along the relocated Railroad Creek banks and the tailings piles slopes so that these areas can be maintained in the future.

Along segments where Railroad Creek is not relocated, existing riprap along Railroad Creek would be supplemented with new riprap to construct barbs to reduce bank

erosion and scour adjacent to the bridges and tailings piles. Riprap placement would require stream bank and in-stream work.

Additional work adjacent to Railroad Creek includes the construction of a new vehicle bridge over the creek, and the water treatment facilities. The new bridge would be constructed just east of Tailings Pile 3. The water treatment facility would also be constructed east of Tailings Pile 3, within the footprint of the existing wetland east of Tailings Pile 3. Pipelines would cross beneath Copper Creek to convey contaminated water to the treatment facility. The treatment system would discharge treated groundwater into Railroad Creek via one or more outfalls.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

The majority of the Railroad Creek channel currently adjacent to the tailings piles will be relocated to the north, and the Copper Creek channel will be extended to intersect the relocated channel. No filling activities are currently planned where Railroad or Copper Creeks will remain in their existing channels, except enhancement and extension of existing riprap as described above. Some excavation within the creek channels would be performed to key in the riprap below estimated depth of scour, and to enable construction of a pipeline crossing Copper Creek for the treatment system. No dredging is anticipated, except for removal of ferricrete, which is an existing byproduct of hazardous substances discharged into Railroad Creek adjacent to the tailings piles. However, relocation of Railroad Creek will address currently known occurrences of ferricrete. The mass of ferricrete to be removed would be determined during remedial design, along with completion of a hydrologic analysis to determine the depth of excavation to key in the riprap.

A portion of the wetland area immediately east of Tailings Pile 3 will be filled to accommodate part of the east water treatment system. The rest of the existing wetland will be significantly modified to serve as an engineered wetland component of the water treatment system.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

A groundwater barrier wall and collection system is included in the proposed cleanup action to collect contaminated groundwater from the Site for treatment. This water, which would normally enter Railroad or Copper Creek as baseflow, would be discharged to Railroad Creek downstream of the Site contamination sources, resulting in no substantial decrease in flow within Railroad Creek downstream from the tailings piles.

During construction, surface water will be needed for potable water usage for the construction crew and camp, dust control, and other construction purposes. The Agencies estimated that there will be up to about 50 workers living near the Site during a 5-to 6-month construction season, over two years for Phase I construction and an additional year for Phase II construction. The source of potable water to the construction camp will likely be from Railroad Creek or possibly Copper Creek via the

existing Holden Village intake system, located upstream of the Site. The location of the workers' camp has not been determined but may be located in the baseball field area, unless this location would interfere with the proposed cleanup action, or potentially within Holden Village, if amenable to Holden Village and the USFS per the conditions of Holden Village's special use permit. Another, smaller, potential camp associated with the construction unloading and staging area at Lucerne. In addition, water from the creeks and/or Lake Chelan would be used for dust suppression and production of concrete for construction of the water treatment facility. Water used for construction would be obtained in accordance with the requirements for a temporary water right permit.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

Floodplains have yet to be delineated and will be analyzed during the remedial design phase of the project. Some remedial actions are anticipated to be located within the floodplain of Railroad and Copper Creeks, (e.g., removal of contaminated soils from the lagoon area, excavation and grading of tailings, construction of the groundwater barrier wall and collection system, riprap placement, construction of an access road along the north side of the tailings piles, and construction of a bridge over Railroad Creek). However, these activities are estimated to be completed within two years for Phase I and an additional year for Phase II construction, and will not diminish flood capacity of the existing creek channels. Additionally, changes to floodplains will occur due to relocation of a segment of Railroad Creek which will need to be addressed during remedial design.

The floodplain analysis to be conducted during remedial design will be used to determine proper placement of riprap, and location of the water treatment facilities.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

The proposed cleanup action provides for long-term collection and treatment of groundwater with elevated metals concentrations. Treated water would be discharged from the treatment plant into Railroad Creek. The NPDES regulations are a potential ARAR; and requirements for point source discharges and stormwater runoff are potentially applicable for the Site, any point source discharge of contaminated water (e.g., discharge following treatment of groundwater and portal drainage), stormwater runoff at the Site, and where the construction site involves 1 acre or more.

The treatment plant is expected to operate as long as contaminated groundwater would otherwise discharge into Railroad Creek. Groundwater collected for treatment is estimated to range from about 2.3 million gallons per day during the spring to 1.5 million gallons per day during the fall months. Treatment would be required to use all known available and reasonable technologies (AKART) to achieve proposed cleanup levels in the treated water discharge. Based on reported experience with similar treatment systems at sites with similar influent water quality, anticipated order of magnitude metals concentrations in the treatment system effluent for the Site's

constituents of concern are shown below, followed by the proposed cleanup level in parentheses[1]:

- Aluminum: 100 to 1,000 ug/L (152 ug/L);
- Cadmium: 0.03 to 3 ug/L (0.09 ug/L);
- Copper: 10 to 100 ug/L (1.17 ug/L)[2];
- Iron: 200 to 2,000 ug/L (1,000 ug/L);
- Lead: 0.1 to 1 ug/L (0.54 ug/L); and
- Zinc: 30 to 300 ug/L (11 ug/L).

Comparing these anticipated ranges in effluent values with the respective proposed surface water cleanup levels, iron and lead concentrations in the effluent may meet the proposed cleanup levels, whereas concentrations of aluminum, cadmium, copper, and zinc may not. However, the anticipated range in metal concentrations in the effluent are much lower, often two orders of magnitude, than the blended influent to the treatment plant of groundwater (including the portal drainage) collected from the Site, which represents a net improvement in water quality.

b. Groundwater:

1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.

Some groundwater (including portal discharge) that would usually discharge into Railroad Creek from the Site would be intercepted and collected for treatment and be discharged at the treatment system outfall. Based on mass-loading analysis for the Site, the Agencies predicted that approximately 620 million gallons per year of contaminated groundwater would be collected and treated prior to be being discharged into Railroad Creek.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

Metal hydroxide sludge generated in the process of treating the contaminated groundwater will be disposed of in a limited purpose landfill located on one or more of

[1] Note proposed cleanup values are adjusted for background and hardness where applicable. Note that use of a mixing zone may be appropriate for the treated effluent discharge, as discussed in Appendix F of the SFS.

[2] The Aquatic Life Ambient Freshwater Quality Criteria--Copper 2007 Revision (EPA-822-R-07-001), (the "2007 copper criterion") was published in the Federal Register on February 22, 2007. The 2007 copper criterion provides a basis to determine acute and chronic concentrations for protection of aquatic organisms based on the Biotic Ligand Model. The model determines concentrations that are protective based on an analysis of ambient conditions for a number of parameters. To date, relatively few data have been collected at the Site to provide a basis for predicting acute and chronic copper concentrations for Railroad Creek under this criterion. The Agencies anticipate the cleanup level established at the time of the ROD would be based on the background concentration for dissolved copper in accordance with WAC 173-340-730(5)(c), and that this could be modified in accordance with ARARs based on additional data collection following implementation of the remedy.

the tailings piles. The annual volume of sludge produced by treatment will vary over time, both because of changes in the amount of metal in the groundwater to be treated, but also as the sludge consolidates under its own weight. The Agencies estimated that a total of about 10.6 million gallons of sludge would be removed from the east and west treatment system ponds the first year of operation, with a solids content of about 4 percent. Annual sludge generation is anticipated to decrease over time. Estimates of the volume sludge generated will be revised based on on-going pilot treatment studies at the Site. After placement in a landfill cell, and consolidation, the sludge would have a solids content of around 20 percent and would occupy less than a fifth of its initial volume.

Site-specific sludge characterization will need to be conducted during initial start-up of the treatment plant. Sludge characterization conducted at other mine sites has indicated that sludge from the same type of treatment process, which would be used at Holden, is chemically stable and that leachate produced from sludge consolidation is alkaline with metals concentrations in the leachate typically well below the level needed to protect groundwater at the Site. The on-site landfill would conform to the standards for limited purpose landfills [WAC 173-350-400], including a liner and leachate collection system.

During construction, wastewater will be generated in the construction crew camp and will be discharged into the ground through a septic tank. The location of the workers' camp has not been determined but may be located in the baseball field area, unless this location would interfere with the proposed cleanup action, or potentially within Holden Village, if amenable to Holden Village and the USFS per the conditions of Holden Village's special use permit. Another, smaller, potential camp associated with the construction unloading and staging area at Lucerne.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

During tailings regrading, stormwater runoff will be collected in a ditch downgradient of the tailings piles and conveyed to the treatment system, prior to discharge to Railroad Creek.

2) Could waste materials enter ground or surface waters? If so, generally describe.

Construction will incorporate BMPs to reduce risk of wastes being discharged to groundwater or surface waters. No waste material would intentionally be discharged except water that has been treated in the proposed on-site water treatment facility.

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

- Metals-impacted groundwater (including seeps and portal drainage) from all known sources above proposed cleanup levels at the Site would be collected for treatment before being discharged into Railroad Creek.
- Refer to the list of erosion reduction and control measures in Section B.1.h above that are also mitigation measures for water quality impacts at the Site.
- Work would be performed in accordance with potential ARARs (see Section A.10). A construction SWPPP for the Site would be prepared and implemented. Typically this would include requirements such as having the hydraulic and fuel systems for heavy equipment used for work along the stream bank and in-stream work have their oil and fuel lines inspected for leaks prior to use. Equipment used for in-stream work will be required to use synthetic or vegetable-based biodegradable lubricants and hydraulic fluids.
- Spill prevention and containment requirements would be required by construction contract documents. Requirements that oil and fuel spill containment supplies (floating absorbent booms, absorbent pads, etc.) must be on site during work, would be subject to verification by the Agencies construction inspector(s).
- All heavy equipment and support vehicles that cross Railroad Creek and/or are used for stream bank or in-stream work will need to be cleaned of any oil, grease, or hydraulic fluids that may come in contact with creek water during the crossing.
- Mitigation of construction impacts associated with riprap placement and ferricrete removal would help restore Railroad Creek to more natural flow conditions where the existing channel will remain, such as existed prior to deposition of the tailings. Appropriate design standards based on potential ARARs will be used for any stream channel modifications and relocation. This could include pools or woody debris to reduce the creek velocity and creating slow water habitats. New riprap added along the existing creek and as part of the banks of the relocated creek will be used to construct barbs to reduce bank erosion and scour adjacent to the bridges, Lucerne-Holden Road, and tailings piles. During remedial design, a hydrologic/geomorphic study will be performed to support design of riprap along existing Railroad and Copper Creek channels, as well as the relocated segment of Railroad Creek and extension of Copper Creek. Channel modifications and riprap installation will reduce reliance on deteriorated riprap and log cribbing that exists west of Copper Creek. Woody debris will be installed, and disturbed areas of the bank would be planted to restore or establish the riparian corridor to pre-mining conditions.
- Ferricrete formations within Railroad Creek will be addressed through removal and/or creek relocation to restore aquatic habitat.

The proposed cleanup action includes construction of source control measures to reduce future metals releases to groundwater. Source controls include removal of contaminated soil by excavation of soils that exceed proposed cleanup criteria from the lagoon, mill building, ventilator portal detention area, and removal or other cleanup of soils above proposed cleanup levels in the Lower West Area, Holden Village, the baseball field, or areas of visible accumulations of wind-blown tailings north and east of the mine. Excavations would be backfilled with clean soil obtained from the water treatment facility, other necessary excavation or Dan's Camp, and revegetated. Source controls would also include capping the tailings and waste rock piles, and soils above proposed cleanup levels in the maintenance yard area.

4. **Plants**

a. Check or circle types of vegetation found on the site:

X deciduous tree: alder, maple, aspen, other
X evergreen tree: fir, cedar, pine, other
X shrubs
X grass
____ pasture
____ crop or grain
X wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
____ water plants: water lily, eelgrass, milfoil, other??
X other types of vegetation. See attached Table 4.6-5 from the Remedial Investigation report.

b. What kind and amount of vegetation will be removed or altered?

Regrading activities will require removal of trees and shrubs on the slopes and tops of the tailings piles. Existing vegetation currently covers less than about 20 percent of the tailings piles that extend over about 90 acres; these trees and shrubs were planted during previous reclamation work, or to a lesser extent have developed naturally. Closure of the tailings piles would include placement of a soil cap, and revegetation as discussed in Section 4.d below. In addition a total area of about 10 acres of mixed trees and shrubs would be removed from the Lower West Area and the wetlands east of Tailings Pile 3 for construction of the west and east water treatment facilities. Other incidental clearing would be performed to construct or improve run-on diversion swales along the south side of the Site, other construction access, and in areas used for construction staging, and temporary worker's camp(s). Remedial construction may include construction staging and/or a temporary construction workers' camp on roads in the former Winston Townsite and/or the ball field, unless this would interfere with the cleanup. Location of staging area(s) and camp will be determined during remedial design. The proposed location for the workers' camp and staging areas would minimize impacts to vegetation in the National Forest.

c. List threatened or endangered species known to be on or near the site.

Special status species were reviewed in the Remedial Investigation report. Tables 4.6-11 and 4.6-12 from that report are attached and provide a listing of these species (both animals and plants) that may occur in the vicinity of the Site, along with their potential to occur in the project area. Tables 4.6-13 through 4.6-15 from that report list Forest Service Survey and Manage species (both animals and plants) with potential to occur in the project area. The list of special status species is revised from time to time in accordance with procedures described in the potential ARARs. The most current lists will be incorporated into remedy planning at the time the ROD is prepared and, thereafter, will be amended as required.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

The Agencies will review and approve the final revegetation plan. Plants currently being considered for revegetation include alders, western white pine, Douglas fir, ponderosa pine, red osier dogwood, and vaccinium.

- The tailings and waste rock piles would be revegetated with the appropriate plant species to be determined during remedial design.
- Riprap placed along the existing Railroad Creek corridor and the relocated segment of Railroad Creek would be revegetated with appropriate riparian vegetation using tublings. The tublings would help protect shoots from browsing animals immediately after planting and are a cost-effective method of planting.

Forest Service weed prevention requirements will be followed to control the spread of noxious weeds during implementation of the proposed cleanup action. These practices include:

- Certifying that equipment used for the project is free of any weeds before the equipment is mobilized to the Site; and
- Inspection and approval for all gravel, fill, quarries, and borrow sources before use and transport. If weeds of concern are present, they will be treated before transport and use. Where weeds occur at borrow pit sites used for the project, the top 8 inches of soil will be removed, stockpiled, and treated for weeds.

Terrestrial monitoring would occur to verify remedy protectiveness, habitat restoration, and the success of revegetation. Details are included in the Conceptual Monitoring Program for the Site, included as Appendix H to the SFS.

5. **Animals**

a. Circle any birds and animals which have been observed on or near the site or are known to be on or near the site:

birds: The attached Tables 4.6-7 and 4.6-8 from the remedial investigation report include listings of avian species observed and potentially occurring at and in the vicinity of Holden Mine.

mammals: The attached Tables 4.6-9 and 4.6-10 from the remedial investigation report include listings of all species observed, probably present, and possibly present at Holden Mine.

fish: Fish communities observed in Railroad Creek during the Remedial Investigation include the following: cutthroat trout (*oncorhynchus clarki* spp.), rainbow trout (*O. mykiss*), mottled sculpin (*Cottus bairdi*); and (in lower Railroad Creek) Kokanee salmon (*O. nerka*).

amphibians, lizards and snakes: The attached Table 4.6-6 from the Remedial Investigation report lists species likely to occur within the Railroad Creek drainage.

b. List any threatened or endangered species known to be on or near the site.

Special status species were reviewed in the Remedial Investigation report. Tables 4.6-11 and 4.6-12 from that report are attached and provide a listing of these species (both animals and plants) that may occur in the vicinity of the Site, along with their potential to occur in the project area. Tables 4.6-13 through 4.6-15 from that report list Forest Service Survey and Manage species (both animals and plants) with potential to occur in the project area. An updated list will be obtained at the time of the ROD.

c. Is the site part of a migration route? If so, explain.

The Site is located in the Railroad Creek valley. Valleys such as the Railroad Creek valley are unique habitats within the Chelan drainage basin as they have big meanders, a low gradient for long stretches, backwater areas, and could easily provide migration stopover habitat. The location of this forest at middle elevations in a low-gradient portion of a large glacial valley provides an ideal situation for development of abundant foraging resources, diverse structural components necessary to support reproduction of numerous species, and excellent cover and critical habitat connectivity to facilitate travel between seasonally available resources at low and high elevations. According to Mallory Lenz, a biologist with the Chelan Ranger District, sandhill cranes have been reported in the marshy area along Railroad Creek during their migration period. Deer also use the valley as a migration route.

d. Proposed measures to preserve or enhance wildlife, if any:

Proposed measures to preserve or enhance wildlife populations at the Site include the following:

- Improving water quality and habitat in Railroad Creek by the collection and treatment of groundwater (including portal drainage and seeps) sources above proposed cleanup levels at the Site and relocation of a heavily impacted segment of Railroad Creek adjacent to the tailings piles.
- Regrading to improve stability and pulling the tailings piles back away from the edge of the existing creek channels or relocating the creek channel for protection from flood damage would also improve the riparian corridor along Railroad Creek for wildlife. This increase in area of a riparian corridor along the tailings piles will help mitigate the removal of existing riparian habitat needed to construct and operate the water treatment facilities and the additional potential impacts of the barrier and collection system in the Lower West Area. Measures will be taken to minimize impacts on existing riparian habitat in these areas. Woody debris will be installed along the riparian corridor areas at the Site, and disturbed areas of the existing creek banks and relocated creek segment would be replanted to restore the riparian corridor habitat conditions.
- Source control measures (e.g., cleanup actions for the lagoon, mill building, maintenance yard, ventilator portal detention area, and other areas with soils above proposed cleanup levels) would be implemented to eliminate releases of metals to surface water and prevent direct contact with terrestrial ecological receptors.
- Tailings and waste rock piles would be revegetated to prevent erosion and direct contact, and reduce infiltration. This would have a secondary benefit of creating better habitat.
- Ferricrete formations in Railroad Creek would be broken up and the substrate de-compacted by mechanical ripping to restore aquatic habitat within the existing creek channel, and the relocated creek segment would be design to prevent formation of ferricrete in the new channel.
- The existing channel, typified by relatively straight high velocity sections with log cribbing and riprap berms at the Site, would be modified and the relocated channel designed to reduce potential for future scour and erosion, based on results of a

hydrologic/ geomorphic study during remedial design, and to satisfy potential ARARs.

- Terrestrial and aquatic biological monitoring would be conducted to determine whether the proposed cleanup action is protective and to assess biodiversity and species abundance. Details are included in the Conceptual Monitoring Plan for the Site, included as Appendix H to the SFS.

6. **Energy and natural resources**

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Final energy requirements and the best source(s) to provide energy for long-term operation and maintenance for the collection and treatment system would be determined during remedial design. This is likely to involve a combination of energy sources; such as locally generated hydroelectricity for running pumps with diesel generators as backup; and diesel- or gasoline-powered vehicles for maintenance of groundwater collection ditches and disposal of sludge from the water treatment facility.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No. The project would not create shaded areas that would affect nearby properties.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

The proposed water treatment facility would use large ponds for sedimentation following acid neutralization to remove dissolved metals, and solar drying to help dewater the sludge. Feasibility of these and other treatment system components needs to be verified during remedial design. The treatment systems would rely on gravity flow (rather than pumps) to the extent practicable.

7. **Environmental health**

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

The proposed cleanup action summarized in the Proposed Plan is intended to cleanup and control releases of hazardous substances and mitigate associated environmental health hazards resulting from past mining operations that have caused an ongoing release of hazardous substances from the Site.

Chemicals to be stored and used at the Site during construction and for the lifetime of the project include diesel and gasoline fuel for vehicles, and hydrated lime for neutralization of the acid mine drainage. Diesel fuel may be used to operate treatment system pumps for water and sludge. Lime would be used to reduce acidity in the groundwater treatment process. The Agencies estimate that long-term operation of the treatment system would require an energy equivalent of about 8,800 gallons of diesel fuel per year. In the early

years of remediation, an estimated 2,300 tons of lime would be used each year for neutralization of the acid mine drainage.

1) Describe special emergency services that might be required.

Normal medical emergency services that are typical of large construction projects could be required during construction of the proposed cleanup action. Provision of emergency services would be addressed in the site-specific construction health and safety plan. Since the Site is in a very remote location, contact with police, fire departments, or medical emergency responders would need to be via satellite phone.

2) Proposed measures to reduce or control environmental health hazards, if any:

Implementation of the proposed cleanup action would be performed in accordance with a site-specific health and safety plan, and a SWPPP. Remedial actions to address Site contamination are detailed in the Proposed Plan (this SEPA checklist is an attachment to the Proposed Plan).

b. **Noise**

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

The Site is located within the National Forest with limited local habitation. The predominant source of noise in the area currently consists of human-generated noises from Holden Village activities, including buses, motorized equipment and vehicles, and occasional chain saws, generators, and construction-related noise. These noises would not affect the remedial action.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Noise generated from the project has the potential to impact both people and wildlife. The DFFS provides some preliminary analysis of noise from construction and operation activities associated with implementation of different remedy alternatives, particularly with regard to impacts to Holden Village. While this preliminary analysis did not include the proposed cleanup action, construction and operation activities are similar and, therefore, the DFFS analysis is relevant and is discussed below.

In the short term, noise associated with traffic, heavy construction equipment (dozers, excavators, loaders, compactors, and trucks), and generators would be created during construction of the remedy, for portions of 3 years, during typical 5- to 6-month construction seasons. No construction work for the proposed cleanup action is anticipated to occur at night. Most vehicle traffic would be diverted around Holden Village. Peak construction noise levels at the Holden Village perimeter were estimated in the DFFS to be around 53 decibels (“moderate noise”). The average construction noise level at the Village perimeter was estimated to be around 47 decibels (“faint noise”). Noise from

heavy construction equipment would occur during tailings pile and waste rock regrading, construction of the treatment facilities, construction of the groundwater barrier wall and collection system, source control (e.g., removal of contaminated soil) in various areas of the Site, demolition of the mill building, creek relocation, and other remedial actions taken at the Site. Additionally, noise and vibration from potential blasting where the relocated channel is anticipated to be in bedrock adjacent to Tailings Pile 2 will be noticeable at Holden Village during construction. Further details on the remedial actions are described in the Proposed Plan. Noise and vibration from the borrow pit and riprap quarry operations may also be noticeable at Holden Village during construction depending on the locations selected, and will likely have some potential impact on wildlife surrounding these areas.

In the long term, noise would be associated with operation of the treatment plant, sludge disposal, and maintenance of the remedial action. The treatment plant will likely require a generator (diesel or hydroelectric) that will be necessary for some treatment processes, such as pumping water and sludge disposal. Fuel and lime would be delivered to the treatment facility by truck on a regular basis as well. Regular maintenance activities would also include construction vehicles (such as a backhoe) for maintaining the collection system and upgradient diversion swales.

3) Proposed measures to reduce or control noise impacts, if any:

Measures to reduce or control noise impacts to Holden Village from the project include:

- A majority of vehicle traffic would be diverted around Holden Village during construction of the Proposed Plan.
- Construction activities are anticipated to be limited to daytime operations.
- The larger of the treatment plants (i.e., east treatment plant) would be located over a half mile from the eastern edge of Holden Village. The west treatment plant would be located approximately 1000 feet west of the western edge of Holden Village.
- For the east treatment plant trucks delivering fuel and lime would not have to go through the village. For the smaller west treatment plant trucks delivering fuel and lime may use access roads established during construction to bypass the village and/or may need to pass through the village.
- Generator(s) associated with the treatment plants would be located inside a sound dampening structure.
- The location of the workers' camp has not been determined but may be located away from Holden Village in the baseball field area, unless this location would interfere with the proposed cleanup action, or potentially within Holden Village, if amenable to Holden Village and the USFS per the conditions of Holden Village's special use permit. Another, smaller, potential camp associated with the construction unloading and staging area at Lucerne.

Measures to reduce or control noise impacts to wildlife from the project would include annual wildlife surveys and timing restrictions during high impact activities. Treatment activities causing noise above ambient levels and located within 1/4 mile of specified areas (e.g. suitable spotted owl nesting, roosting, and foraging habitat) would be conducted outside of the primary nesting season (March 1 - July 31), unless surveys have been completed and for example, spotted owls are not located within the suitable habitat. Surveys are conducted over a two-year survey period, and are considered current for two years following completion of the surveys. If any of the specified areas would actually be removed or disturbed under the remedy, then the timing restriction changes, and activities would be revised accordingly. Such measures would be implemented in accordance with the Land and Resource Management Plan for Wenatchee National Forest as Amended by Pacific Northwest Forest Plan (NWFP, 1994) and subsequent amendments of the NWFP (2001, 2004, and 2007), and other potential ARARs.

8. **Land and shoreline use**

a. What is the current use of the site and adjacent properties?

The Site is situated on National Forest System Lands administered by the Okanogan-Wenatchee National Forests, and on patented mining and mill site claims (private land) owned by Holden Village, Inc. Affected areas of public land would continue to be managed as part of the National Forest following implementation of the proposed cleanup action. The Forest Service has withdrawn the area around

the Site from mineral entry. The withdrawal includes approximately 1,265 acres of National Forest land from location and entry of new mining claims under the United States mining laws [30 U.S.C. Ch. 2] (1994). A legal description of the mineral withdrawal is provided in BLM Public Land Order No. 7533 [67 FR 50894].

Holden Village, Inc. currently occupies and runs a non-denominational religious retreat in the former mining company town under a special use permit from the Forest Service. This community includes approximately 60 Holden Village staff that reside in the Village year round, and during the summer months, the combined staff and visitor population can be on the order of 500 people at any given time. The Holden Village community relies on their incoming and outgoing visitor population to contribute to the ongoing maintenance work necessary to sustain operations and various programmatic services essential to their ongoing mission. In this way, the community is very unique and fragile, and cannot remain viable if made to endure long stretches of construction work where visitors are not able to be accommodated. Holden Village has indicated it is in their best interest to temporarily close during peak remedy construction periods, and then resume operations at a similar level after implementation of the proposed cleanup action. Excluding visitors and staff of Holden Village, seasonal visitors include recreational users of the National Forest (e.g., hikers, fisherman, hunters, horse campers). After construction, it is expected that the Railroad Creek Watershed will continue to be occupied by at most a few hundred permanent residents, along with seasonal visitors on the order of 5,000 to 10,000 persons each year.

The Village utilizes portions of the former mine operations area of the Site (primarily on the patented claims) for various infrastructure, including a vehicle maintenance yard and garage, hydroelectric power plant, potable water treatment facility, recycling, solid waste storage, firewood staging area, and portable sawmill. The Village uses the surface of the West Waste Rock Pile for the storage of miscellaneous materials and solid waste. There are several hiking trails throughout the area, and Holden Village residents and/or visitors use parts of the mill site and tailings piles for recreational purposes on an occasional basis.

b. Has the site been used for agriculture? If so, describe.

No.

c. Describe any structures on the site.

Structures located on the south side of Railroad Creek at the Site include the mill building, a small building that was formerly operated by Holden Village as a museum, Holden Village's maintenance shop, hydroelectric power plant, and potable water treatment facility. There are approximately 25 Holden Village structures located on the north side of Railroad Creek. See Figure 3 of the Proposed Plan for building location and approximate footprints.

d. Will any structures be demolished? If so, what?

The former mill building would be demolished in whole or in part as needed to remove contaminants, as described in the proposed cleanup action. The mill building burned after

the mine closed, leaving exposed steel beams, intermittent concrete walls, foundation elements, and unprocessed ore and mineral salts present on the surface of abandoned tanks and other equipment. Some demolition will be necessary within an area of one to two acres to safely remove soils and mineral processing residuals that are above proposed cleanup levels.

e. What is the current zoning classification of the site?

The Chelan County Code is potentially applicable to the private portions of the Site and not applicable to USFS federal lands. The majority of the Site is located within the Wenatchee National Forest and is subject to the Wenatchee Forest Land and Resource Management Plan. For the privately owned portions of the Site, the current zoning classification is commercial forest, according to the Chelan County Planning Department.

f. What is the current comprehensive plan designation of the site?

For the private portions of the Site, the current comprehensive plan designation is commercial forest, according to the Chelan County Planning Department.

g. If applicable, what is the current shoreline master program designation of the site?

Not applicable for the Site.

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.

Formal delineation studies have not been conducted, but the area downstream of Tailings Pile 3 includes riparian wetlands. The Railroad Creek valley in the vicinity of Holden is a glacially carved, broad, relatively low-gradient valley. Photos and topographic maps from prior to development of the Holden Mine depict a meandering stream with a well developed floodplain and multiple channels in the area where the mine was constructed. Where the tailings piles are currently located, the valley floor was a relatively flat, wetland meadow. Farther upstream from the tailings piles, the stream channels were interwoven through riparian forest. The valley is bounded on both the north and south sides by steep mountainsides covered with conifer forest on undisturbed slopes, and deciduous vegetation in areas disturbed by humans and by natural processes, such as avalanche and landslide paths. This forest provides habitat for a multitude of riparian-dependent species, and important resources for both riparian and upland species.

The area where the mine operated is the largest of only a few floodplain valley reaches in the Railroad Creek drainage. Moreover, this is one of the few floodplain valleys in the entire Lake Chelan drainage, and so it is important to the overall ecology of the Lake Chelan Basin.

i. Approximately how many people would reside or work in the completed project?

The residential population of the Site, i.e., Holden Village, are not expected to be altered significantly after construction of the proposed cleanup action is completed (see Section B.8.a. above). Treatment plant operation and Site monitoring are expected to require one person working part-time under normal conditions, with up to several people potentially involved on occasions for monitoring or maintenance activities.

j. Approximately how many people would the completed project displace?

None.

k. Proposed measures to avoid or reduce displacement impacts, if any:

Not applicable.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

Remedial actions associated with the proposed cleanup action are expected to enhance the existing and projected land uses. Treatment of impacted groundwater, source control actions, and planned vegetation measures are expected to beneficially impact aquatic and terrestrial species.

The Agencies understand that Holden Village, Inc. has legitimate concerns for the viability of its operations if remedial construction results in closure or significantly constrains operations of the Village for more than two consecutive years, or if there is a second closure within five years of the conclusion of the first construction period. The Agencies are sensitive to this request. Ultimately, Intalco will develop a proposed remedy construction schedule, which is subject to Agency approval. However, the Agencies will strive to ensure that the schedule is consistent with the expressed preferences of Holden Village, and the preferred alternative (Alternative 14) proposes implementing remedy construction in two phases. Under this approach, a two-year phase one would be followed by a five-year break before phase two.

9. **Housing**

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

No permanent housing would be provided for any income category. Remedial construction may include a temporary construction workers' camp in an area that would not interfere with the cleanup. Location of staging area(s) and camp will be determined during remedial design. Estimates by the Agencies indicate the camp would house a peak population of about 50 people for up to 5 to 6 months annually for construction over the Phase I (2-year) and Phase II (1-year) construction periods.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

No housing would be eliminated with implementation of the proposed cleanup action.

c. Proposed measures to reduce or control housing impacts, if any:

The temporary construction camp would be removed following completion of the proposed cleanup action. No permanent impacts are expected to be associated with providing temporary housing during construction.

10. **Aesthetics**

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

Single-story buildings associated with the east and west treatment plants would be added to the Site. The building has not yet been designed/purchased. Other structures would include lime storage and generator facilities associated with the east and west treatment facilities. Dimensions of these structures would be determined during remedial design. The east treatment plant would be located approximately one half mile east from Holden Village, and the west treatment plant would be located approximately 1000 feet west from Holden Village. Portions of the east facility may be visible from the road, and portions of the west treatment facility will likely be visible from the road.

b. What views in the immediate vicinity would be altered or obstructed?

No views are expected to be obstructed by the treatment plant complex.

c. Proposed measures to reduce or control aesthetic impacts, if any:

Vegetation screens would be maintained during construction between the treatment plants and the main road to minimize potential aesthetic impacts.

11. **Light and glare**

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

The constructions season for the proposed cleanup action is anticipated to occur over periods of 2 years for Phase I and 1 year for Phase II construction, approximately 5 to 6 months per year to avoid winter conditions at the Site. Lighting for construction activities may be required early in the morning or late in the evening, depending on the type of activity (e.g., maintenance of construction equipment) and time of the year the work is occurring.

No artificial outdoor lighting is anticipated to be needed once construction of the proposed cleanup action is complete.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

None expected.

c. What existing off-site sources of light or glare may affect your proposal?

None.

d. Proposed measures to reduce or control light and glare impacts, if any:

N/A

12. **Recreation**

a. What designated and informal recreational opportunities are in the immediate vicinity?

The Site is located on National Forest System Lands and is bounded to the west, north, and south by the Glacier Peak Wilderness Area. Typical recreational activities of this National Forest land include hiking, fishing, hunting, camping, etc. Holden Village residents and/or visitors use parts of the Site and tailings piles for recreational purposes on an occasional basis.

b. Would the proposed project displace any existing recreational uses? If so, describe.

No existing recreational uses expected to be permanently eliminated by implementation of the remedy. The Agencies anticipate there would be temporary trail closures as well as interruption of some Holden Village activities on the south side of Railroad Creek during construction.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

Limits and duration of temporary trail closures and other curtailment of Holden Village activities on the south side of Railroad Creek would be determined during remedial design. Following implementation of the remedy, fish populations in Railroad Creek are expected to increase, and could lead to increased recreational use of the area.

13. **Historic and cultural preservation**

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.

A "Draft Determination of Eligibility Report," dated 1991, was prepared by the USFS and nominated the Holden Mine Historic District to the National Register of Historic Places, focusing on the Holden Mine mill and mine complex with its associated buildings and features, the Holden Village townsite, and the outlying properties known as Honeymoon Heights and the Winston home sites. This report recommended that the District be expanded to include sites at Lucerne. It was submitted in 2001 to the State Historic Preservation Office. In May 2001, the State Historic Preservation Office (SHPO) concurred that Holden Village was eligible, but did not indicate whether the entire Holden Mine Historic District was eligible. Concurrence on the eligibility of the district is still pending.

Any proposed modifications to the structures and/or immediately surrounding areas are required to be reviewed by the USFS and SHPO. A Section 106 report will be prepared for the proposed cleanup action.

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

Proposed historic landmarks including the Holden Mine mill and mine complex with its associated buildings and features, the Holden Village townsite, and Honeymoon Heights and the Winston home sites are located within or adjacent to the Site. An assessment of the Holden Mine is provided in the historic district nomination document.

c. Proposed measures to reduce or control impacts, if any:

Any proposed modifications to the structures and/or immediately surrounding areas are required to be reviewed by the USFS and SHPO. Demolition of the derelict mill building will be limited to what is needed to safely perform cleanup of residual processing wastes and impacted soil under and around the mill structures.

14. **Transportation**

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

The Site is accessed by a dirt road that originates at Lucerne and extends west on the north side of Railroad Creek (See Figure 2 of the Proposed Plan). Lucerne is located on Lake Chelan at the mouth of Railroad Creek and can only be reached be reached via a passenger ferryboat service, or by private boat or float plane.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

No public transit is available within or connecting to Holden. Lucerne is accessible by commercial ferry on a regular basis, the ferry dock is about 11 miles east of the former mine.

c. How many parking spaces would the completed project have? How many would the project eliminate?

No parking is eliminated as part of this project. Holden Village will be able to continue to use the existing vehicle maintenance yard, which would be paved under the proposed cleanup action.

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).

The Agencies anticipate that improvements and maintenance to the existing road between Lucerne and Holden Village would be necessary. For example, the bridge at Ten-Mile Creek would need to be improved to withstand the increased traffic load associated with construction traffic and equipment. Also the surface of the dirt road would require gravel application and grading after and/or during construction of the proposed cleanup action. Improvements will also need to be made to existing roads at the Site. A bridge would also be constructed across Railroad Creek at the east end of Tailings Pile 3. This bridge may be temporary for use during construction of the proposed cleanup action, or could be permanent, subject to determination by the Agencies during remedial design.

A gravel-surfaced maintenance access road would be constructed along the toe of the tailings pile associated with the groundwater collection system. This road would be

accessible only for construction in the short term, and maintenance and monitoring activities for the proposed cleanup action in the long term.

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

Based on the remote access to the Site, construction and operation equipment, fuel, and lime would be transported by barge from Chelan to Lucerne where it will then be transported up valley to the Site by truck. The barge use required for this project could impact residents around Lake Chelan by increasing commercial traffic on the lake, and possibly by decreasing the occasional or overall availability of barges for non-construction activity. The greatest potential impacts would occur during construction of the remedial action, a 5- to 6-month construction season each year over a period of about two years for Phase I construction and an additional year for Phase II construction, as heavy equipment and supplies are being transferred to and from the Site. Impacts after construction of the remedial action would be decreased substantially as barges would be used for fuel and lime delivery to the Site, likely varying between one delivery per week and one delivery per month.

Construction workers can reach the Site by taking a passenger ferry boat service, private boat, or float plane to Lucerne and then by truck or other vehicle to Holden.

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.

Operation and maintenance of the completed project are anticipated to require less than one vehicular trip per day. Frequency of deliveries of fuel and lime would depend on final design and supply arrangements, but would likely vary between one delivery per week and one delivery per month.

g. Proposed measures to reduce or control transportation impacts, if any:

The bridge to be constructed across Railroad Creek at the east end of Tailing Pile 3, would allow construction traffic to access the former mine operations area of the Site while avoiding driving through Holden Village. The Agencies also expect that all traffic to a temporary construction workers camp (for example if in the baseball field area west of Holden Village), and to a potential construction staging area in the former Winston townsite, could also be routed across this bridge, south of the mine and then across the existing Holden Village vehicle bridge, to avoid construction traffic through the Village.

Construction would include a spill prevention, control, and countermeasure (SPCC) plan to reduce risks and mitigate potential impacts of potential fuel spills or other material used in construction and subsequently during long-term operations of the water treatment system.

15. **Public services**

a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.

No increase anticipated.

b. Proposed measures to reduce or control direct impacts on public services, if any.

Not applicable.

16. **Utilities**

a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other.

There is no commercial utility or telephone service to the area. Holden Village's electricity is supplied by a privately owned hydroelectric generator powered by diversion of a portion of the Copper Creek flow. Holden Village obtains potable water from Copper Creek upstream of the Site. Holden Village uses intensive recycling and composting for solid waste management. Holden Village wastewater is treated with a privately owned and maintained septic system located east of the village.

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

During construction of the proposed cleanup action, temporary utilities will need to be supplied to the camp used for construction workers, including water, electricity, and a septic system. Water may be obtained through the current Holden Village system or via withdrawal from Railroad Creek upstream of the Site. Electricity to the camp would likely be provided using diesel generators. The Holden Village septic system may be used to handle the wastewater generated by the camp, or alternative systems may be needed for temporary use during the Phase I (2-year) and Phase II (1-year) construction periods.

The proposed cleanup action includes construction, use, and closure of limited purpose landfills for disposal of solid waste and contaminated soils generated during the cleanup, and for long-term disposal of sludge from the water treatment facility.

Additional utilities are required for long-term use to power the treatment facility, e.g., to pump water and sludge from the treatment facility to a limited purpose landfill on the tailings piles. Electrical energy for operation of the treatment facility would come from diesel, liquid petroleum gas, or hydroelectrical generators, as determined during remedial design.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: .....

Valerie Bound, Section Manager
Toxics Cleanup Program

Date Submitted: .....

TO BE COMPLETED BY APPLICANT

EVALUATION FOR AGENCY USE ONLY

D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS

NOT APPLICABLE

(do not use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

   Proposed measures to avoid or reduce such increases are:

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

   Proposed measures to protect or conserve plants, animals, fish, or marine life are:

3. How would the proposal be likely to deplete energy or natural resources?

   Proposed measures to protect or conserve energy and natural resources are:

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

   Proposed measures to protect such resources or to avoid or reduce impacts are:

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

   Proposed measures to avoid or reduce shoreline and land use impacts are:

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

   Proposed measures to reduce or respond to such demand(s) are:

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

Attachments:

The following tables from the Draft Final Remedial Investigation Report, Holden Mine Site (Dames & Moore 1999) are included as attachments to this checklist.

Table 4.6-5 Common Plant Species
Table 4.6-6 Herpetofauna Likely to Occur within the Railroad Creek Drainage
Table 4.6-7 Master List of Avian Species Observed and Potentially Occurring at and in the Vicinity of Holden Mine
Table 4.6-8 Bird Species Observed by Survey Area
Table 4.6-9 Master List of All Species Observed, Probably Present and Possible Present at Holden Mine
Table 4.6-10 Mammal Species Observed, by Survey Area, at Holden Mine
Table 4.6-11 Species of Federal Concern which may Occur in the Vicinity of Holden Mine, as Indicated by U.S. Forest Service, August 13, 1997
Table 4.6-12 Special Status Species in the Project Area
Table 4.6-13 U.S. Forest Service Survey and Manage Component 2 Mollusk Species with Potential to Occur in the Project Area
Table 4.6-14 U.S. Forest Service Survey and Manage Component 2 and Protection Buffer Plants with Potential to Occur in the Project Area
Table 4.6-15 Survey and Manage Species for which No Survey Protocols are Available due to the Unique or Unknown Life History of these Species

TABLE 4.6-5
COMMON PLANT SPECIES

Scientific Name	Common Name
Trees	
Abies amabilis	Pacific silver fir
Abies lasiocarpa	Subalpine fir
Picea engelmannii	Engelmann spruce
Pinus contorta	Lodgepole pine
Pinus monticola	Western white pine
Pinus ponderosa	Ponderosa pine
Populus balsamifera	Black cottonwood
Populus tremuloides	Quaking aspen
Prunus emarginata	Bitter cherry
Pseudotsuga menziesii	Douglas fir
Thuja plicata	Western red cedar
Tsuga heterophylla	Western hemlock
Tsuga mertensiana	Mountain hemlock
Shrubs and Vines	
Acer glabrum	Douglas or mountain maple
Alnus sinuata	Sitka alder
Amelanchier alnifolia	Serviceberry
Ceanothus velutinus	Snowbrush
Cornus stolonifera	Red-osier dogwood
Holodiscus discolor	Oceanspray
Mahonia nervosa	Oregon grape
Oplopanax horridum	Devil's club
Pachistima myrsinites	Oregon boxwood
Rhododendron albiflorum	White-flowered rhododendron
Rosa gymnocarpa	Baldhip rose
Rubus lasiococcus	Dwarf bramble
Rubus parviflorus	Thimbleberry
Salix scouleriana	Scouler's willow
Salix spp.	Willows
Sambucus racemosa	Elderberry
Sorbus scopulina	Mountain ash
Symphoricarpos alba	Snowberry
Vaccinium spp.	Blueberries/Huckleberries
Herbs	
Aruncus dioicus	Goat's beard
Athyrium filix-femina	Lady fern
Calamagrostis rubescens	Pinegrass
Carex spp.	Sedges
Cryptogramma crispa	Parsley fern
Elymus glaucus	Blue wildrye
Epilobium angustifolium	Fireweed
Epilobium paniculatum	Willow-weed
Juncus mertensianus	Rush
Pteridium aquilinum	Bracken fern
Smilacina spp.	False Solomon's seal, wild lily of the valley
Verbascum thapsus	Common mullein

TABLE 4.6-6
HERPETOFAUNA LIKELY TO OCCUR WITHIN THE RAILROAD CREEK DRAINAGE

Amphibians	Lizards and Snakes
Long-toed salamander	Northern alligator lizard
Pacific giant salamander	Rubber boa
Tailed frog	Western terrestrial garter snake
Western Toad	Common garter snake
Pacific treefrog	
Cascades frog	
Columbian spotted frog	

TABLE 4.6-7
MASTER LIST OF AVIAN SPECIES OBSERVED AND POTENTIALLY OCCURRING AT AND IN THE VICINITY OF HOLDEN MINE

Species Observed	Probable Summer Breeders	Probable Year Round Residents not observed (due to secretive nature, etc.)
Golden Eagle	Spotted sandpiper	Cooper's hawk
Sharp-shinned hawk	Common nighthawk	Northern goshawk
Red-tailed hawk	Calliope hummingbird	Ruffed grouse
Rough-legged hawk	Olive-sided flycatcher	Spruce grouse
Blue grouse	Dusky flycatcher	Great horned owl
Northern flicker	Willow flycatcher	Barred owl
Yellow-bellied sapsucker	Western flycatcher	Northern pygmy owl
Hairy woodpecker	House wren	Northern saw-whet owl
Pileated woodpecker	Winter wren	Three-toed woodpecker
Hammond's flycatcher	Swainson's thrush	Black-backed woodpecker
Violet-green swallow	Solitary vireo	Gray jay
Barn swallow	Warbling vireo	Brown creeper
Stealer's jay	Yellow warbler	Pine siskin
Clark's nutcracker	Wilson's warbler	Pine grosbeak
Common raven	Fox sparrow	Evening grosbeak
Mountain chickadee	Lincoln's sparrow	
Chestnut-backed chickadee	Western tanager	
Red-breasted nuthatch		
Golden-crowned kinglet		
Ruby-crowned kinglet		
Townsend's solitaire		
Hermit thrush		
Varied thrush		
American robin		
American pipit		
American dipper		
Ceder waxwing		
Yellow-rumped warbler		
Townsend's warbler		
MacGillvary's warbler		
Song sparrow		
Dark-eyed junco		
White-crowned sparrow		
Golden crowned sparrow		
Red crossbill		
White-winged crossbill		
Rosy finch		
Finch spp.		

TABLE 4.6-8
BIRD SPECIES OBSERVED BY SURVEY AREA

North-aspect Slope	South-aspect Slope	Upstream Riparian	Downstream Riparian	Mine Tailings
Sharp-shinned hawk Pileated woodpecker	Golden eagle	Red-tailed hawk	Stellar's jay	Red-tailed hawk
Stellar's jay	Sharp-shinned hawk	Blue grouse	Mountain chickadee	Hairy woodpecker
Clarks nut cracker	Red-tailed hawk	Northern flicker	Chestnut-back chickadee Red-	Barn swallow
Raven	Rough-legged hawk	Hammond's flycatcher	breasted nuthatch	Violet-green swallow
Mountain chickadee	Northern flicker	Violet-green swallow	Golden-crowned kinglet	Stealer's jay
Chestnut-backed chickadee	Yellow-bellied sapsucker Clark's nutcracker	Mountain chickadee	American dipper	American pipit
Red-breasted nuthatch	Mountain chickadee	Red-breasted nuthatch	Dark-eyed junco	Song sparrow
Golden-crowned kinglet	Red-breasted nuthatch	Golden-crowned kinglet		Dark-eyed junco
Ruby-crowned kinglet Hermit thrush	Golden-crowned kinglet	Townsend's solitaire		
Varied thrush	Townsend's solitaire	American robin		
American robin	American robin	Hermit thrush		
Yellow-rumped warbler	Dark-eyed junco	Cedar waxwing		
Townsend's warbler	Red crossbill	Townsend's warbler		
Dark-eyed junco	Rosey finch	McGillvary's warbler		
White-winged crossbill	Finch spp.	Dark-eyed junco		
Finch spp.		White-crowned sparrow		
		Golden-crowned sparrow		
		Red crossbill		
		Finch spp.		

TABLE 4.6-9
MASTER LIST OF ALL SPECIES OBSERVED, PROBABLY PRESENT AND POSSIBLE PRESENT AT HOLDEN MINE

All Species Observed	Bat Species Potentially Present	Species Probably Present, but Not Observed	Species Possible Present, but Not Observed
Bat spp.	California myotis	Masked shrew	Fisher
Pika	Western small-footed myotis	Dusky shrew	Wolverine
Douglas squirrel	Long-eared myotis	Northern water shrew	Lynx
Golden-mantled ground squirrel	Keen's myotis	Snowshoe hare	Elk
Mule deer	Little brown myotis	Bushytail woodrat	
Deer mouse	Fringed myotis	Pacific jumping mouse	
Chipmunk sp.	Long-legged myotis	Southern redbacked vole	
Black bear	Yuma myotis	Heather vole	
	Hoary bat	Longtail vole	
	Silver-haired bat	Hoary Marmot	
	Big brown bat	Porcupine	
	Western (Townsend's) big-eared bat	Coyote	
		Marten	
		Long-tailed weasel	
		Short-tailed weasel	
		Mink	
		Mountain lion	
		Bobcat	

TABLE 4.6-10
MAMMAL SPECIES OBSERVED, BY SURVEY AREA, AT HOLDEN MINE

Observations may have been of actual animals or their sign

North-facing slope	South-facing Slope	Upstream riparian	Downstream riparian	Mine tailings
Bat spp.	Douglas squirrel	Douglas squirrel	Douglas squirrel	Golden-mantled ground squirrel
Pika	Golden-mantled ground squirrel	Golden-mantled ground squirrel	Golden-mantled ground squirrel	Chipmunk sp.
Douglas squirrel	Chipmunk sp.	Chipmunk sp.	Chipmunk sp.	Black bear
Golden-mantled ground squirrel	Deer mouse	Black bear	Deer mouse	Mule deer
Chipmunk sp.	Mule deer	Mule deer	Beaver	
Deer mouse			Black bear	
Mule deer			Mule deer	

TABLE 4.6-11
SPECIES OF FEDERAL CONCERN WHICH MAY OCCUR IN THE VICINITY OF HOLDEN MINE, AS INDICATED BY U.S. FOREST SERVICE, AUGUST 13, 1997

Common Name	Habitat requirements	Potential to Occur in Project Area
Cascades frog *Rana cascadae*	Small pools and marshy areas adjacent to streams	Possible. Suitable habitat for this species exists in the project area.
Columbia spotted Frog *Rana luteiventris*	Marshy edges of lakes, springs, ponds, or streams	Possible. Suitable habitat exists for this species in the project area.
Tailed frog *Ascaphus truei*	Cold, rocky mountain streams	Possible. Suitable habitat exists for this species in the project area.
Black tern *Ascaphus truei*	Fresh water marshes and lakes	No. There is no suitable habitat for this species in the project area.
Columbian sharp-tailed grouse *Tympanuchus phasianellus columbianus*	Prairie, thickets, forest edges and openings	No. There is no suitable habitat for this species in the project area.
Ferruginous hawk *Buteo regalis*	Plains, prairies	No. There is no suitable habitat for this specie sin the project area.
Harlequin duck *Histrionicus histrionicus*	Mountain streams in summer, rocky coastal waters in winter	Possible. Suitable habitat exists for this species in the project area.
Little willow flycatcher *Empidonax traillii brewsteri*	Stream side, willow thickets	Probable. Suitable habitat exists for this species in the project area.
Loggerhead shrike *Lanius ludovicianus*	Open country with scattered trees and small shrubs, shrub-steppe	Possible. Suitable habitat exists on southern aspects.
Northern goshawk *Accipiter gentilis*	Coniferous and deciduous forests, winters in lowlands	Probable. Suitable habitat exists for this species in the project area.
Olive-sided flycatcher *Contopus borealis*	Conifer forests, burns, slashings (summer)	Probable. Suitable habitat exists for this species in the project area.
Western burrowing owl *Athene cunicularia hypugea*	Shrub-steppe, nonforested plains, and grasslands.	No. There is no suitable habitat for this specie sin the project area.
Western sage grouse *Centrocercus urophasianus phaios*	Sagebrush plains and foothills	No. There is no suitable habitat for this specie sin the project area.
California bighorn sheep *Ovis canadensis californiana*	Alpine meadows and grassy slopes near mountain cliffs	Unlikely. The closest bighorn sheep population is 20 miles to the south.
California wolverine *Gulo Gulo luteus*	Wide ranging, especially in coniferous forest and montane areas	Possible. Wolverine have been observed at the higher elevations of Railroad Creek drainage
Long-eared myotis *Myotis evotis*	Forests	Possible. Suitable habitat exists.
Long-legged myotis *Myotis volans*	Forests, some hibernate in caves in winter	Possible. Suitable habitat exists.
Pacific fisher *Martes pennanti pacifica*	Dense, mature spruce-fir and lowland forests	Possible. Fisher have been observed at the higher elevations of Railroad Creek drainage
Western big-eared bat *Plecotus townsendii pallescens*	Forests, roost in caves, mines, and under bark on trees	Possible. Suitable habitat exists.
Small-footed myotis *Myotis ciliolabrum*	Open, arid areas, roosts in rocky crevices, caves, mines, and old buildings	No. There is no suitable habitat for this species in the project area.
Yuma myotis *Myotis yumanensis*	Open areas in forests	Possible. Suitable habitat exists.
Westslope cutthroat trout *Oncorhynchus (=Salmo) clarki lewisi*	Streams, tributaries, and lakes	Most abundant trout species in Railroad Creek. See Section 4.8.1.4.
White milk-vetch *Astragalus sinuatus*	Rocky hillsides, associated with big sagebrush	No. There is no suitable habitat for this species in the project area.
Grape-fern *Botrychium paradoxum*	Old, disturbed, gravelly areas, often associated with spruce seedlings.	Possible. Suitable habitat exists.

TABLE 4.6-11 (CONTINUED)
SPECIES OF FEDERAL CONCERN WHICH MAY OCCUR IN THE VICINITY OF HOLDEN MINE, AS INDICATED BY U.S. FOREST SERVICE, AUGUST 13, 1997

Common Name	Habitat requirements	Potential to Occur in Project Area
Clustered lady's slipper *Cypripedium fasciculatum*	Moist to dry and rocky open coniferous forest (Douglas fir and ponderosa pine	Possible. Suitable habitat exists.
Wenatchee larkspur *Delphinium viridescens*	Moist meadows from 2500-5000'	Possible. Suitable habitat exists.
Showy stickseed *Hackelia venusta*	Rocky slopes with ponderosa pine	Possible. Suitable habitat exists.
Chelan rockmat *Petrophyton cinerascens*	Basalt cliffs and bluffs	Possible. Suitable habitat exists.
Seely's silene *Silene seelyi*	Steep talus slopes and rock crevices	Possible. Suitable habitat exists.
Thompson's clover *Trifolium thompsonii*	Open areas on sandy loam and gravelly soils with sagebrush	No. There is no suitable habitat for this species in the project area.

TABLE 4.6-12
SPECIAL STATUS SPECIES IN THE PROJECT AREA.

Species	Status	Habitat Requirements	Potential to Occur in Project Area
Peregrine falcon *Falco peregrinus*	FE, SE	• Mainly open country, nests on ledges high on cliffs • Often hunts in riparian zones	Possible. The area contains good hunting habitat and there are recorded sightings in the Railroad Creek drainage.
Bald eagle *Haliaeetus leucocephalus*	FT, ST	• Lakes and rivers, nests in tall trees and on cliffs • Diet consists primarily of fish	Possible. Bald eagles have been observed on Lake Chelan and the lower part of Railroad Creek and Domke Lake are designated as bald eagle recovery territory.
Northern spotted owl *Strix occidentalis*	FT, SE, FSS	• Old growth forest with a multi-layer canopy • Usually nests in old cavities • Preys on small mammals, especially woodrats	Possible. A female spotted owl was radio tracked to the upper Railroad Creek drainage in 1993 and a male currently resides near Domke Lake.
Gray wolf *Canis lupus*	FE, SE, FSS	• All habitats with a sufficient prey base and protection from human harassment • Three wolf dens have recently been confirmed in the Northern Cascades	Possible. A number of unconfirmed wolf sightings have recently been reported in the Railroad Creek drainage.
Grizzly bear *Ursus arctos*	FT, SE, FSS	• All habitat types with a suitable food base and isolated from human activity. • A small population may exist in the Northern Cascades	Possible. A grizzly bear siting at Domke Lake in 1995. was reported to and recorded by the USFA
Lynx *Lynx canadensis*	FC, ST, FSS	• Spruce, subalpine fir and lodgepole pine forests • Distribution is tied to that of snowshoe hare, which makes up to 80% of its diet.	Possible. Suitable lynx habitat is found at higher elevations around Holden Mine, and there is a lynx record from Dumbell Mountain.
Bull trout *Salvelinus confluenis*	FP	• Cold water mountain lakes and streams	Possible. Railroad Creek provides suitable habitat.
Wenatchee mountain's checkermallow *Sidalcea oregana var. calva*	FC, ST	• Wet meadows, near streams • Endemic to Chelan and Kittitas counties	No. There are no known populations in the Railroad Creek drainage.

FE = Federally Endangered
FT = Federally Threatened
FC = Federally Candidate for threatened or endangered status
FP = Proposed for federal status
SE = State endangered
ST = State threatened
FSS = Forest Service sensitive species

TABLE 4.6-13
U.S. FOREST SERVICE SURVEY AND MANAGE COMPONENT 2 MOLLUSK SPECIES WITH POTENTIAL TO OCCUR IN THE PROJECT AREA

Scientific Name	Common Name	Occurrences on Federal Lands (Frest 1993) (Burke 1999)
Land Snails		
Cryptomastix devia	Puget Oregonian	Fort Lewis Military Reservation, Columbia Gorge National Scenic Area
**Cryptomastix hendersoni*	Columbia oregonian	Naches Ranger District only
**Megomphix hemphilli*	Oregon Megomphix	Mt. Baker and Olympic National Forests
Oreohelix n. sp. 1	Chelan mountain snail	Wenatchee National Forest, in Chelan and Entiat Ranger Districts
Slugs		
**Deroceras hesperium*	Evening Field Slug	Olympic National Park
**Hemphillia burringtoni*	Burrington Jumping Slug	Olympic National Park
Hemphillia glandulosa	Warty Jumping Slug	Olympic National Park and Olympic National Forest, Gifford Pinchot National Forest
**Hemphillia malonei*	Malone Jumping Slug	Mt. Hood National Forest, Columbia River Gorge National Scenic Area
**Hemphillia pantherina*	Panther Jumping Slug	Gifford Pinchot National Forest
Prophysaon coeruleum	Blue-grey Tail-dropper	Gifford Pinchot National Forest
Prophysaon dubium	Papillose Tail-dropper	Trinity National Forest, probably Mt. Hood National Forest, Wenatchee National Forest
Freshwater Snails		
Lyogyrus n. sp. 2	Masked Duskysnail	Wenatchee National Forest

*May occur, but surveys are not required in the Wenatchee National Forest

TABLE 4.6-14
U.S. FOREST SERVICE SURVEY AND MANAGE COMPONENT 2 AND PROTECTION BUFFER PLANTS WITH POTENTIAL TO OCCUR IN THE PROJECT AREA

Scientific Name	Common Description	Habitat Associations
Fungi		
Oxyporus nobilissimus	noble polypore	the base or major root branches of large diameter old-growth noble fir and Pacific silver fir trees, snags and stumps (Hibler and O' Dell 1998)
Lichens		
Hypogymnia duplicata	foliose lichen w/hollow narrow lobes, arboreal	an epiphyte on mountain and western hemlock, Pacific silver fir, subalpine fir, and Douglas fir
Lobaria linita	foliose lichen, N-fixing	on lower boles of Pacific silver fir, in sub-alpine areas, and on rock outcrops and boulders in moist conifer forests
Pseudocyphellaria rainierensis	foliose lichen, N-fixing	an epiphyte on conifer trees in old-growth forests with cool, humid microclimates
Bryophytes		
Diplophyllum plicatum	leafy liverwort	on decayed wood, down logs, trunks of Douglas fir Pacific Yew, Sitka spruce, mineral soil, and rock in cool habitats with high humidity (USFS 1997)
Kurzia makinoana	leafy liverwort	in forested and bog sites on decaying wood or humus, rocky cliffs, ledges, soil banks, in shaded moist sites (USFS 1997)
Marsupella emarginata aquatica	aquatic liverwort	in colonies attached to submerged rocks in cold perennial streams, only one site is known at Waldo Lake in the Oregon Cascades (USFS 1997)
Schistostega pennata	Luminous moss (Protection Buffer species)	On damp rock, soil and decaying wood in dark places such as cave or mine shaft mouths, rock crevices or overhangs. Low light is required.[1]
Tritomaria exectiformis	leafy liverwort	on dry to moist, partially shaded soil, litter and soil in rock crevices, decaying logs, peaty soil over cliffs, and wet soil banks (USFS 1997)
Ulota meglospora	Giant-spored tree moss (Protection Buffer species)	Epiphytic on conifers, hardwoods, particularly maples, alder and tanoak and numerous other shrubs. Prefers branch tips away from competition of other bryophytes. Can be in dry sites. [1]
Vascular Plants		
Allotropa virgata	candystick	in deep humus of coniferous forests at lower elevations, including east Cascade slopes (Hitchcock and Cronquist 1973)
Botrychium minganense	grape fern	moist sites, in old-growth western red cedar, on mossy slopes, ridges, and benches (Smith-Kuebel and Lillybridge 1993) — Correct Spelling
Botrychium montanum	grape fern	same as *B. minganense*
Coptis aspleniifolia	spleenwort-leaved goldthread	moist woods and bogs (Hitchcock and Cronquist 1973)
Galium kamtschaticum	boreal bedstraw	wet areas with seeps or sanding water in the Pacific silver fir zone and the mountain hemlock zone (Potash 1991)
Habenaria orbiculata	round-leaved rein-orchid	moist, mossy forests (Hitchcock and Cronquist 1973)

[1] From a table created by Terry Lillibridge, Botanist, Wenatchee National Forest

TABLE 4.6-15
SURVEY AND MANAGE SPECIES FOR WHICH NO SURVEY PROTOCOLS ARE AVAILABLE DUE TO THE UNIQUE OR UNKNOWN LIFE HISTORY OF THESE SPECIES

Source: Terry Lilibridge, Botanist, Wenatchee National Forest

Scientific Name	Common Name	Group	Wen. NF	Status	Habitat
Brotherella roellii	R ll's golden log moss	Moss	S	PB	On rotten logs/stumps; Alder/Maple tree bases in cool to moist coniferous/deciduous forest at low elev. TSHE/ABAM/TSME
Buxbaumia viridis	Green bug moss, Green shield moss	Moss	S	PB	Well decayed, rotten logs (Class 4/5), peaty soil and humus in dense, shady and humid coniferous forest-low elev. to subalpine. No perennial gametophyte generation.
Rhizomnium nudum	Naked round moss, Naked mnium	Moss	S	PB	On moist (not wet) organic soil typically in concave areas; sometimes among rocks or rotten logs from middle elevations to alpine (with persistent snow banks); closed canopy TSHE, ABAM, TSME, often with OPHO.
Tetraphis geniculata	Bent-kneed four-tooth moss, Ant spearmoss	Moss	S	PB	On well rotted stumps and logs (rarely rocks), in shaded , humid locations at low to middle elevations. Difficult to ID w/o sporophyte. 100% OG; easily confused with T. pellucida
Bondarzewia mesenterica (montana)		polypore	D	2	Moist ABGR, TSHE, ABAM zones saprophytic on Abies spp. or PSME
Sowerbyella (Aleuria) rhenana	Stalked orangepeel fungus	cup fungus	S	PB	Saprophytic on twigs/duff of mixed conifers in ABAM/TSME zones.
Otidea leporina	Donkey ears	cup fungus	S	PB	Moist ABGR/TSHE, ABAM, or TSME zones under PSME or TSHE.
Otidea onotica	Donkey ears	cup fungus	D	PB	On exposed soil, duff or moss in moist, ABAM, or TSME zones under PSME or TSHE. Also possible in moist ABGR/TSHE.
Otidea smithii	brown clustered ear cup	cup fungus	S	PB	On exposed soil, duff or moss in moist, ABAM, or TSME zones under PSME or TSHE. Also possible in moist ABGR/TSHE and riparian w/cottonwoods.
Polyozellus multiplex	Blue chanterelle	chanterelle	D	PB	ABAM/TSME zones, mycorrhizal on Abies
Sarcosoma mexicana	Starving-man's licorice	cup fungus	D	PB	On conifer duff in moist ABGR/TSHE, ABAM, and TSME zones; also riparian in drier ABGR.