USDA Forest Service
Alaska Region

FOCUSED UPLAND ENGINEERING EVALUATION/COST ANALYSIS (EE/CA)

FINAL REPORT

SALT CHUCK MINE

TONGASS NATIONAL FOREST, ALASKA

Prepared by:
URS Group, Inc.

April 2010

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FOCUSED UPLAND ENGINEERING EVALUATION/COST ANALYSIS (EE/CA)
SALT CHUCK MINE
TONGASS NATIONAL FOREST, ALASKA

Prepared for

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE – ALASKA REGION

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April 2010

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ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ABA	acid-base accounting
ADEC	Alaska Department of Environmental Conservation
ADNR	Alaska Department of Natural Resources
ALM	Adult Lead Model
AMH	abandoned mine hazard
AP	acid potential
ARARs	applicable or relevant and appropriate requirements
ARD	acid-rock drainage
ARRA	American Recovery and Reinvestment Act
ASCC	Alaska State Climate Center
AST	above-ground storage tank
ATVs	all-terrain vehicles
BaP	benzo(a)pyrene
BaPeq	benzo(a)pyrene equivalent
BCF	bioconcentration factor
bgs	below ground surface
CDC	Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CL	confidence level
COCs	chemicals of concern
COPCs	chemicals of potential concern
CSM	conceptual site model
cy	cubic yards
DAF	dilution attenuation factor
DRO	diesel range organics
DQOs	data quality objectives
f_{oc}	faction organic carbon
Forest Service	United States Department of Agriculture, Forest Service
EE/CA	Engineering Evaluation/Cost Analysis
°F	degrees Fahrenheit
ft^2	square feet
g/g	grams per gram
GSA	General Services Administration
HDPE	high-density polyethylene
IEUBK	Integrated Exposure Uptake Biokinetic Model
IQR	interquartile range
kg/kg	kilograms per kilogram

ACRONYMS AND ABBREVIATIONS (continued)

MDL	method detection limit
µg/dL	micrograms per deciliter
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MNA	monitored natural attenuation
msl	mean sea level
NCP	National Contingency Plan
ND	not detected
NEPA	National Environmental Policy Act of 1969
NOAA	National Oceanic and Atmospheric Administration
NP	neutralization potential
NPL	National Priorities List
NPR	neutralization potential ratio
OGC	Office of General Counsel
OVK	Organized Village of Kasaan
O&M	operation and maintenance
%	percent
PAHs	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PGEs	platinum group elements
POL	petroleum, oil, & lubricants
PPE	personnel protective equipment
PQL	practical quantitation limit
PRAGs	preliminary removal action goals
QA/QC	Quality Assurance/Quality Control
RAO	removal action objective
RCRA	Resource Conservation & Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RPDs	relative percent differences
RPPT	reductive precipitation
RRO	residual range organics
RSL	risk screening level
SHPO	State Historic Preservation Office
SRE	streamlined risk evaluation
SSLs	soil screening levels
TBC	To-Be-Considered
TCLP	toxicity characteristic leaching procedure
TEFs	toxicity equivalency factors
TOC	total organic carbon

ACRONYMS AND ABBREVIATIONS (continued)

TRPH	total recoverable petroleum hydrocarbons
USBLM	U.S. Bureau of Land Management
USC	United States Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U. S. Fish & Wildlife Service
WRCC	Western Regional Climate Center

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EXECUTIVE SUMMARY

This document presents the results of a Focused Engineering Evaluation/Cost Analysis (EE/CA) for removal actions at selected upland locations of the Salt Chuck Mine, located on Prince of Wales Island in the Tongass National Forest of southeast Alaska. This project was completed by URS Corporation (URS) for the United States Department of Agriculture, Forest Service (Forest Service) under General Services Administration (GSA) Contract GS-10F-0105K, Task Order AG-0109-D-06-0009.

This EE/CA focuses on the following specific upland areas of the Salt Chuck Mine site that lie on Forest Service managed lands: the mill area and associated debris piles, former building C4, the above-ground storage tank (AST)/drum cache area, and the electric locomotive batteries. Other areas and impacted environments of the broader Salt Chuck Mine site that are not located on Forest Service managed lands, including intertidal tailings deposits, are not addressed by this EE/CA. Two upland tailings piles (Piles D14 and D15) and some freshwater stream tailings deposits are on Forest Service managed lands, but are not addressed by this EE/CA because those impacted areas have similar characteristics to intertidal tailings deposits. Impacted areas not addressed in this EE/CA for removal action are anticipated to be addressed under U.S. Environmental Protection Agency (USEPA) authority. The site has been listed as a National Priorities List (NPL) site (i.e., Superfund site). The Forest Service will work cooperatively to address any areas remaining on Forest Service lands which are not addressed by this EE/CA.

The intent of this EE/CA was to develop and evaluate viable alternatives to support human health risk-based removal actions, abandoned mine hazard (AMH) mitigation, and regulatory compliance. This document was prepared in support of an interim action only. Certain exposure pathways and risks that are better addressed under a site-wide and comprehensive site-specific risk assessment are not addressed as part of this EE/CA, but may be considered under the NPL process. These exposure pathways include subsistence level resource use, such as consumption of berries and/or wild game. While long term cumulative human health risks will be better addressed during a site-wide risk assessment under the NPL process, using residual chemical concentrations remaining following removal actions, this EE/CA evaluates cumulative risks using the targeted cleanup levels proposed for this removal action. In addition, ecological hazards are not considered in this EE/CA; however, they may be quantitatively evaluated as part of the ecological risk assessment during the NPL process. Confirmatory sampling data quality objectives (DQOs) will consider future data use for human health and ecological risk assessment.

The primary source of contamination at the Salt Chuck Mine site is the extensive tailings deposit. Tailings located primarily in the intertidal zone south and southeast of the mill cover an area of approximately 23 acres and comprise roughly 100,000 cubic yards (cy) of material, with tailings in the upland part of the site comprising only a small fraction of this total. Tailings lie above the intertidal zone around the mill, adjacent to the unnamed stream in Piles D14 and D15, in the bottom of the unnamed stream, and along the tailings spit.

The tailings around the mill contain elevated concentrations of a number of potentially hazardous substances, including copper and selenium, as well as commingled petroleum constituents. Petroleum constituents appear to have migrated into tailings beneath and adjacent to the west side and southeast corner of the mill, and into the intertidal zone. The lateral extent of contamination is approximately

28,000 square feet (ft^2), or about 0.6 acres. The most widespread chemical of concern (COC) is copper. The extent of copper exceeding the proposed cleanup level of 460 milligrams per kilogram (mg/kg) [ADEC Method 2, Migration to Groundwater] likely extends to the edge of the tailings pile. The thickness of the mill tailings ranges from 8 inches to 4 feet, with most test holes encountering 2 to 2-1/2 feet of tailings. The total volume of tailings in this area was estimated to be 3,100 cy.

Other sources of contamination in the upland areas of the site addressed by this EE/CA include diesel formerly stored in ASTs and drum caches east of the mill; and hazardous substances in soils around building C4, which may have been used as an assay shop. The extent of diesel range organics (DRO) in the AST/drum cache area exceeding the proposed cleanup level of 1,250 mg/kg, combined with the extent of metals in soils around building C4 that exceed proposed cleanup levels under ADEC Method 2 criteria, and background is approximately 9,900 ft^2, or about 0.2 acres, with a total volume of approximately 900 cy.

Waste rock piles at the site do not appear to be generating acid mine drainage at the present time, based on measured surface water pH; however, acid generation tests performed on two waste rock samples collected in 2009 indicate a potential for acid generation in some, but not all, of the waste rock. Waste rock is therefore conservatively considered to be not suitable for use in removal action construction activities.

Abandoned equipment and general debris is present around the site, such as a boiler at tailings pile D15, a barge, dock debris, and miscellaneous debris associated with structures east of building C4, west of the unnamed stream, and around the mine workings and tramway. The buildings include workers' housing, a general office, and a blacksmith or machine shop. No evidence of hydrocarbon staining or other potential sources of hazardous substances were observed in these areas, and no sampling was conducted. Removal of much of this material for safety reasons is included as a common element to the action alternatives. Lead batteries contained in the tram locomotive are included for removal as part of this EE/CA.

A Streamlined Risk Evaluation (SRE) was completed to evaluate potential risks to human receptors from target areas addressed by this EE/CA. The SRE identified recreational users (e.g. hunters, hikers, rock climbers, etc.) and future mining workers as potential receptors; however, site data were also compared to State of Alaska Method Two and Method Three cleanup criteria which are protective of human health under a residential land use scenario. The SRE identified the following Chemicals of Concern (COCs) that had maximum concentrations greater than applicable ADEC Method Two or Three cleanup criteria, and pose a potential threat to human health:

- For soil, DRO, antimony, arsenic, copper, lead, mercury, selenium, and silver were identified as COCs.
- For unsaturated tailings, DRO, benzo(a)pyrene equivalents (BaPeq), benzo(a)anthracene, antimony, arsenic, copper, mercury, selenium, and silver were identified as COCs.

Key Applicable or Relevant and Appropriate Requirements (ARARs) identified for this EE/CA include:

- Alaska Oil and Other Hazardous Substance Pollution Control Regulations (18 AAC 75)
- Alaska Solid Waste Regulations (18 AAC 60)
- National Historic Preservation Act (32 CFR Part 229, 40 CFR § 6.301[b], 36 CFR Part 800) and Preservation of Historical and Archaeological Data (40 CFR § 6.301[c])

Based on the conclusions of the SRE, and the ARARs evaluation, the following Removal Action Objectives (RAOs) were developed:

- Reduce risks for recreational users and future miners from exposure to chemicals in surface soils and tailings via dermal contact, incidental ingestion, and outdoor inhalation.
- Prevent migration of hazardous substances in surface soil, tailings, and sludge to groundwater and surface water.

An Engineering Evaluation was completed to identify, evaluate, and assemble technologies potentially applicable to the management of threats to human receptors at the site into candidate removal action alternatives. The removal action alternatives were then evaluated against three primary criteria: in accordance with USEPA EE/CA guidance, including effectiveness, implementability, and cost. The following candidate removal action alternatives were assembled and evaluated:

- No Action Alternative
- Alternative 0 – Institutional Controls and Debris Removal (with Capping In-Place)
- Alternative 1 – Excavation, Consolidation in Mill Site Repository, and Capping
- Alternative 2 – Excavation, Consolidation in Borrow Pit Repository, and Capping
- Alternative 3 – Excavation and Off-Island Disposal
- Alternative 4 – Excavation, Consolidation in Borrow Pit Repository, and Capping utilizing Haul Road
- Alternative 5 – Excavation and Off-Island Disposal utilizing Haul Road

These alternatives were analyzed on an individual basis with respect to the above criteria, as well as with respect to each other in a comparative analysis. This analysis shows that the No Action alternative and Alternative 0 would not effectively meet ARARs and RAOs, while Alternatives 1, 2, 3, 4, and 5 would be effective in meeting ARARs and RAOs. All alternatives are considered to be implementable, with some uncertainties and assumptions. Total capital costs of action alternatives (Alternatives 0, 1, 2, 3, 4, and 5) range from $930,000 (Alternative 0) to $3,580,000 (Alternative 3). The alternatives rank in capital cost from lowest to highest as follows: No Action Alternative < Alternative 0 ($930,000) < Alternative 1 ($2,040,000) < Alternative 2 ($2,700,000) < Alternative 4 ($2,740,000) < Alternative 5 ($3,180,000) < Alternative 3 ($3,580,000). Total Operation and Maintenance costs of action alternatives range from $184,000 (Alternative 5) to $987,000 (Alternative 2).

Based on the evaluation of alternatives using EE/CA guidance, and from the comparative analysis of the removal action alternatives, Alternative 5 is recommended. Alternative 5 involves construction of a haul road from the existing Forest Service road to the mill site, excavation of impacted media, and transport to an appropriate off-island disposal facility. This alternative is protective of human health, complies with ARARs, and has relatively low short-term risks.

The following are the primary features of Alternative 5 that result in its selection as the recommended alternative:

- Alternative 5 has the least uncertainty of alternatives that would meet RAOs and ARARs within the removal action areas.
- Alternative 5 substantially reduces the uncertainty, logistical challenges, potentially project cost impacts, and environmental risks associated with mobilizing equipment to the site and removing waste by barge through the Salt Chuck Bay.
- Alternative 5 provides a high degree of short- and long-term effectiveness.
- Alternative 5 substantially reduces long-term O&M costs and related uncertainty over other alternatives which include an on-site repository.
- Alternative 5 includes site development that will be greatly beneficial to future site activities as the overall site moves into the NPL process.

1.0 INTRODUCTION

This report presents the results of a Focused Engineering Evaluation/Cost Analysis (EE/CA) completed by URS Corporation (URS) for the United States Department of Agriculture, Forest Service (Forest Service) for selected upland areas of the Salt Chuck Mine site located on Prince of Wales Island in the Tongass National Forest, Alaska (Figure 1-1). The EE/CA was completed in accordance with General Services Administration (GSA) Contract No. GS-10F-0105K, Task Order AG-0109-D-06-0009 dated June 28, 2006, and Modification No. 0005 dated September 22, 2009; U.S. Environmental Protection Agency (USEPA) guidance document entitled *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA* (USEPA, 1993a); and URS Memorandum entitled *Strategy Meeting Summary and Conceptual Plan, Salt Chuck Mine*, dated September 9, 2009 (Appendix A), which summarizes the results of an agency and stakeholder strategy meeting held on August 13, 2009.

1.1 BACKGROUND

In the 1990s, the Forest Service completed preliminary removal assessments for numerous abandoned and inactive mine sites located in the Tongass National Forest. Inventories conducted in 1995 and 1997 at the Salt Chuck Mine identified physical and chemical hazards that pose a potential threat to the public and the environment (U.S. Bureau of Land Management [USBLM], 1998; Montgomery Watson, 1999). As a result of the USBLM (1998) preliminary removal assessments, it was determined that additional investigation and cleanup was needed.

URS was contracted by the Forest Service in 2002 to conduct an EE/CA at the site. The scope of the original EE/CA was to address the entire Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site consisting of both upland and intertidal areas. A field investigation conducted in Summer 2002, based on URS' (2002) work plan, was designed to build upon USBLM's previous work at the site. Expanded site boundaries and preliminary risk interpretation of the 2002 data, however, indicated the need for additional investigation, which was conducted in 2006 based on URS' (2006) work plan addendum. A Draft EE/CA report was prepared by URS in May 2007 that included both the upland and intertidal areas, and presented the results of both the 2002 and 2006 field investigations (URS, 2007).

Since submittal of the 2007 Draft EE/CA, however, communication between U.S. Department of Agriculture (USDA) Office of General Counsel (OGC), USEPA Region 10, and State of Alaska attorneys, program managers, and project managers lead to an understanding that the Salt Chuck Mine CERCLA site is to be managed as a mixed-ownership site, with the Forest Service managing the upland areas. In addition, the site as a whole has been listed under the USEPA National Priorities List (NPL) as a "Superfund" CERCLA site. Following the release of the Draft EE/CA, the USEPA evaluated the entire Salt Chuck Mine site and found the site to be eligible for its National Priorities List (NPL). Due to the presence of contamination on both the US Forest Service-managed uplands and the State of Alaska-owned inter-tidal area, site was proposed for the NPL in September 2009 as mixed-ownership site. The listing of the site on the NPL occurred in February 2010. Through the NPL process, additional investigation and a site-wide baseline risk assessment will be completed as well as the development and evaluation of comprehensive remedial action objectives alternatives to address issues on State-owned inter-tidal land and any remaining issues on Forest Service-managed uplands in cooperation with the Forest Service. The primary basis for this EE/CA is the availability of federal stimulus funds under the American Recovery and Reinvestment Act (ARRA) for use in conducting a removal action on selected Forest Service-managed upland areas of the site to enhance and be conducted alongside future NPL activities lead by the USEPA, specifically the removal of mine debris in and around the mill site for safety purposes, and removal of soil and tailings that clearly pose a risk to human health at the mill site, building C4, and above-ground storage tank (AST)/drum cache area.

1.2 PURPOSE AND OBJECTIVES

The purpose of this EE/CA was to:

- Summarize results of past contamination studies for the media and areas targeted by this EE/CA (soil and unsaturated tailings at the mill site, building C4, and AST/drum cache area).
- Document the need for removal actions to address contamination in the selected areas.
- Conduct a Streamlined Risk Evaluation (SRE) for protection of human health to determine potential threats posed by contamination in the selected areas.
- Provide a framework for evaluating and selecting potential response actions and technologies for the focused removal action.

The objective of the focused upland EE/CA is to develop removal action objectives (RAOs) pertinent to the limited scope of the action, identify removal action alternatives, screen the alternatives, and recommend an alternative(s) that will satisfy the RAOs based on the evaluation criteria of effectiveness, implementability, and cost. Conclusions from this report will be used to guide decision making and preparation of a performance work statement for contractor solicitations to execute the selected alternative for removal action.

2.0 SITE CHARACTERIZATION

Characterization of environmental conditions at the site is based on information collected during field investigations conducted in 1995, 1997, 2002, and 2006. These investigations were conducted by the USBLM and URS on behalf of the Forest Service. In addition, a site visit was performed in October 2009 to evaluate current site conditions for the purpose of developing appropriate removal alternatives, and an evaluation of waste rock piles for suitability for use as potential construction material in removal actions. This section includes a description of the site, a discussion of site history and physical setting, and a summary of site investigations completed to date, including the results of soil and unsaturated tailings analysis in the selected upland area as compared to values developed in the SRE.

2.1 SITE DESCRIPTION AND BACKGROUND

Salt Chuck Mine is located at the northern extremity of Kasaan Bay, on Prince of Wales Island, approximately 4½ miles south-southwest of Thorne Bay, Alaska. The mine is located within Section 16 and 17, Township 72 South, Range 84 East, Copper River Meridian, Alaska. The mine takes its name from the shallow, restricted Salt Chuck Bay, which borders the mine site to the south, and forms the northernmost arm of Kasaan Bay (Figures 1-1 and 2-1). The nearest year-around population is located at Thorne Bay, which is accessible from the site by road and trail. The closest community by water is the Organized Village of Kasaan (Kasaan), located 10 miles southeast of the site on the east side of Kasaan Bay.

The site is located in a mineral-rich area with much historic mining activity nearby (Maas et al., 1995). The Rush & Brown Mine is located on the west slope of Lake Ellen (Figure 1-1). Venus Mine is located about 1-1/2 miles southwest of the site, in an area that drains southward into Karta Bay. Haida Mine is located northeast of Browns Bay about 2-1/2 miles southeast of the site.

2.1.1 Site History

Salt Chuck Mine was originally known as the Goodro Mine when the first claims were staked in 1905 (USBLM, 1998). By 1907, approximately 35 feet of adit had been driven, a short shaft had been sunk, and several surface cuts were opened. A mill with a rated capacity of 30 tons/day was constructed on site in 1915. The mill capacity was increased to a 300 tons/day in 1923. Total production figures for the mine indicate that over 326,000 tons of ore were mined at the site, with production halting in 1941 (USBLM, 1998). Copper, gold, silver and platinum group elements (PGEs), most notably palladium, were the primary ores produced from Salt Chuck Mine.

Claims at the mine site were relocated again in 1979 and 1996, and several companies investigated the Salt Chuck area in the 1980s and 1990s. Santoy Resources and Nevada Star Resource Corporation (2007) recently held mining claims northwest and northeast of the mill site, and Santoy conducted an exploration program in the area in 2000 (Santoy Resources Ltd., 2007; Szumigala et al., 2000). Pure Nickel, Inc. currently holds active unpatented Federal mining claims at or near the site covering about 2,700 acres. These claims extend from about 200 feet north of the mill to the northwest beyond Lake Ellen, northeast of the mill around Power Lake, and southeast of the mill and intertidal tailings areas along the coast east of the unnamed island. Exploration of these claims was approved by the Forest Service via a Plan of Operations, but deferred in the last couple years as Pure Nickel focused efforts on other projects in Alaska and Canada (Pure Nickel Inc., 2008, 2009; USBLM, 2009). The current claims do not appear to be within the removal areas that are the subject of this EE/CA. Potential repository sites, however, may be within the claims area. This issue is incorporated into consideration of applicable or relevant and appropriate requirements (ARARs) and the evaluation of alternatives in Sections 3.0 through 5.0. Pure Nickel, Inc. has provided the Forest Service a letter of no objection to construction of a temporary haul road over their mineral claims for the purpose of removal action.

The remnants of at least 25 structures are present at the mine site (Figure 2-2). Remains of buildings are located near the beach, along the tramway leading from adit W1 to the mill, upstream along the unnamed stream that flows past the portal of W1, and near the glory hole. The buildings include cabin sites formerly used to house and feed workers, a superintendent's house, a general office, a blacksmith or machine shop, a large mill, and platforms used to load and transfer rock. Two large ASTs that formerly held diesel fuel to supply four separate banks of Fairbanks Morse diesel engines are also present adjacent to the mill site.

Mine workings at the site (Figure 2-2) are located at elevations between 100 and 300 feet above mean sea level (msl) and consist of a large glory hole connected to a main haulage adit (W1), two shafts (W4 and W5), and a tunnel (W3) (USBLM, 1998). The upland portions of the site encompass nearly 45 acres. Thirteen waste rock dumps are distributed along a 0.5-mile corridor from the northeast side of the glory hole, south to the mill site located at the head of Salt Chuck. The waste rock dumps range in size from over 100 cubic yards (cy) to over 4,000 cy (USBLM, 1998). A large amount of the rock was also used to create a tramway bed leading from the main adit to the mill site.

An extensive tailings deposit comprising roughly 100,000 cy of material is located primarily in the intertidal zone south and southeast of the mill (URS, 2007). Smaller areas of tailings lie above the intertidal zone along the tailings spit, around the mill, adjacent to the unnamed stream (Piles D14 and D15), and in the bottom of the unnamed stream (Figures 2-2 and 2-3). Together, the tailings deposits cover an area of approximately 23 acres. The distribution and thickness of tailings in the mill site area are further discussed in Section 2.2.

Federal actions taken to reduce public hazards at historic mines must adhere to provisions of the National Historic Preservation Act of 1966. The Salt Chuck Mine was included in a pilot study conducted by the Forest Service to assess the significance and National Register eligibility of historic mining sites (Bruder, 2002). The four criteria for National Register significance are: A) association with significant events; B) association with significant people; C) representativeness of culture or technology; and D) potential for yielding important information about the human past. The study indicated that the Salt Chuck Mine was the most important copper producer in the Ketchikan Mining District, the only single lode palladium mine in Alaska, and of national importance as a palladium producer in the 1920s. The study concluded that the mine property is a district entity that should be regarded as a historic district, that major components reflecting the mine's most important years of production have been preserved to date, and that the property retains good integrity of setting, feeling, materials, and workmanship. It was concluded that the mine should be considered eligible for National Register listing under criteria A, B, and D, with the strongest case for eligibility set forth under criterion A. The State Historic Preservation Officer agreed with the determination of eligibility. These results are incorporated into the consideration of ARARs, and the evaluation of mine debris detailing and removal as part of the removal action alternatives in the EE/CA (Sections 3.0 through 5.0).

2.1.2 Climate

The nearest climatological data station to Salt Chuck Mine providing data recorded by the National Oceanic and Atmospheric Administration (NOAA) is located at Annette Island, south of Ketchikan and approximately 50 miles southeast of the site (USBLM, 1998). Annual precipitation at Annette Island is approximately 110 inches, with the rainy season in fall and early winter (Alaska State Climate Center [ASCC], 1992 as cited in USBLM, 1998; Western Regional Climate Center [WRCC], 1999a). Average annual temperature is 46 degrees Fahrenheit (°F). July and August are the warmest months, with average high temperatures in the mid-60s (°F), and January is typically the coldest month, with average low temperatures in the low-30s (°F).

Local climate summaries are also available for Beaver Falls and Ketchikan, which are closer to Salt Chuck than Annette Island. Although temperature data for Beaver Falls and Ketchikan are consistent with that of Annette Island, higher annual precipitation amounts of approximately 150 inches have been recorded at these two stations (WRCC, 1999b, 1999c).

2.1.3 Regional and Local Geology

The Salt Chuck area is underlain by Paleozoic ultramafic igneous rocks that intrude a sequence of older sedimentary and volcanic rocks. The Salt Chuck Mine ore body is hosted in a magnetite clinopyroxenite/gabbro sequence similar to other Alaskan-type ultramafic-mafic intrusions in southeast Alaska (Himmelberg and Loney, 1995), the nearest of which is the Union Bay complex on the eastern shores of Clarence Strait. Mineralization at the mine consists of chalcopyrite, bornite, digenite, chalcocite, and covellite with magnetite, pyrrhotite and pyrite also present (USBLM, 1998).

2.1.4 Soils

Soils surrounding the main workings at the Salt Chuck Mine have been predominantly classified as McGilvery soils with minor components of Kogish Peat and Maybeso Mucky Peat to the north (USBLM, 1998). These soils occur within broken mountain slope topography that contains rock outcrops, deep organic-rich soils, and peat. The soils are generally moderately to well-drained, and are characterized to a 15-inch depth as being comprised of a 1- to 4-inch layer of peat and forest litter, overlying a mixed layer of peat and sandy to gravelly loam with boulders. The soils support a variety of plant species, including Western hemlock, blueberry, red cedar, devil's club, and salmonberry.

Soils adjacent to the intertidal zones are classified as Karta–Tolstoi very gravelly loam (USBLM, 1998). The profile of these soils includes a thin layer of forest litter and organic debris overlying silt loam up to 6 inches thick. The silt loam is underlain by a layer of gravelly to gravelly sandy loam up to 4 feet thick.

These soils are moderately well drained and support a vegetative series dominated by Western hemlock, and blueberry.

Soils encountered in the AST/drum cache and building C4 areas during the 2006 and 2009 site visits consist of dark brown to black organic-rich soils and peat at the surface ranging from about 6 to 30 inches thick, overlying either discontinuous light brown to gray silty sand, or rocky talus/weathered bedrock material. Test holes advanced with a hand auger throughout this area hit refusal at the top of the talus or bedrock unit at depths ranging from about 1 to 3 feet. It is unknown whether the underlying unit is a natural talus deposit or weathered bedrock. An exposure of fractured bedrock lies in a headwall a short distance upslope from the ASTs. The discontinuous mineral soil layer was encountered in isolated areas near building C4 and west of the ASTs.

2.1.5 Hydrology

2.1.5.1 Freshwater

Surface water bodies in the upland part of the Salt Chuck Mine Site include flow from the main adit, a small unnamed stream, and Lake Ellen Creek (Figure 2-1). The selected upland areas targeted by this EE/CA are located outside of the watersheds of these streams to the east.

Surface water runoff in the upper part of the Salt Chuck Mine enters the glory hole at the 300-foot elevation and drains into the haulage level of the main adit. The water mixes with groundwater, collects behind rock and debris near the adit portal, and discharges from the portal at an estimated flow rate of <0.1 cubic feet per second (cfs). Rainwater collection in the glory hole and groundwater percolation through bedrock fractures are the principal factors that create discharge from the main adit portal. Current portal flow and high porosity in the adit debris prevent head buildup in the glory hole.

The small, unnamed stream, originating northeast of the site from Power Lake bisects the mine property and converges with water discharging from the main portal adit (Figures 2-1 and 2-2). During high flow events, the unnamed stream overflows its channel near the adit portal, and flows both west down the established drainage and south along the rail line. The rail line overflow leaves the track after approximately 100 feet and flows westerly, rejoining the unnamed stream. The stream continues to the south, flowing into the head of Salt Chuck about 300 feet west of the mill site, and continuing along the west side of the tailings pile at low tide. The flow rate in this stream ranges from less than 1 to 10 cfs, and varies directly with rainfall conditions. Wetland areas are present along the entire length of the stream (Figure 2-4).

Lake Ellen Creek, originating from Lake Ellen 0.5 miles west of the site, flows around the western portion of the mine site into Kasaan Bay. At low tide, Lake Ellen Creek merges with the unnamed stream southwest of the tailings pile before entering Salt Chuck Bay (Figure 2-1). Estimated average flow in Lake Ellen Creek is approximately 25 cfs, based on rough measurements made in 2006.

2.1.5.2 Groundwater

Shallow groundwater occurs intermittently and seasonally just below surface soils in upland areas of the site. Test holes dug in the AST/drum cache and building C4 areas encountered groundwater at the interface between organic surface soils and the underlying weathered bedrock or talus unit throughout this area in October 2009, but only near building C4 in September 2006. Groundwater was not encountered in sample holes dug in this area July 1997 or July 2002. When and where present, depth to groundwater ranged from about 1 to 2-1/2 feet below ground surface (bgs) in the AST/drum cache and building C4 areas.

Test holes dug at the mill site in 2009 encountered groundwater sporadically at depths ranging from 1-1/2 to 4 feet bgs; groundwater was absent in some holes up to 4 feet deep. Groundwater was not encountered in sample holes dug in this area in July 1995, July 2002, or September 2006.

2.1.5.3 Saltwater

Surface water runoff and the limited groundwater present in the selected upland areas flow directly into the head of Salt Chuck Bay.

An intertidal zone encompassing approximately 80 acres is located south of the mill site, and extends around an unnamed island in the middle of Salt Chuck Bay (Figure 1-1). The intertidal zone is covered by fucus, gravel, and beach grasses. At high tide, saltwater from Salt Chuck Bay inundates the lower portions of Lake Ellen Creek, the unnamed stream, and the main tailings pile. The streams, tailings, and outlying sediment are exposed at low tide. Maximum tidal ranges in the Kasaan Bay area are typically on the order of 18 to 23 feet (NOAA, 2002). At highest high tides, saltwater is expected to be on the order of 3 to 9 feet above the seafloor near the mouth of Lake Ellen Creek. The bench that the mill sits on is roughly 6 to 10 feet above the highest tide line, and building C4 is about 6 feet above the highest tide line.

2.1.6 Ecological Setting

The Kasaan Peninsula area is located on east-central Prince of Wales Island, bounded by Clarence Strait to the north and Kasaan Bay to the south. The peninsula is a long mountainous ridge with steep, heavily-timbered slopes, and numerous abandoned mines, prospects, and mineral occurrences located on its western half.

The mine workings at Salt Chuck are located in an upland environment characterized by gently rolling hills, bedrock, and dense vegetation (USBLM, 1998). Site vegetation includes spruce, cedar, hemlock, and alder trees, intermixed with abundant berry bushes and devil's club (Table 2-1). Wetland areas are present along the entire length of the small unnamed stream that bisects the mine site (Figure 2-4).

The mill structure is located in a narrow band of lowlands adjacent to Kasaan Bay, dominated by alders and bushes. The intertidal beach areas are classified as estuarine intertidal, emergent, and persistent in a tidal regime that is irregularly flooded. The intertidal area is classified as regularly flooded, with sand and gravel flats and aquatic beds-algae. Lake Ellen Creek is classified as riverine, tidal, with an unconsolidated bottom and permanent tidal wetland (USBLM, 1998).

Species of birds and terrestrial mammals common to Southeast Alaska and which may be present in the upland areas of the site area are listed in Tables 2-2 and 2-3. Lake Ellen Creek is an anadromous fish stream supporting pink, chum, and coho salmon, steelhead, and dolly varden (USBLM, 1998). Sculpins and frogs were observed near the mouth of the small stream that bisects the site, and evidence of deer, bear, and river otter have been observed throughout the area. There are no federally-listed terrestrial or freshwater threatened or endangered species in Southeast Alaska (ADFG 2009).

2.1.7 Land Use

The Salt Chuck Mine site in general is accessible by trail, boat, float plane, or helicopter. Service roads extend past the north end of the mine site, and are used by hunters and casual recreational vehicle traffic. Areas north and east of the site are designated as timber harvest units, and were actively logged in 1997 with no apparent direct effects to the mine site (USBLM, 1998).

The Salt Chuck area is designated as an area of intensive public recreation use by the Alaska Department of Natural Resources (ADNR, 1998) *Prince of Wales Island Area Plan*. Salt Chuck Bay is an excellent protected waterway for canoes, kayaks, and other small boats, and passage to Lake Ellen is possible for small craft on high tides. The glory hole at the Salt Chuck Mine is regularly used by rock climbers for rappelling. A Forest Service campground is located about 1.2 miles northwest of the site at Lake No.3. In addition, a recreational public cabin is located on Forest Service land at the mouth of the Karta River about five miles south of the site. Although there are no dock facilities at the mine site, a trailhead at the upper end of Salt Chuck Bay is accessible during high tide by small craft. However, USBLM (1998) reports that this mode of access is used less frequently than the road system and trail extending from the glory hole to the mill. There is a marked trailhead located along the Forest Service road about 0.5 miles north of the glory hole. The nearest public access boat ramp to the site is located in Kasaan, about 10 miles southeast of the site.

According to the ADNR (1998) plan, the Salt Chuck Mine falls within Land Management Subunit 11b (Karta Bay), which is designated as having high fish and wildlife habitat and harvest values. Crucial habitat has been identified in this area for seasonal black bear populations, waterfowl, herring spawning, and salmon rearing and schooling.

The Salt Chuck area is designated for potential intensive community use for harvest of clams, crab, oysters, waterfowl, and black bear by residents of Kasaan, Hollis, and Craig (ADNR, 1998). Residents may also collect berries from the area. The closest of these communities, Kasaan, is located about 10 miles southeast of Salt Chuck Mine along the eastern shore of Kasaan Bay.

2.2 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

The tailings around the mill contain elevated concentrations of a number of potentially hazardous substances such as copper and selenium, as well as commingled petroleum constituents from diesel engines, fuel tanks, and sludge on the floor of the mill. Additional tailings may be present under the mill debris. The sludge accumulated beneath the tanks adjacent to four banks of diesel engines in the northwest corner of the mill. Petroleum constituents appear to have migrated into tailings beneath and adjacent to the west side and southeast corner of the mill (USBLM, 1998; URS, 2007). Low levels of polychlorinated biphenyls (PCBs) have also been detected in tailings around the mill, possibly from former electrical equipment at the mill. The concentrations of selected metals and petroleum constituents exceeding proposed cleanup levels are discussed in Sections 2.4 through 2.5, and depicted on Figures 2-5 and 2-6. As the metals contamination is likely similar throughout the mill area tailings deposit, the lateral extent of contamination for the purposes of this EE/CA was assumed to be the extent of tailings mapped based on physical characteristics and dimensions measured in the field and off aerial photographs (Forest Service, 1991a, 1991b), which is approximately 28,000 square feet (ft^2), or about 0.6 acres. The extent of copper exceeding the proposed cleanup level likely extends to the edge of the tailings pile. Commingled petroleum constituents exceeding cleanup levels lie within the extent of the tailings deposit.

Test holes were dug around the mill in 2009 to refine tailings thickness estimates for the limited removal action addressed by this EE/CA. The thickness of the mill tailings ranges from 8 inches to 4 feet, with most test holes encountering 2 to 2-1/2 feet of tailings. Grass and wood debris, or waste rock/talus material, was encountered beneath the tailings in this area. Based on assuming an average thickness of 3 feet, the total volume of tailings in this area was estimated to be 3,100 cy.

Other sources of contamination include diesel formerly stored in ASTs and drum caches east of the mill (Photograph 5; Figures 2-2 and 2-3); and hazardous substances in soils around building C4, which may have been used as an assay shop (Photograph 4). The concentrations of selected metals and petroleum constituents exceeding proposed cleanup levels are discussed in Sections 2.4 through 2.5, and are contoured on Figures 2-5 and 2-6. The extent of diesel range organics (DRO) in the AST/drum cache area and metals in soils around building C4 exceeding the proposed cleanup level is approximately 9,900 ft^2, or about 0.2 acres.

Test holes dug around the AST/drum cache and building C4 areas in 2009 encountered soil thicknesses on the order of 1 to 3 feet above weathered bedrock or talus, with most test holes encountering soil thicknesses in the range of 1-1/2 to 2-1/2 feet. Shallow groundwater occurs intermittently and seasonally at the interface between the surface soils and bedrock/talus material in this area. The soils targeted for removal include surface soils down to groundwater or the weathered bedrock/talus unit. An average soil thickness was assumed to be 2-1/2 feet, yielding a total soil volume of approximately 900 cy for the combined AST/drum cache and building C4 areas.

Other abandoned equipment was encountered around the site during the previous investigations, such as a boiler at tailings pile D15, and miscellaneous debris associated with structures east of building C4, west of the unnamed stream, and around the mine workings and tramway (Figure 2-2). The buildings include workers' housing, a general office, and a blacksmith or machine shop. No evidence of hydrocarbon staining or other potential sources of hazardous substances were observed in these areas, and no sampling was conducted.

2.3 PREVIOUS INVESTIGATIONS

Existing site data and historical information were originally compiled by USBLM in a report entitled *"Removal Preliminary Assessment, Final Report"* completed for the Salt Chuck Mine (USBLM, 1998).

The USBLM conducted an inventory-level evaluation of physical and chemical hazards in 1995. During the 1995 evaluation, unfiltered water samples were taken to determine if metals or other hazardous substances were leaching into downstream waters. Samples were also collected from the mine tailings and analyzed to evaluate the presence of heavy metals. These samples were described as “character” samples, indicating that the analyses were not necessarily performed by standard protocols generally required for site assessments. The data collected provided guidance to determine if follow-up environmental sampling was warranted.

The Salt Chuck Mine was listed on the Federal Agency Hazardous Waste Compliance Docket, published in the Federal Register on June 27, 1997.

In July 1997, additional water, tailings, sediment, soil, and mollusk tissue samples were collected from the Salt Chuck Mine and from background locations by USBLM. Sample analyses were generally performed to provide usable data for site assessment purposes. The objective of the 1997 *Preliminary Assessment/Site Inspection* was to determine if hazardous substance releases warranted removal actions under CERCLA.

In July 2002, URS conducted a sampling program at Salt Chuck Mine for the Forest Service as part of a site-wide EE/CA (2007). The objective of the investigation was to further characterize the nature and extent of contaminants, conduct a risk-based evaluation of site data, and assess removal action alternatives to prevent or mitigate releases at the site (URS, 2002). The following media were collected and analyzed during this investigation: soil in upland areas of the site; sludge found at the mill; tailings from the mill area, the unnamed stream, and the intertidal zone; saltwater sediment beyond the tailings; surface water in both freshwater and intertidal areas; and bivalve tissue from the intertidal tailings and Salt Chuck sediment. Background samples of soil, sediment, freshwater, and bivalve tissue were also collected in 2002. Expanded areas of intertidal tailings encountered during the 2002 field investigation, and a preliminary risk interpretation of the data, indicated the need for additional investigation.

In September 2006, URS returned to the site to conduct additional field work to further characterize the nature and extent of the chemical threats to human health and the environment that had been identified as a result of the previous investigations. The 2006 investigation focused on areas where additional data was required to eliminate data gaps. The specific objectives of the 2006 field investigation included the following:

- Defining the extent of contaminated soil exhibiting RCRA characteristic levels of hazardous substances adjacent to building C4;
- Waste characterization of soil and tailings at building C4 and the mill area;
- Further characterization of intertidal tailing zones;
- Re-estimation of the volume of intertidal tailings;
- Further characterization of sediment, surface water, and shellfish tissue in the intertidal tailings zones, the intertidal areas west and east of the Unnamed Island, the intertidal portions of southern Salt Chuck and Brown’s Bay, and the background sediment site at Gosti Island;

- Evaluation of ground conditions of onshore area west side of Salt Chuck for suitability for containment area construction; and
- Documentation of the physical characteristics of the site to aid in evaluation of possible future access by heavy equipment, and to identify potential borrow sources.

The results of the 2002 and 2006 investigations were compiled in a document entitled *Draft EE/CA, Engineering Evaluation/Cost Analyses (EE/CA), Salt Chuck Mine, Tongass National Forest, Alaska* dated May 2007 (URS, 2007). While the 2007 Draft EE/CA was underway, it was unclear whether the State of Alaska or the United States held title to the tidelands at the site. With exceptions not relevant to the Site, the U.S. Supreme Court confirmed Alaska's ownership of "any real property interest in the marine submerged lands within the exterior boundaries of the Tongass National Forest" (*State of Alaska v. United States,* 546 U.S. 413, 415 2006.)

- It was thought that the site as a whole would likely be listed under the NPL as a "Superfund" site in 2010, after which a site-wide Remedial Investigation/Feasibility Study (RI/FS) would be anticipated to be completed. The August 2009 strategy meeting (URS, 2009) provided the basis for the scope of the upland EE/CA focused on land under the jurisdiction, custody, and control of the Forest Service, the intent of which is to focus on removal actions that can be accomplished with Federal stimulus funds on selected portions of the upland areas, that can enhance and be conducted alongside future NPL activities, including removal of mine debris in and around the mill site for safety purposes; and removal of soil and tailings that clearly pose a risk to human health at the mill site, building C4, and the AST/drum cache area.

- In late October 2009, a site visit was performed by URS and Forest Service engineers, scientists, and archaeologists for the purposes of: identifying the scope of debris removal actions, identifying potential repository locations for tailings and soils, evaluating the preliminary feasibility of barge access to the site, refining soil and tailings volume estimates, and sampling of waste rock for suitability of use as construction material. Field notes documenting observations made during this field visit are provided in Appendix B.

2.4 ANALYTICAL DATA

The following subsections summarize available data from the 1995, 1997, 2002, and 2006 investigations and 2009 engineering site reconnaissance that are pertinent to preparing the EE/CA for selected upland areas of Salt Chuck Mine. Sample locations are shown on Figures 2-1 and 2-3, and analytical results are summarized in Tables 2-4 through 2-8. Raw laboratory analytical data for the 2002 and 2006 investigations are provided in Appendices C and D, respectively. Waste rock testing results from the 2009 site visit are provided in Appendix E.

Quality Assurance/Quality Control (QA/QC) procedures implemented during the 1995 and 1997 sampling and analytical activities were not available; therefore, assessment of data quality for these investigations was limited to a qualitative understanding of sample methods used, and comparative results of duplicate sample analyses. Data collected during the 2002 and 2006 investigations were validated in accordance with USEPA and ADEC standards in effect at the time of the investigations. Data validation flags appear on the summary data Tables 2-4 through 2-8 where appropriate, and complete data validation procedures and memoranda for the 2002 and 2006 investigations are provided in Appendices F through H.

Data Tables 2-4 through 2-8 are divided by media type, as well as by inorganic and organic analytes. Soils data from building C4 and the AST/drum cache areas are provided in Tables 2-4 through 2-6. Soil near building C4 analyzed specifically by the Toxicity Characteristic Leaching Procedure (TCLP) is presented in Table 2-5. Sediment, surface water, saturated tailings, and bivalve tissue data that are outside the scope of this EE/CA are reported in a draft EE/CA report (URS 2007).

During the previous USBLM (1998) investigations, several soil and tailings character samples were analyzed for a complete suite of heavy metals targeted by a mining assay laboratory. The data included a number of metals that are not listed in Tables 2-4 and 2-7 because they are not considered relevant to the EE/CA investigation (URS, 2002, 2007). As the intent of this EE/CA is to focus on priority-pollutant and other metals that have known toxicological effects to human health, the list of metals was reduced as follows. For most of the metals dropped from consideration (e.g., bismuth, gold, palladium), no human health risk-based values exist. In the case of gallium, lanthanum, tungsten, and uranium, all site data were non-detect. Other inorganics such as sodium and potassium are considered essential nutrients, and are not typically part of risk analyses. Risk-based values do exist for some of the metals (e.g., cobalt, molybdenum, titanium), but there are no chemical-specific regulatory ARARs governing these metals, and the site data are below the risk-based values, and/or below regional background levels (Gough, et al., 1988; Maas, et al., 1995; URS, 2001). Thus, these types of metals were not considered further in the EE/CA investigation.

Information related to site soils, sludge, and unsaturated tailings, including general trends and qualitative comparisons to background data, are presented below in Sections 2.4.1 through 2.4.3. These data are further compared to background and to human health risk-based values developed for this project in the SRE in Section 2.5. The results of waste rock testing are presented in Section 2.4.4. Intertidal tailings and surface water data located downgradient of the selected upland areas are summarized in Section 2.4.5 to the extent that they are pertinent to understanding migration from the areas targeted by the removal action.

2.4.1 Soils

Two composite surface soil samples were collected during the 1997 field investigation in the upland area east and north of the mill site to test for possible hazardous substances related to the AST area and fuel drum caches. In 2002, an additional 10 surface soil samples were collected in the AST and drum cache areas, and two samples were collected next to building C4 (former assay shop). Five background soil samples were also collected in 2002. In 2006, three additional soil samples were collected in the vicinity of building C4 to further define the extent of metals contamination and to determine if the contaminated soil is a hazardous waste for alternatives analysis and possible disposal purposes. The analytical results are summarized below.

- **Background.** Background soil samples were collected at five locations outside the boundaries of the mine site and analyzed for metals, DRO, RRO, and total organic carbon (TOC). Background soils in the area contain relatively high concentrations of TOC, ranging from 59,640 to 132,500 mg/kg (0.05964 to 0.1325 g/g). Antimony, cadmium, selenium, and thallium were not detected in background samples. The range of concentrations for other metals is provided in Table 2-4. In the case of arsenic, two of the five samples exhibited concentrations above ADEC Method Two cleanup levels. The use of background metals and TOC data in the SRE is described in Sections 2.5.1.2 and 2.5.2.2., respectively.

- **Building C4.** Soil samples collected next to this building exhibited concentrations of copper, lead, mercury, and other inorganics that were well above background . The distribution of copper and lead in this area is shown on Figure 2-5. TCLP analysis at the sample location with the highest concentrations indicates that Resource Conservation & Recovery Act (RCRA) levels defining a toxicity characteristic solid waste are not exceeded. Based on that result, it is anticipated that the soil would not be considered a hazardous waste for disposal purposes.
- **ASTs and Drum Caches.** The results of analyses for petroleum hydrocarbons in this area indicate the presence of DRO in most samples in the range of 174 to 17,400 milligrams per kilogram (mg/kg), and residual range organics (RRO) in the range of 195 to 7,400 mg/kg. The lateral distribution of DRO in soils is depicted on Figure 2-6. DRO and RRO analyses were also conducted using a silica gel cleanup approach at five of the sample locations in an effort to identify contributions from naturally occurring organics. These analyses yielded DRO up to 4,580 mg/kg (compared to 5,500 mg/kg without silica gel cleanup), and RRO up to 1,240 mg/kg (compared to 1,640 mg/kg without silica gel cleanup), indicating that some polar compounds of probable biogenic origin were removed by the silica gel cleanup procedure, that may be present in the total DRO results. Other samples showed silica gel results that do not appear to be significantly different than those samples not undergoing this process (e.g., SSSC-15).

  Two polynuclear aromatic hydrocarbons (PAHs), benzo(a)anthracene and benzo(a)pyrene (BaP), were detected at low levels in one of two samples from the AST area (Table 2-6). BaP equivalent (BaPeq) concentrations that account for the cumulative exposure of all carcinogenic PAHs were calculated as described in Section 2.5.2.2 and listed in Table 2-6.

  Test holes dug in this area in 2009 to refine soil thickness estimates encountered hydrocarbon odors in the vicinity of the unknown building remains, near the southeast corner of the wooden drum crib, and about 25 feet due south of the ASTs. Hydrocarbon odors were notably absent at the following locations: near building C4, between the drum crib and the unknown building remains, within about 20 feet southeast and southwest of the ASTs, and in between the drum caches and the mill tailings/waste rock pile. The test hole locations are shown on Figure 2-6.

2.4.2 Sludge

During the 1995 investigation, a sample of a thick sludge was collected from the floor of the northwest corner of the mill. The sludge had accumulated beneath fuel tanks adjacent to four banks of diesel engines, and appeared to have migrated into the intertidal zone (USBLM, 1998). Analysis of the sludge sample indicated a concentration of 163,000 mg/kg DRO. Additional sampling was conducted during the

2002 investigation along the west side and southwest corner of the mill building where the sludge and possible diesel contamination appeared to have migrated into tailings.

2.4.3 Unsaturated Tailings

One character sample of tailings above the intertidal zone in the mill area was collected in 1995, and four additional samples of these materials were collected in 2002.

Most of the material surrounding the mill is a mixture of waste rock and tailings. The samples collected in this area exhibit elevated concentrations of several metals well above background levels in soil (Table 2-4), the most pronounced of which are copper and selenium (Figure 2-5). In addition, several PAHs and PCBs were detected in samples from this area (Table 2-8). Test holes dug in this area in 2009 to refine tailings thickness estimates encountered hydrocarbon odors in the vicinity of the barge southeast of the mill ruins and along the west side of the mill. These field observations were incorporated into the interpretation of extent on Figure 2-6.

2.4.4 Waste Rock

Natural oxidation of sulfide minerals in rocks by weathering can result in the formation of sulfuric acid, lowering pH and causing increased levels of dissolved metals in surrounding water. Acid-generating minerals include the various mineral forms of pyrite and other sulfide minerals, which can be neutralized by alkaline minerals in rock such as calcite. The potential for acid generation is a factor in determining whether a rock source may be viable for construction activities.

For the purpose of evaluating the usefulness of waste rock piles near the mill as a construction material, two composite grab samples of waste rock from material were collected in October 2009 and analyzed for acid generation potential. One composite sample was collected from the D1 pile, and the other composite sample was collected from rock mixed within the tailings around the mill site (Photograph 8). Each composite sample was comprised of twelve cobble-sized rocks. The samples were submitted to ALS Laboratory in Vancouver, BC for analysis of acid generation potential using acid-base accounting (ABA) static tests, including fizz test; paste pH; total sulphur; sulphur as sulfate; sulphur as sulfide; bulk acid neutralization potential (NP) by the modified Sobek method; acid potential (AP); net neutralization potential (Net-NP; Net-NP = NP-AP); and, neutralization potential ratio (NPR; NPR = NP/AP).

The results of these tests are provided in Appendix E. Based on the results, one sample showed a potential for acid generation, and one sample did not. Hence, as a conservative measure, none of the waste rock piles are considered to be viable material sources for construction.

2.5 STREAMLINED RISK EVALUATION (SRE)

The emphasis of this SRE is on supporting the development of appropriate alternatives for removal action at the selected upland areas rather than on following risk assessment procedures to support site closure decisions. Potential upland ecological risk concerns were not considered in this focused upland EE/CA, but may be addressed as necessary under the future site-wide NPL process for the site.

According to USEPA (1993b) *Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA,* a streamlined process can be used where the risk assessment is conducted as part of a removal evaluation. An SRE can be intermediate in vigor, can be focused on specific threats rather than all pathways, and can utilize comparisons of hazardous substance concentrations to federal or state standards or other risk-based criteria in an effort to develop preliminary removal action goals (PRAGs). The SRE used as part of this removal action involved three steps:

1) Data Evaluation. This step involved the identification of applicable analytical data for use in the SRE.
2) Human Health SRE. This step involved the development of a human health conceptual site model (CSM) and the identification of chemicals of potential concern (COPCs) that may require further action in affected upland media. COPCs were initially identified by comparing the maximum detected concentrations to PRAGs. With the exception of DRO, the preliminary removal action goals used in this SRE were primarily ADEC Method Two cleanup levels, which are based on and protective of a potential residential land use. However, these values were supplemented with other risk-based criteria, as necessary. For naturally-occurring inorganics, a comparison of the maximum concentrations against background levels was also performed.
3) Risk Characterization. This step was designed to further evaluate the significance of COPCs based on protection of groundwater and the likelihood of groundwater migration as a pathway to the intertidal zone, and to identify the final list of chemicals of concern (COCs) in soils and upland tailings that form the basis for this removal action. This step also identifies uncertainties present in this upland SRE.

This SRE is intended to be used as a risk management tool to establish the basis for defining the RAOs in support of this removal action as described in Section 3.1, and was not designed as an in-depth evaluation of all potential human health risks. Refined risk screening procedures, such as the screening of chemical data against 1/10th ADEC Method Two cleanup levels, are anticipated to occur during the site-wide NPL risk assessment using the confirmatory sampling data collected subsequent to the removal action (Section 4.2.1). Despite the limited intent of this SRE, the approach does generally incorporate standard steps for risk assessment, and the approach incorporates aspects of both ADEC and USEPA regulations and methodologies (e.g., ADEC, 2008a, 2008b, 2008c, 2009a; USEPA, 1989, 1993b, 2009). Certain exposure pathways and risks that are better addressed under a site-wide and comprehensive site-specific risk assessment are not addressed as part of this EE/CA, but may be considered under the NPL process. These exposure pathways include subsistence level resource use, such as consumption of berries and/or wild game.

2.5.1 Data Evaluation

Site characterization and data collection activities, including information developed by both USBLM (1998) and URS (2007), are detailed in Sections 2.1 through 2.4 of this report. Upland soil and unsaturated tailings data are summarized in Tables 2-4 through 2-8.

2.5.1.1 Data Validation

Validation of site data was conducted to identify those data that are usable for risk assessment purposes. USEPA guidance states that, in order to meet data quality objectives (DQOs) for risk assessment, analytical data shall meet Level III quality criteria, which is defined as the level that can accurately identify and quantify chemicals present in site media, and can be relied upon to make assessments which may affect human health (USEPA, 1993a). Data that fail to meet Level III criteria are classified as Level I or Level II. Data of Level I quality can provide indications of chemicals when present, but cannot quantify concentrations. Character sample data collected at the Salt Chuck site in the 1990s were generally considered Level II, in that, like an on-site mobile laboratory, they approximate quantity for the purpose of roughly identifying extent, but do not have QA/QC reports that can be used to validate information such as system performance, detection limits, etc., and as such, cannot be relied upon to make assessments that may affect human health.

Analytical data collected in the upland area during the 2002 and 2006 investigations at the Salt Chuck Mine are provided in Appendices C and D, respectively. The validation process performed on these data are summarized in URS memoranda and an ADEC checklist provided in Appendices F through H, and discussed in the following section.

2.5.1.2 Data Reduction

Prior to risk evaluation in the SRE, data were evaluated in the validation process and reduced using the following strategies:

- Non-detected results were reported with “U” flags in the raw laboratory data, and listed as “ND” in the summary data tables (Tables 2-4 through 2-8) with detection limits provided in parentheses. For non-detected data, proxy concentrations equal to the detection limit were utilized for preliminary COC selection in the SRE to identify compounds that should be retained for further evaluation.
- Data were reviewed by the laboratory and data validator to determine if “J” qualifiers should be assigned for estimated values. These flags were added to tabulated summary data for several reasons: where a result fell below the Practical Quantitation Limit (PQL) but higher than the Method Detection Limit (MDL); where matrix spike or surrogate recoveries were outside of laboratory QC criteria; where duplicate relative percent differences (RPDs) were outside of control limits; where holding times were exceeded; and where matrix interference was present. Footnotes describing the use of “J” flags for individual data points are provided in Tables 2-4 through 2-8, as appropriate. The estimated concentrations were used in the SRE and re-assessed for data quality if necessary during risk characterization.
- Analytical results rejected in the data validation process are typically noted with “R” flags and are excluded from use in the risk evaluation. However, no rejected data were present in the upland soil and tailings data set.
- Blanks were evaluated in the validation process to determine if “B” qualifiers should be assigned for chemicals also detected in method blanks. Inorganic compounds not considered common

laboratory contaminants were flagged as non-detects if the measured concentration was less than ten times the maximum detected concentration in a method blank or equipment blank, or less than five times the detected concentration in a continuing calibration blank.

- In accordance with 18 Alaska Administrative Code (AAC) 75.380(c)(1) as cited in Guidelines For Data Reporting, Data Reduction, and Treatment of Non-Detect Values (ADEC, 2008c), the maximum concentration was used for analytical results where both a normal and duplicate field sample were collected. Both the normal and duplicate data are presented in the summary data tables. If one result was detected and the other non-detected, the detected value was selected.
- The maximum concentration of each detected compound in each media was used for evaluation in the SRE.
- The maximum concentration of duplicate results was used for evaluation in the SRE.
- Background data were used in the SRE to eliminate COPCs (e.g., metals) that may initially indicate a risk, but are present at the site at natural concentrations. During the 1995 through 2006 investigations, background data were collected for a variety of media. Background locations are discussed in Section 2.4, depicted on Figure 2-1, and included on summary data Tables 2-4 and 2-6. Background values used in the SRE were identified in accordance with EPA (2002) guidance.
- The original USBLM (1998) soil/unsaturated tailings character sample data sets, which had been analyzed by a mining assay laboratory, were reduced during development of the URS (2002) Work Plan by several heavy metals that were not considered relevant to the EE/CA investigation. The rationale for this process is described in Section 2.4.
- Character sample results were used for approximating extent of contamination, but were separated out in the risk evaluation. For comparison purposes, frequency of detections were calculated for non-character samples alone, as well as for character and non-character samples added together.

2.5.2 Human Health SRE

This human health SRE involved the development of a CSM which identifies human receptors and complete exposure pathways, selection of COPCs through comparison to the ADEC Method Two cleanup goals (including direct contact, outdoor inhalation, and migration to groundwater) that were identified as PRAGs, and qualitative discussion of potential human health risks. This SRE is intended to be used as a risk management tool to establish the basis for defining RAOs in support of this removal action presented in Section 3.0, and was not designed as an in-depth evaluation of all human health risks. A site-wide risk assessment is anticipated be performed as part of the NPL process using the confirmatory sampling data collected in conjunction with the removal action.

2.5.2.1 Receptors and Pathways of Concern

Human receptors of concern for the upland portion of the Salt Chuck Mine site are expected to include recreational users (e.g. hunters, hikers, rock climbers, etc.) and future mining workers. Pathways of concern for risk to human health are presented in a CSM outlined on Figure 2-7, and described in the following paragraphs.

For impacted surface soils and unsaturated tailings, potentially complete pathways for recreational users exist, and include incidental ingestion of surface soil or unsaturated tailings, dermal contact, and inhalation of particulates. With the possible exception of mercury, the types of chemicals at the site are not volatile, such that inhalation of vapors is considered an insignificant exposure pathway. ADEC Method Two cleanup levels that are based on direct contact and inhalation of soils under a residential land use scenario are presented in Section 2.5.2.2.

The Salt Chuck area is open to hunting; however, the target areas of this EE/CA cover only approximately 0.6 acres, and likely represent only a small portion of the potential foraging area of game species such as bear and deer. Hence, chemical uptake from the site and accumulation into tissues at harmful concentrations is unlikely to be significant, and was not considered in the development of RAOs. Quantitative evaluation of this pathway, if deemed necessary in the future, may be performed as part of the NPL process.

While no berry bushes surrounding the mill site or in the POL-contaminated area were observed during a site visit in October 2009, soils in the site vicinity are known to support blueberry and salmonberry bushes. The retention of all bioaccumulative chemicals, irrespective of the chemical concentration as recommended in the risk assessment procedures manual (ADEC, 2009b), was not performed in this SRE. As indicated above for wild game consumption, further risk evaluation of bioaccumulatve chemicals may be performed as a part of the site wide NPL process. Bioaccumulative compounds present in soil at concentrations below risk-based criteria, which were not retained for further evaluation in the SRE, are discussed in the uncertainty section (Section 2.5.2.3.3).

Groundwater ingestion is not considered to currently be a pathway of concern for humans, because groundwater is not used in the local area and there are no drinking water wells within a 15-mile target distance hydrologically downgradient of the Salt Chuck Mine site (USBLM, 1998). Groundwater in the upland area is potentially potable, but shallow groundwater appears to occur intermittently and seasonally at the interface between shallow surface soils and weathered bedrock or talus. The migration-to-groundwater pathway for soils is retained in the SRE due to ADEC requirements under 18 AAC 75 that soil cleanup levels be protective of this pathway, and to be protective of groundwater migration to surface water. ADEC Method Two soil cleanup levels based on migration-to-groundwater are discussed in Section 2.5.2.2.

2.5.2.2 Selection of Preliminary Removal Action Goals (PRAGs)

The following sections describe the selection of PRAGs for the human health SRE. These values were used in the SRE to interpret the significance of site data, and to assist in risk management decisions where a risk or hazard was identified.

Direct Contact and Inhalation Pathways. With the exception of DRO and lead, the approach for pathways involving soils and unsaturated tailings was to use ADEC (2008a) Method Two soil cleanup levels (18 AAC 75.340) for sites with greater than 40 inches per year mean annual precipitation. These levels are provided in Table 2-9 for the compounds sampled during the EE/CA investigations. These values were used to select COPCs based on potential incidental ingestion of, and direct contact with, upland soils and unsaturated tailings. For individual Aroclors, no ADEC cleanup levels have been established under Method Two and only the total PCB value was considered. For iron, no ADEC cleanup levels have been established under Method Two, and residential soil USEPA (2009) Risk Screening Levels (RSLs) values were considered.

Migration-to-Groundwater Pathway. With the exception of iron, DRO, and lead, the approach for this pathway was to use soil cleanup levels following ADEC Method Two regulations and guidance (18 AAC 75.340). These levels, where available, are provided in Table 2-9 for potentially hazardous materials, including metals and organic compounds sampled during the EE/CA investigations. For iron, no ADEC cleanup levels are available and the USEPA soil screening level (SSL) for protection of groundwater (USEPA, 2009) was selected for use in the SRE (value in parentheses in Table 2-9).

Approach for Lead. Under the upland scenario, lead concentrations in soil and unsaturated tailings, were compared to the ADEC (2008a) Method Two cleanup level for residents.

Approach for DRO and RRO. Site DRO and RRO data were initially screened using ADEC (2008a) Method Two soil cleanup levels. For soil data from the AST/drum cache area that exceeded these values, a site-specific alternative cleanup level was calculated under ADEC Method Three (18 AAC 75.340e) to account for the presence of naturally occurring organics in the soil, and to develop an RAO for the limited purposes of the removal action in this area (Appendix I). The calculated Method Three cleanup level for soil was not applied to the unsaturated tailings because this is a different media with different organic carbon content.

Since completion of the 2007 draft EE/CA, ADEC (2008e) issued guidance on the use of total organic carbon (TOC) in alternate cleanup level calculations. The existing background TOC data, which were collected in 2002 based on standards approved by ADEC at the time (URS, 2002; Forest Service, 2002), do not precisely follow recommendations in the new ADEC guidance, in that they are not located in the immediate vicinity of the AST area. However, the background TOC data were considered usable for the limited purposes of the removal action in the AST/drum cache area for the following reasons:

- Five background TOC values are available (Table 2-6) and were collected in areas where hydrocarbons would not be expected to influence the results (Figure 2-1);
- The background samples were collected in forested upland areas very similar to the immediate vicinity of the AST/drum cache area; and,
- None of the TOC values showed variability of greater than an order of magnitude.

Thus, the site-specific soil TOC data were used to calculate an average TOC value of 0.0761 grams per gram (g/g), and this value was used in place of the default fraction organic carbon (f_{oc}) value in the ADEC migration-to-groundwater equation.

ADEC also provided feedback on the dilution attenuation factor (DAF) used in the Method Three calculation, indicating that it should be modified from the standard default of 13.2 (ADEC, 2008e) to a DAF of 1, in order to account for the proximity to surface water and detections of petroleum constituents in the intertidal zone (Palmieri, 2009). As the online Method Three calculator does not allow modification of this parameter, the modified DAF was applied after using the online calculator to derive an initial result.

The initial results of the Method Three calculation for the AST/drum cache area, based on a residential scenario, yields a migration-to-groundwater value for DRO in soil of 16,500 mg/kg and a direct contact value of 8,300 mg/kg. As the DAF is directly proportional to the soil cleanup level (ADEC, 2008e, Equation 12), reducing the DAF from 13.2 to 1 was achieved by dividing the initial Method Three migration-to-groundwater result by 13.2 which results in a soil cleanup level of 1,250 kilograms per kilogram (kg/kg). This value is proposed as the cleanup level for DRO in soil at the AST/drum cache.

Cumulative Risk. Under 18 AAC 75.345(g) *"If using method two or method three for determining applicable cleanup levels..., a responsible person shall ensure that, **after completing site cleanup,** the risk from hazardous substances does not exceed..."*, for cleanups conducted under ADEC Method Two or Three, a calculation of cumulative risk must be conducted using 1/10th the Method Two direct contact and inhalation values. Cumulative risk is intended to be evaluated for the site as a whole, and typically does not include petroleum hydrocarbon mixtures or lead (ADEC, 2008b). Because this assessment is in support of interim action for a limited part of the site, for the purposes of the SRE, cumulative risk has been addressed by evaluating the adequacy of our cleanup levels by running ADEC's cumulative risk calculator under a post-removal scenario, as described in Section 2.5.2.3.4.

Additionally, cumulative risks for high molecular weight PAHs are accounted for by calculating BaPeqs as recommended in ADEC (2009b) by multiplying the toxicity equivalency factors (TEFs) presented in Schoeny and Poirer (1993) by the PAH concentration for a given sample, then adding the concentrations to achieve sample-specific BaPeq concentrations. The PAH-specific TEFs used for this calculation are listed below:

Benzo(a)anthracene	0.1
BaP	1.0
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.01
Chrysene	0.001
Dibenzo(a,h)anthracene	1.0
Indeno(1,2,3-cd)pyrene	0.1

The resulting sample-specific BaPeqs are listed in Tables 2-6 and 2-8. These values were compared to ADEC Method Two cleanup levels for BaP (Table 2-9) in the SRE to identify potential risks.

2.5.2.3 Risk Characterization

Typically, not all chemicals present at a site pose health risks or contribute significantly to overall site risks. USEPA guidelines (USEPA, 1989) recommend focusing on a group of "chemicals of potential concern" based on inherent toxicity, site concentration, and behavior of the chemicals in the environment.

To identify these COPCs, risk-based values are compared to site concentrations of chemicals. If site concentrations of a chemical exceed their respective concentrations, then further evaluation of their concentrations is conducted, and the chemicals may be retained as COPCs for further evaluation in the risk assessment. For inorganics expected to occur naturally in the environment without influence from humans, background comparisons were also performed. It should be noted that an exceedance of a risk-based value by a maximum concentration does not necessarily represent either an individual or an additive health concern within the context of a particular site.

The results of the comparisons between site concentrations and PRAGs are presented in Table 2-10 for soil in the building C4 and AST/drum cache areas, and in Table 2-11 for unsaturated tailings in the mill site. Risks to human receptors are discussed by media in the following sections.

2.5.2.3.1 Soil

For the purpose of initial COPC development, the most conservative ADEC criterion was selected. In most cases, this criterion was based on protection of groundwater, following ADEC migration to groundwater cleanup levels. However, COPCs are also discussed in relation to ADEC direct contact and outdoor inhalation criteria, which are considered a more appropriate measure of environmental significance in this human health risk evaluation.

Site soils in the following distinct areas were considered in this removal action: the fuel drum caches and the upper AST area, and the area around building C4 (Figures 2-3, 2-5 and 2-6). While these areas lie adjacent to one another, they were considered separately as they are distinguished by different types of COCs. Based on the maximum concentration in any area, seven metals (i.e., antimony, arsenic, copper, lead, mercury, selenium, and silver) plus DRO were initially identified as COPCs for soils

Antimony. Antimony was identified as a COPC because the maximum soil concentration of 15.4 mg/kg at building C4 is greater than the Method Two cleanup level for migration-to-groundwater of 3.6 mg/kg. The maximum detected concentration of antimony of 15.4 mg/kg is below the ADEC Method Two direct contact cleanup level of 33 mg/kg. Antimony was retained as a COC for this removal action based on potential concerns regarding migration to groundwater only.

Arsenic. Arsenic was initially identified as a COPC because the maximum soil concentration of arsenic of 4.95 mg/kg at the site is greater than both the Method Two cleanup levels for the migration-to-groundwater and direct contact, as well as the background concentration of 4.06 mg/kg. Two of four soil samples contain arsenic levels that exceed background. Because the slight exceedences of background are likely to be within the range of natural data variability, arsenic was retained as a soil COC on this basis only for the sample with the highest concentration (SCSS-2). Arsenic was also slightly above background at SCSS-26 (4.31 to 4.51 mg/kg vs. 4.06 mg/kg background); however, this location is not recommended for removal action because the exceedance of background is minor, and the measured concentration is probably within the range of natural variability. No other metals exceed cleanup levels at this location, and removal of vegetation and topsoils solely for achieving a low level of arsenic which is probably natural could result in more harm to the environment than is warranted.

Copper. Copper was identified as a COPC because the maximum soil concentration of 7,320 mg/kg at the site is greater than the Method Two migration-to-groundwater cleanup level of 460 mg/kg, as well as the direct contact level of 3,300 mg/kg. As such, copper was retained as a COC for soil for both the migration-to-groundwater and direct contact pathways for this removal action.

Lead. Lead was identified as a COPC because the maximum soil concentration at the site of 6,170 mg/kg is greater than the ADEC residential pathway-specific value of 400 mg/kg. Soil exposure to casual visitors and adult future miners at the site is likely to be much less than presumed under the residential exposure scenario. However, it is possible that a pregnant miner or recreational user may visit the site, so the more protective endpoint for children was used, and the default soil cleanup level of 400 mg/kg in residential settings was identified as the target RAO. As such, a removal action is recommended to address the lead concentrations greater than 400 mg/kg as depicted on Figure 2-5.

Mercury. Mercury was identified as a COPC because the maximum soil concentration at the site of 311 mg/kg is greater than the Method Two migration-to-groundwater cleanup level of 1.4 mg/kg, the outdoor inhalation cleanup level of 13 mg/kg, and the direct contact cleanup level of 25 mg/kg. Mercury was retained as a COC for this removal action.

Selenium. Selenium was identified as a COPC because the maximum soil concentration at the site is greater than the Method Two cleanup level for migration-to-groundwater of 3.4 mg/kg. The maximum detected selenium concentration of 8.36 mg/kg is well below the ADEC Method Two ingestion value of 410 mg/kg. Selenium was retained as a COC for this removal action based on potential concerns regarding migration to groundwater only.

Silver. Silver was identified as a COPC because the maximum soil concentration of 17.8 mg/kg at the site is greater than the Method Two cleanup level for migration-to-groundwater of 11.2 mg/kg. The maximum detected concentration is well below the ADEC Method Two ingestion value of 410 mg/kg. Silver was retained as a COC for this removal action based on potential concerns regarding migration to groundwater only.

Petroleum Hydrocarbons. RRO and DRO samples were collected in the AST and drum cache area, and a number of sample locations exceeded the ADEC Method Two cleanup levels for DRO. As described in Section 2.5.2.2, an ADEC Method Three cleanup level was calculated for DRO using site-specific TOC data to develop a migration to groundwater pathway value. The extent of DRO exceeding the proposed 1,250 mg/kg RAO is depicted on Figure 2-6.

In summary, the soil COCs targeted for this removal action include antimony, arsenic, copper, lead, mercury, selenium, silver, and DRO. The extent of several of the metals and DRO exceeding their respective cleanup levels is shown on Figures 2-5 and 2-6.

2.5.2.3.2 Unsaturated Tailings

The unsaturated tailings that are considered in this removal action include the area adjacent to mill where most of the material surrounding the mill is a mixture of waste rock and tailings. Sludge sampled from the floor of the northwest corner of the mill is also included in this section due to the proximity of this sample to the tailings piles. The analytical program for unsaturated tailings included inorganics, PCBs, PAHs, DRO and RRO. The single sludge sample contained only measurements for DRO.

The COPCs initially identified for the unsaturated tailings and sludge include antimony, arsenic, copper, iron, mercury, selenium, silver, DRO, BaP, and benzo(b)fluoranthene (Table 2-11). Each of these COPCs are further considered below. In addition, an expanded discussion on lead is included below to provide rationale for not selecting it as a COPC.

Antimony. Antimony was identified as a COPC because the maximum unsaturated tailings concentration of 5.11 mg/kg at the site is greater than the Method Two cleanup level for migration-to-groundwater of 3.6 mg/kg, as well as the background value of 0.4 mg/kg (Table 2-11). Because the maximum detected concentration of antimony is below the direct contact level of 33 mg/kg, antimony in unsaturated tailings is not considered to pose an unacceptable health risk to human receptors of concern at the site. Antimony was selected as a COC for this removal action based on potential concerns regarding migration to groundwater only.

Arsenic. Arsenic was identified as a COPC because the maximum unsaturated tailings concentration of 10.2 mg/kg at the site is greater than the Method Two cleanup levels for direct contact and migration-to-groundwater, as well as the background concentration of 4.06 mg/kg. Thus, arsenic was selected as a COC in unsaturated tailings for this removal action based on potential impacts to human health and migration to groundwater.

Copper. Copper was identified as a COPC because the maximum unsaturated tailings concentration at the site of 53,400 mg/kg exceeds the Method Two cleanup level for migration-to-groundwater of 460 mg/kg, as well as the direct contact value of 3,300 mg/kg. Thus, copper was selected as a COC in unsaturated tailings for this removal action based on potential impacts to human health and migration to groundwater.

Iron. Iron was initially identified as a COPC because the maximum unsaturated tailings concentration at the site is greater than the USEPA soil screening level for groundwater protection of 640 mg/kg. Because there is only one data point for iron and that data point (SO03) is a character sample (Sections 2.5.1.1 and 2.5.1.2), and because ADEC has not established Method Two cleanup levels for iron, iron was not retained as a COC. Nonetheless, the SO03 location is targeted for removal based on other COCs (copper, silver, and antimony) identified in the unsaturated tailings.

Lead. The potential for health effects from lead exposure is typically evaluated differently from most chemicals, in that the criterion is based on a level of concern in blood predicted using lead concentrations in a variety of exposure scenarios and media (e.g., produce, drinking water, soil, etc.). Because the most significant risk from lead exposure is for children, the more protective endpoint for children was considered, and the default soil cleanup level of 400 mg/kg in residential settings was identified as the target removal action objective. None of the lead concentrations in unsaturated tailings exceeded 400 mg/kg.

Mercury. Mercury was identified as a COPC because the maximum unsaturated tailings concentration of 20.7 mg/kg at SCSS-27 is greater than the Method Two migration-to-groundwater cleanup level of 1.4 mg/kg. The maximum mercury concentration in the tailings also exceeds the Method Two outdoor inhalation level. Mercury was selected as a COC in unsaturated tailings.

Selenium. Selenium was identified as a COPC because the maximum unsaturated tailings concentration at the site of 65.4 mg/kg is greater than the Method Two cleanup level of 3.4 mg/kg based on migration-to-groundwater. The maximum concentration is well below the ADEC Method Two direct contact value of 410 mg/kg. Selenium was retained as a COC based on potential impacts to groundwater only.

Silver. Silver was identified as a COPC because the maximum unsaturated tailings concentration at the site is greater than the Method Two cleanup level for migration-to-groundwater of 11.2 mg/kg. The maximum detected (non-character sample) silver concentration of 34.1 mg/kg is well below the ADEC Method Two ingestion value of 410 mg/kg. Silver was retained as a COC based on potential impacts to groundwater only.

DRO. The DRO levels in the unsaturated tailings (Table 2-8) are above the ADEC Method Two soil cleanup level for migration-to-groundwater of 230 mg/kg in two of four tailings samples, and below the ingestion level for all tailings samples. The sludge sample exceeded PRAGs. DRO was retained as a COC in tailings and sludge.

PAHs. BaP, benzo(a)anthracene, and benzo(b)fluoranthene were identified as COPCs because their maximum unsaturated tailings concentrations of 2.69, 4.05, and 4.87 mg/kg, respectively at the site are greater than their Method Two cleanup levels for direct contact. To further evaluate the potential cumulative risks from these high molecular weight PAHs, BaPeqs were calculated as indicated in Section 2.5.2.2. In addition, the maximum benzo(a)anthracene concentration also exceeds the migration-to-groundwater Method Two cleanup level. Given that future mine workers could reasonably be exposed to unacceptable risk levels via direct contact with unsaturated tailings, BaPeqs were targeted as a COC for this removal action to address BaP, benzo(a)anthracene, and benzo(b)fluoranthene. Benzo(a)anthracene in unsaturated tailings was also selected as a COC for the migration-to-groundwater pathway in the mill area. The distribution of BaPeqs and benzo(a)anthracene are depicted on Figure 2-6.

In summary, the COCs in unsaturated tailings targeted for this removal action include antimony, arsenic, copper, selenium, silver, DRO, BaPeqs, and benzo(a)anthracene. The extent of several of the metals and organics exceeding their respective cleanup levels is shown on Figures 2-5 and 2-6.

2.5.2.3.3 Uncertainty

Varying degrees of uncertainties (generally conservatively biased) are present in screening evaluations. An understanding of those limitations is critical to support risk management decision-making processes. Areas of uncertainty are discussed below:

- Recent trends in the environmental sampling of PCBs have resulted in a variety of analytical data for this chemical. Traditionally, PCBs have been reported as five Aroclors (1016, 1242, 1248, 1254, and 1260). The chemical manufacturer (Monsanto) had defined the Aroclors based on the total amount of chlorine present, as well as the congener composition. However, various biotic and abiotic processes can shift the congener composition, and analytical methods have been refined so that both homolog and up to 2009 individual congeners can be detected using USEPA Method 1668. These analyses are costly, and interpretation of congener data relative to established toxicity data, which are based on Aroclor measurements, contributes to the uncertainty in risk evaluations for PCBs. Given the high cost of analytical work, coupled with the uncertainties of extrapolating measured congener concentrations to toxicity data based on Aroclor analyses, PCB data were not collected using the analytical method for congeners in this study; rather total PCB risks are estimated based on Aroclor data.

- The maximum detected concentration of inorganics in background soil samples was used in the COC selection process. The USEPA (2002) guidance considers the use of maximum detected background concentrations as uncertain. With the exception of arsenic, the use of maximum background did not affect the COC selection. With regard to arsenic, the use of the maximum background detection affected the COC selection in only one location (SCSS-26). The ratio of the arsenic site concentration to background is only 1.1 at this location.
- Bioaccumulative compounds are defined by ADEC as having a bioconcentration factor (BCF) equal to or greater than 1,000 for organic compounds, or identified by USEPA as bioaccumulative inorganic compounds. According to ADEC (2009b) guidance, if the ingestion of wild foods is a complete pathway at the site, bioaccumulative compounds should be retained as COPCs. Only those bioaccumulative chemicals in soil and unsaturated tailings at concentrations greater than ADEC Method Two cleanup levels were retained. Bioaccumulative chemicals detected in both soil and tailings that were not retained for consideration in this removal action included cadmium, nickel, and zinc. PCBs in unsaturated tailings were also not retained. These chemicals may be further evaluated in a site wide risk assessment as part of the NPL process.
- ADEC Method Two soil cleanup levels were not systematically adjusted by a factor of 1/10th to account for cumulative risk for soil or tailings exposure during the SRE process. In general, the risk criteria were based on conservative ADEC migration-to-groundwater cleanup levels, and are generally considered protective of cumulative risk.
- In general, only data that have undergone Level III data validation are typically selected as usable for risk assessment purposes. For this reason, because the historical character sample data for inorganics did not undergo standard data validation procedures, nor did they follow standard laboratory methods, the character sample data are considered uncertain and risk decisions were generally made using the maximum non-character sample concentrations.
- The maximum concentration of duplicate results was used for risk evaluation in the SRE. Where duplicate results vary widely, this introduced uncertainty in the value used in the SRE, it could indicate natural heterogeneity in the soil or tailings, and may result in overestimating risk.

2.5.2.3.4 Risk Summary and Conclusion

This SRE addresses only potential human health risks in support of the development of alternatives for a removal action for selected upland areas at the Salt Chuck Mine site. Based on this conservative analysis, further action is recommended to address the following COCs that had maximum concentrations greater than applicable ADEC Method Two or Three cleanup criteria, indicating a potential direct exposure human health risk:

- For soil, DRO, antimony, arsenic, copper, lead, mercury, selenium and silver were identified as COCs.
- For unsaturated tailings, DRO, BaPeqs, benzo(a)anthracene, antimony, arsenic, copper, mercury, selenium, and silver were identified as COCs.

RAOs concerning these media and compounds are presented in Section 3.0. In the absence of $1/10^{th}$ risk screening and a Method 4 Risk Assessment prior to the interim action, an evaluation of post-removal cumulative risk was performed assuming the RAOs are achieved. The benzo(a)pyrene cleanup level was used in the post-removal calculation because the basis of the BaPeq concentrations are inclusive of benzo(a)anthracene contributions to the direct contact exposure pathway. A separate evaluation of benzo(a)anthracene, which was selected based on the more conservative migration-to-groundwater pathway, was not deemed necessary. As noted in Appendix J, the results of the cumulative risk calculation indicate that the noncarcinogenic hazard index is less than 1. Two chemicals are at or exceed concentrations that result in a 1×10^{-5} cancer risk: benzo(a)pyrene and arsenic. The proposed cleanup level for arsenic is based on naturally-occurring background concentrations. While the cleanup level for benzo(a)pyrene is at the target risk of 1×10^{-5}, BaPeq concentrations well below this cleanup level are slated for removal in soil and tailings because they are collocated with other chemicals targeted for removal (metals and DRO). Further cumulative risk evaluation may be addressed during a site-wide NPL risk assessment effort using the confirmatory sampling data.

3.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

This section presents an evaluation of whether a removal action is warranted for the selected upland areas of the Salt Chuck Mine site, and determines an appropriate scope of the removal action. The removal action is recommended for implementation in the selected areas where it is considered necessary to prevent, minimize, or mitigate damage to public health. RAOs are presented that represent residual levels of chemicals in soil/tailings which are protective for the specific exposure and transport pathways evaluated in the Human Health SRE.

3.1 NON-TIME CRITICAL REMOVAL ACTION ASSESSMENT

Section 104(a) of CERCLA authorizes federal agencies to remove or arrange for the removal of hazardous substances, whenever there is a release or threat of release of such materials that may endanger human health or the environment. CERCLA also requires that methods and criteria for determining the appropriate removal action and the extent of the remedy be documented. Based on available data, these criteria are met at the Salt Chuck Mine site where elevated concentrations of listed hazardous substances in surface soil and tailings were found. The determination of whether or not a CERCLA release poses a threat requiring a non-time critical removal action is based on eight factors defined by 40 Code of Federal Regulations (CFR) 300.415(b)(2):

1. Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants, or contaminants;
2. Actual or potential contamination of drinking water supplies or sensitive ecosystems;
3. Hazardous substances in containers that may pose a threat of release;
4. High levels of hazardous substances in soils largely at the surface, that may migrate;
5. Weather conditions that may cause hazardous substances to migrate or be released;
6. Threat of fire or explosion;
7. The availability of other appropriate federal or state response mechanisms to respond to the release; and,
8. Other situations or factors that may pose threats to public health or welfare, or the environment.

The identified CERCLA releases at the Salt Chuck site meet the criteria established in items 1 through 5 as discussed below:

1. *Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants, or contaminant:* A complete exposure pathway exists between identified CERCLA releases and potential human receptors via direct contact with surface soil and tailings in upland locations.
2. *Actual or potential contamination of drinking water supplies or sensitive ecosystems:* High concentrations of metals are present in surface soil and tailings at the mine site, and may impact nearby sensitive environments or groundwater.
3. *Hazardous substances in containers that may pose a threat of release:* Batteries present in the electric locomotive pose a potential threat of release.

4. *High levels of hazardous substances in soils largely at the surface, that may migrate:* High concentrations of metals are present in surface soil and tailings at the mine site and a potential for migration exists, as has been demonstrated during past sampling events.
5. *Weather conditions that may cause hazardous substances to migrate or be released:* High precipitation could mobilize metals and hydrocarbon contamination via runoff or migration to groundwater from the upland areas to the Salt Chuck intertidal area.

3.2 REMOVAL ACTION OBJECTIVES

RAOs can include both qualitative goals and quantitative cleanup criteria. The Human Health SRE identified the media and exposure and transport pathways that are intended to be addressed by the limited removal action under the focused upland EE/CA. The SRE integrated both an evaluation of risk and information to support reasonable risk-management decisions based on chemical-specific ARARs. The RAOs identified include the following:

- Reduce risks for recreational users and future miners from exposure to hazardous substances in surface soils and tailings via dermal contact, incidental ingestion, and outdoor inhalation.
- Prevent migration of hazardous substances, including metals, and petroleum hydrocarbons in surface soil, tailings, and sludge to groundwater and surface water.

To address these RAOs, quantitative target removal goals were established as listed in Table 3-1, and are discussed in the context of ARARs in the following section. Because of potential concerns regarding impacts to ecological receptors and groundwater following the removal action, and because not all upland areas are being addressed, these RAOs may not to lead to closure of the upland part of the Salt Chuck Mine site. Rather, the RAOs are intended to support this interim action only.

3.3 IDENTIFICATION OF POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section describes potential ARARs identified for the removal action alternatives, which are identified in accordance with the National Contingency Plan (NCP) and USEPA guidance. Removal actions must achieve potential ARARs to the extent practicable, considering site-specific conditions, including the urgency of the situation, the scope of the removal action, and the impact of potential ARARs on cost and duration of the removal action (40 CFR 300.415(j)).

No federal, state, or local permits are required for remedial actions conducted wholly on-site (CERCLA 121(e), 42 United States Code (USC) 9621(e) and 40 CFR 300.400(e)(1)). On-site removal actions meet only substantive requirements, not administrative requirements, of potential ARARs. Administrative requirements, such as permits, reports, and records, along with substantive requirements, apply only to hazardous substances sent off-site for further management. The substantive requirements identified as potential ARARs for the Salt Chuck Mine site removal action were based on a review of federal environmental laws and more stringent state environmental and facility siting laws. Several terms used throughout this section are identified below:

Applicable Requirements. Under NCP, applicable requirements are defined as, “those cleanup standards, standards of control and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site” (40 CFR 300.5).

Relevant and Appropriate Requirements. Relevant and appropriate requirements are, “those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not “applicable” to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site” (40 CFR 300.5).

To-Be-Considereds (TBCs). TBCs are non-promulgated advisories or guidance issued by federal or state government that are not legally binding and do not have the status of potential ARARs.

State Standards. State standards are ARARs if they are “promulgated, are identified by the state in a timely manner, and are more stringent than federal requirements.” The term “promulgated” means that the standards are of general applicability and are legally enforceable (40 CFR 300.400[g][4]).

Potential ARARs include chemical-, location-, and action-specific ARARs:

- Chemical-specific ARARs are human health or ecological risk-based numerical values or methodologies, which when applied to site-specific conditions, are used to determine acceptable concentrations of chemicals that may be found in or discharged to the environment.
- Location-specific ARARs restrict certain types of activities such as those located in wetlands, floodplains, and historic sites.
- Action-specific ARARs are technology- or activity-based restrictions that are triggered by the type of removal action under consideration.

The three types of ARARs are discussed below. A summary of potential ARARs for the Salt Chuck Mine site is provided in Table 3-2. This is a preliminary list of ARARs that may apply to the site or potential removal actions. Final identification of ARARs is reserved for the Action Memorandum.

ARARs may be waived under certain circumstances. The waiver criteria include the following:

- An action is conducted as an interim measure;
- Compliance with the ARAR would result in greater risk to health and the environment;
- Compliance with the ARAR is technically impractical;
- An equivalent standard of performance is applied; or
- Compliance with the ARAR would result in inconsistent application of state requirements.

ARAR waivers may be required for the use of certain RAOs identified in Table 3-1 where the most conservative state cleanup level is not necessarily recommended for this site and limited removal action, for reasons described in Section 2.5 on a case-by-case basis. The following sections provide summaries of potential chemical-specific, location-specific, and action-specific ARARs identified for the alternatives evaluated in this EE/CA.

3.3.1 Chemical-Specific ARARs

Potential chemical-specific ARARs are health-based or risk-based numerical values for COCs that are considered acceptable for material remaining on-site. ADEC regulations for potential impacts to groundwater from waste materials, and soil lead standards for commercial/industrial land uses are examples of potential chemical-specific ARARs for the site. A summary of the types of chemical-specific ARARs potentially applicable to the Salt Chuck Mine site are presented in Table 3-2. Wastes generated from the extraction of minerals are excluded from RCRA Subtitle C hazardous waste requirements under the Bevill Amendment and USEPA's subsequent regulatory determination. Under 40 CFR 261.4(b)(7), the following wastes are excluded from regulation as a hazardous waste:

- Solid waste from the extraction, beneficiation, and processing of ores and minerals (including coal, phosphate rock, and overburden from the mining of uranium ore).
- Beneficiation of ores and minerals is restricted to the following activities: crushing; grinding; washing; dissolution; crystallization; filtration; sorting; sizing; drying; sintering; palletizing; briquetting; calcining to remove water and/or carbon dioxide; roasting, autoclaving, and/or chlorination in preparation for leaching (except where the roasting (and/or autoclaving and/or chlorination)/leaching sequence produces a final or intermediate product that does not undergo further beneficiation or processing); gravity concentration; magnetic and/or electrostatic separation; flotation; ion exchange; solvent extraction; electrowinning; precipitation; amalgamation; and heap, dump, vat, tank, and in situ leaching.

Although not a designated hazardous waste in the absence of other specific criteria, mine tailings are generally considered a solid waste and are therefore regulated by Alaska Solid Waste Regulations. Based upon available information, mine tailings from the Salt Chuck Mine meet the RCRA exemption and it is not anticipated that this material would be regulated as a hazardous waste under federal guidelines.

Alaska Hazardous Waste Regulations (18 AAC 62 and 63) would potentially apply to removal of batteries from the site. These regulations provide for the identification and management of hazardous waste as defined by the USEPA and hazardous waste that exhibits the characteristic of toxicity, persistence, or carcinogenicity; and exempt mining waste from their coverage.

3.3.2 Location-Specific ARARs

Potential location-specific ARARs are requirements that affect the management of hazardous substances due to the location of the site. Potential location-specific ARARs can be triggered for example, if the removal action were to be located in areas with mining claims, or would cause discharge to sensitive locations such as wetlands, floodplains, historic areas, or wildlife refuges. These requirements may limit the type of potential removal action that can be implemented, or may impose additional requirements or constraints on removal action alternatives.

As indicated in Section 2.1.1, mining features and artifacts present throughout the site are eligible for National Register listing under the National Historic Preservation Act (NHPA) of 1966. Detailing of historical debris and removal considerations of selected debris as part of Alternatives 0 through 5 would be coordinated by a Forest Service archaeologist in conjunction with the State Historic Preservation Office (SHPO) and delineated in a cultural mitigation plan. The plan would meet NHPA requirements and address disposition, staging, and replacement of historical materials to be moved during removal action activities.

The 2001 Roadless Area Conservation Rule is a conservation policy limiting road construction and timber cutting and the resulting environmental impact on designated areas of public land. The Tongass National Forest was exempted from the rule in 2003. This project would be allowed under the 2001 Roadless Area Conservation Rule because a road is needed to conduct a response action under CERCLA, or to conduct a natural resource restoration action under CERCLA, Section 311 of the Clean Water Act, or the Oil Pollution Act (36 CFR 294.12(b)(2)). Road construction areas addressed in EE/CA alternatives do not lay within the set of inventoried roadless area maps contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000. As such, road construction addressed in the EE/CA does not require Secretary of Agriculture's approval per the United States Department of Agriculture, Office of the Secretary, Secretary's Memorandum 1042-154, dated May 28, 2009.

For construction of an on-site (mill site or borrow pit) repository to contain contaminated materials, a Jurisdictional determination might need to be made for the proposed repository location in accordance with the U.S. Army Corps of Engineers Wetland Delineation Manual to ensure that the repository would not be placed within a designated wetland area. A preliminary review of National Wetland Inventory maps indicate that the proposed repository locations are not within known wetlands (Figure 2-4). Wetlands avoidance was a criteria evaluated at the proposed repository sites during the October 2009 site visit. The proposed repository sites were selected in locations designed to avoid wetlands and 100-foot stream buffers.

Existing mining claims in the area of the proposed repository may require that the Forest Service file for withdrawal of the repository area from mineral entry to assure the integrity of the repository. In addition, regulations governing mining claims on National Forest System lands (36 CFR Part 228) require that a notice of intent to operate and a plan of operations be submitted to the Forest Service for activities such as mining which might cause disturbance of surface resources. The Forest Service has the authority to limit the adverse impacts mining operations might cause, such as disturbing a waste repository.

Potential location-specific ARARs are identified and discussed in Table 3-2. These potential location-specific ARARs will continue to be evaluated and refined as the selected removal action is developed and finalized.

3.3.3 Action-Specific ARARs

Potential action-specific ARARs are usually technology- or activity-based requirements or restrictions on actions taken with respect to hazardous substance(s). These potential requirements are triggered by the particular removal action alternative, and set performance, design, or other standards that will be used to implement the proposed removal action. Potential action-specific ARARs do not affect the selection of the removal action, but instead may pose restrictions on methods by which a selected alternative may be achieved. Examples of action-specific ARARs include stockpiling of treated or untreated tailings from the site, and discharge of pollutants into surface waters (subject to the Clean Water Act). A complete list of potential action-specific ARARs are presented and discussed in Table 3-2. These ARARs will continue to be evaluated and refined as the selected removal action is developed and finalized.

Alaska's solid waste regulations are applicable to the storage and disposal of solid waste, such as the petroleum and petroleum and metal mixed material soils and tailings materials. Regulations set forth standards for waste disposal facilities, including accumulation and storage limitations, land spreading restrictions, and requirements for special waste disposal. Permitting standards as well as monitoring and reporting requirements are also set forth in these regulations. If one of the on-site repository disposal options is selected, the Forest Service is not required to obtain a permit for a solid waste landfill, but must adhere to Alaska solid waste design, construction, monitoring, and institutional control requirements.

Alaska's hazardous waste regulations define solid wastes that are hazardous waste; establishes standards for generators, transporters, and disposal facilities. Alaska Hazardous Waste Management Regulations include the federal RCRA Subtitle C requirements with additional criteria and standards promulgated by the State of Alaska. These hazardous waste regulations are potentially applicable to the removal and disposal of the batteries present in the electric locomotive north of the mill.

3.3.4 Other Guidance To Be Considered

TBCs are guidance only and are not legally enforceable. TBCs include non-promulgated criteria, advisories, guidance, and proposed standards issued by Federal, state, or local governments. TBCs may be useful in evaluating numerical constituent-specific cleanup goals regarding metals in the tailings. Examples of TBCs applied to the Focused Upland EE/CA include the use of site-specific background levels, as well as USEPA (2009) RSLs and SSLs in the absence of ADEC cleanup levels. Chemical-specific RAOs listed in Table 3-1 include the use of a TBC in the case of arsenic in background.

3.3.5 Summary of Key Project ARARs

Review of Table 3-2 indicates that compliance with the following ARARs will be key to selecting an appropriate removal action alternative for the site.

- ***Alaska Oil and Other Hazardous Substance Pollution Control Regulations (18 AAC 75):*** These regulations provide soil cleanup levels and guidance on risk assessment and the use of background levels used in the determination of RAOs, which will reduce threats of complete exposure pathways and contaminant migration identified in Section 3.1.

- ***Alaska Solid Waste Regulations (18 AAC 60):*** These regulations set forth landfill standards that will need to be met for the disposal of commingled POL and CERCLA hazardous wastes in the proposed repository. When completed, the repository would prevent the continued threats of contaminant migration and exposure to the public (Section 3.1).
- ***National Historic Preservation Act (32 CFR Part 229, 40 CFR § 6.301(b), 36 CFR Part 800) and Preservation of Historical and Archaeological Data (40 CFR § 6.301(c))*:** These are applicable to federal actions affecting potential alteration and removal of historical mining debris during the removal action.

3.4 SCOPE OF THE REMOVAL ACTION

3.4.1 Debris Removal

The scope of mill site debris removal for safety purposes was determined in consultation with Forest Service personnel during the October 2009 site visit. Removal of the debris is essential to provide access for the excavation and removal of the contaminated material at the mill site. The approximate area in which debris would be detailed and removed from the site, under the oversight of the Forest Service archaeologist, is shown on Figure 3-1. This area is bounded by the D15 tailings pile to the southwest, building C1 to the southeast, and the electric locomotive to the north. Debris to be removed consists mainly of metal and wood associated with the former mill building, the abandoned barge, the ASTs, drum caches east of the mill, building C4, and the assay shop. The lead acid batteries from the electric locomotive will also be removed.

3.4.2 Soil and Tailings Removal

The overall approach for identifying the scope of the removal action in soil and tailings was to select physical boundaries that would minimize residual contamination and risk following implementation of the removal action. The boundaries of the removal action are approximated by the cross-hatched areas depicted on Figure 3-1. Boundaries in the mill site tailings area were influenced by the approximate limit of the tailings deposit (as identified by textural characteristics) beyond sample points and beneath the mill where existing sample density is low. Boundaries in the AST/drum cache and building C4 areas were determined based on contours of contaminant concentrations exceeding proposed cleanup levels in Table 3-1. Based on test holes dug in these areas during the October 2009 site visit, approximate thicknesses of 3 feet and 2-1/2 feet were estimated for the tailings and soils, respectively.

The removal action encompasses two upland areas, including approximately 3,100 cy at the mill site, and approximately 900 cy of soil at both building C4 and the AST/drum cache area combined.

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4.0 REMOVAL ACTION TECHNOLOGY SCREENING AND ALTERNATIVE DEVELOPMENT

This section documents the process of identifying and screening removal and containment technologies that are potentially applicable to the upland portion of the Salt Chuck Mine site. Potentially applicable technologies are identified based on available site characterization data and known physical site conditions. Technologies identified are then either retained for further consideration or screened out, based on an evaluation of their ability to effectively address site concerns. The technologies that are retained for further consideration in the EE/CA are then assembled into removal action alternatives to address the site-specific RAOs.

The following subsections present the results of the technology identification and screening, and descriptions of the removal action alternatives developed. The removal alternatives are evaluated in greater detail in Section 5.0.

4.1 TECHNOLOGY IDENTIFICATION AND SCREENING

In accordance with EE/CA guidance, technologies and associated process options having the highest potential for success at the Salt Chuck Mine site were identified for preliminary screening evaluation. Technologies and process options identified as potentially applicable at the site are summarized in Table 4-1. A brief description and screening determination for each process option is also given. The screening determination identifies whether the given process option will be retained for further consideration in assembling candidate removal action alternatives. A discussion of the rationale used to retain or eliminate technologies and process options is provided in this section.

No Action. Evaluation of the no action scenario is required by the NCP, 40 CFR § 300.430(e)(6). The no action scenario represents a baseline condition against which other removal actions are compared.

Physical Access Restrictions. Physical access restrictions prevent access for recreational users, future miners, or other site visitors to impacted areas of the site using fencing, signage, and/or routine security inspections. They may also include large boulders placed at access points to prevent motor vehicles from accessing a particular area. Physical access restrictions are retained for further consideration because they are a reliable method of controlling accidental direct human contact with physical and chemical site hazards.

Debris Removal. Wood and metal debris at the mill site would be removed to reduce the associated physical hazards and provide access to remove contaminated material at the mill site. Debris removal is essential to the implementation of excavation technology, and is retained for further consideration.

Land Use Controls. Land Use Controls may include modifying conditions of the current property or land adding the site to Forest Service Land Status Records to limit certain types of land uses. This may be a stand alone measure, or a supplement to other actions taken as part of an overall site remedy. Future building restrictions in certain portions of the site, such as for an information kiosk, may be an appropriate type of land use control when combined with other site control measures. Land use controls would be subject to an understanding between the Forest Service and mine claim owners (if applicable).

Grading. Grading is used to alter the ground surface contour of an area such that surface water runoff is directed along desired routes. Site plans are developed to establish an overall grading design to optimize surface water conveyance around and away from impacted areas of the site, or in strategic locations across the site. Grading is considered potentially applicable to restore excavated areas and to limit infiltration rates into areas where tailings and soil above ADEC action levels or target cleanup goals remain on-site, and is retained for further consideration.

Diversion. Diversion may include construction or modification of features such as ditches, channels, and berms used to direct or divert surface water flow downslope, away from tailings or impacted soils. Diversion is considered applicable to reduce erosion to areas where tailings and impacted soil remain on-site, and is retained for further consideration.

Surface Water Collection Impoundment. Surface water storage in a surface impoundment or reservoir is used to equalize surface water runoff from a site. This technique is implemented in conjunction with diversion structures (e.g., ditches or channels) to control sediment transfer during large precipitation events. The surface water collection impoundment process option is eliminated from further consideration because it is not necessary based on site observations which did not indicate concentrated points of overland flow at the mill site. Surface water runoff which will occur from the site during the removal action should be able to be adequately conveyed and controlled using other temporary means. If necessary, storage tanks or a temporary basin could be used for collection and equalization of surface water and sediment control. It also may be possible to divert overland flow toward well defined drainages in the vicinity of the mill site.

Revegetation. Replacing vegetation following disturbance of the ground surface will mitigate soil erosion and surface water infiltration and runoff. Establishing vegetation can also be effective in enhancing the stability and permanence of cover systems. Roots from cover plants hold the soil in place, protecting against wind and water erosion. Revegetation can also reduce infiltration of water into surface materials through interception of water by plant root systems and transpiration mechanisms.

Revegetation is typically performed in conjunction with placement of clean fill and soil covers. For this site, revegetation includes topsoil replacement and planting native ground cover. Revegetation would included use of native seed mixtures, and would follow guidance provided in the Revegetation Manual for Alaska (ADNR 2008). Revegetation is retained for further consideration.

Monitored Natural Attenuation. Natural attenuation processes are commonly used for remediation of contaminated sites. A variety of natural processes occur without human intervention at all sites at varying rates and degrees of effectiveness to attenuate (i.e., decrease) the mass, toxicity, mobility, volume, or concentrations of organic and inorganic contaminants in soil, groundwater, and surface water systems. The USEPA uses the term “monitored natural attenuation” (MNA) when referring to the reliance on natural attenuation processes, within the context of a carefully controlled and monitored site cleanup approach, to achieve site-specific objectives within a time frame that is reasonable compared to other more active methods. MNA requires more complex and costly site characterization prior to implementation, long-term monitoring, and potential of continued migration, and/or cross-media transfer of contaminants. Metals do not degrade over time and natural attenuation of the tailings at the site has not been observed to date and it is not expected that it will occur to a significant degree in the foreseeable future. As such, MNA has not been retained for further consideration.

HDPE Liner and Cover. High-density polyethylene (HDPE) is commonly used as a liner material and a cover for consolidated stockpiled tailings and impacted materials. Placement of HDPE liner and cover would prevent direct exposure of the materials to the environment or receptors, virtually eliminate infiltration due to precipitation, and significantly reduce the potential for leaching of the constituents of concern. Leachate collection systems are often a component of a HDPE liner system. HDPE liners and covers are retained for further consideration.

Soil or Waste Rock Cover. Soil or rock from a non-acid producing source could be used to prevent direct contact with tailings and impacted materials to human and ecological receptors, reduce erosion, and provide a media for revegetation. This type of cover may not prevent leaching or contaminant migration without other design features. Soil materials at the site are limited in quantity, and any soil to be used as cover material would have to be imported from an off-site borrow source. Waste rock samples from some of the on-site waste rock piles at the site show that it is potentially acid producing so is not suitable for use as a cover material. Soil covers from a certified clean imported source are retained for further consideration.

Clay Cover. A clay cover consists of low permeability clay layer(s) approximately 6 to 12 inches thick. Clay covers are commonly specified instead of soil covers to further minimize surface water infiltration. Clay covers are typically used in landfill cover designs where strict control of leaching constituents of concern into the subsurface environment is desired. Due to the lack of local material sources and remoteness of the site, and since adequate infiltration control could be achieved by other means, clay covers are not retained for further consideration.

Clean Fill. Clean fill material is required to perform grading activities and to place in excavated areas to re-establish proper drainage. On-site soils are of generally poor quality for re-use as site grading fill and subject to potential contamination. For purposes of costing in this EE/CA, on-site soils are not planned to be re-used as clean fill unless analytical testing during performance of the remediation work indicates that the materials are clean. Waste rock was examined as a potential on-site source of clean fill with the expectation that it could be crushed as needed; however, results from waste rock samples show that it is potentially acid producing. Thus, only the import of clean fill from off-site borrow sources or vendors is retained for further consideration in subsequent evaluations.

Excavation. Excavation techniques employ the physical removal of impacted materials to eliminate future receptor exposure. Excavation technologies typically involve conventional earthmoving construction equipment. Equipment such as hydraulic excavators and dozers would be satisfactory for excavating, moving tailings, and DRO contaminated soil. Some portions of the site with tailings and soil above ADEC action levels beneath the mill site itself would be excavated by hand to preserve the structural integrity of the remaining historic mill features anticipated to remain in place. Excavation techniques used at the site may require dust control measures in disturbed areas to prevent particulate inhalation. Dust control typically involves using water sprays to suppress particulate suspension. Dust control may not be needed at the Salt Chuck Mine because of the typically wet climate.

Excavation would be required under scenarios which involve removal of tailings from the upland zone. Excavated materials may require appropriate segregation based on cleanup levels as indicated by the SRE, and to remove miscellaneous debris such as timber and logs in various portions of the tailings. Some local materials that could be considered for reuse at the site may need to be physically screened to segregate the soil from debris, waste rock, tailings or other contaminated media and tested for potential contamination prior to acceptance for reuse. Excavation is retained for further consideration.

Transportation. Transportation technologies typically involve the use of conventional materials handling equipment, such as excavators, loaders and trucks to load and transport excavated materials either on-site or off-site. Contractors may consider conveyor belts or other technologies as part of the transportation options. As with excavation activities, transportation activities would include dust control measures to prevent particulate suspension around the site when equipment is in use. There is no road the entire way to the site so it is currently only accessible by air, sea, or by foot. Existing roads in the area are approximately ½ mile from the mill site area and connect to the Prince of Wales highway system. Without a road the most practical way to haul heavy loads to and from the site is by barge. The bay is relatively shallow and exposed during low tides, but it is assumed barge access is possible during high tides. Transportation is retained as a necessary component of each of the removal options.

Consolidation, Mill Site Repository Stockpile. A mill site repository would be one option for consolidating the materials in one location for long-term care. Repositories are typically capped with an engineered low-permeability cover system, and may also be revegetated. Consolidation in a mill site repository allows for maintaining tailings and materials above ADEC action levels in a controlled environment, and with an appropriate cover can minimize or eliminate exposure pathways to potential human and ecological receptors. In addition, the potential for large quantities of overland flow can be mitigated by site selection and the design of diversion channels. Consolidation in a mill site repository is retained for further consideration.

Consolidation, Borrow Pit Repository Stockpile. A borrow pit repository would be a second option for consolidating the materials in one location for long-term care similar to the on-site stockpile. The borrow pit repository would be located in an existing borrow pit along the Forest Service access road. Repositories are typically capped with an engineered low-permeability cover system, and may also be revegetated. Consolidation in a borrow pit repository allows for maintaining tailings and materials above ADEC action levels in a controlled environment with easier access for construction and operation and maintenance (O&M). With an appropriate cover it can minimize or eliminate exposure pathways to potential human and ecological receptors. The potential impact of overland flow during storm events can be overcome by proper site selection and the design of diversion channels as needed. Consolidation in a borrow pit repository is retained for further consideration.

Consolidation, Glory Hole Repository Stockpile. The Glory Hole in the upper part of the site has been considered as a potential location for long-term disposition of site waste. This option is not considered to be viable because the nature of the water flow regime through the glory hole is not clearly understood, and it is not known whether the Glory Hole would adequately contain wastes. Additionally, there would be a potential for inadvertently impacting unique environments within the Glory Hole, or impacting cultural resources. Disposal of waste within the Glory Hole is not retained for further consideration.

Capping In-Place. Capping in-place involves the use of covers described above on top of contaminated materials, without transporting and consolidating materials in a controlled stockpile first. Capping in-place typically works best under the following conditions:

- Contaminant sources have been sufficiently abated to prevent recontamination of the cap;
- Contaminants are of moderate to low toxicity and mobility;
- Implementation of the cap will reduce migration of contaminants;
- Infiltration of surface water and groundwater flow is limited;
- Costs and/or environmental effects of removal from the site are very high; and
- Site conditions do not necessitate removal of contaminated materials.

The shallow groundwater, the potential for significant surface water flow and tidal fluctuations or even storm surges could prevent capping in-place from being effective. The large area where capping is needed and undefined drainage patterns which occur during storm events would make erosion control a challenge. A surface water evaluation study may be needed to evaluate the potential quantity of overland flow during storm events.

Conceptually an upland cap would consist of a geotextile separation layer over the impacted areas followed by earthen materials. Material above the geotextile could range from a single growth media layer to multiple layers to promote drainage and additional separation from the waste. The final surface would be an organic growth media layer to support vegetation. At the Salt Chuck site, this technology would include the following elements: placement of soil caps over the upland removal areas consisting of: building C4 (approximately 3,000 ft^2), mill area tailings (approximately 40,000 ft^2), and the AST/drum cache area (approximately 13,000 ft^2); periodic monitoring and inspection of the cap(s); and periodic maintenance as needed. Capping in-place would not include placement of an underlying impermeable liner, and as such, would not be completely effective in meeting RAOs involving migration-to-groundwater/surface water pathways. After cap construction is completed, land use restrictions would be implemented to prevent future excavation at the site, and signs stating that excavation is prohibited would be erected at the site. The capped areas could also have barriers installed to limit access.

For the AST/drum cache and building C4 area surface preparation and access necessary to implement capping of the area would be difficult without tree and stump removal. Capping in-place of upland materials would potentially meet the RAO of preventing unacceptable risks to recreational users and future miners in the upland areas (soils and tailings) by eliminating the exposure pathways of dermal contact, inhalation, or incidental ingestion by isolating the material with a cap, but would not be completely effective in eliminating migration-to-groundwater/surface water pathways. For these reasons, this technology is not retained for further consideration.

Permitted Off-Island Disposal. Off-site disposal involves transporting and placing material in an engineered containment facility located outside of the site boundaries. No currently permitted off-site disposal facility was identified on Prince of Wales Island so the term Off-Island is used when referring to disposal sites. Advantages of using existing off-island disposal facilities include removing tailings and materials exceeding ADEC action levels from the site for permanent disposal for long-term protection of human health and the environment. O&M costs associated with long term on-site storage would be eliminated and there would be fewer site restrictions. Off-island disposal is retained for further consideration.

Stabilization. Stabilization techniques commonly use Portland cement as the primary stabilization agent, and can be conducted as either an in-situ or ex-situ process. For ex-situ stabilization, the work would involve excavation, crushing or processing of impacted materials, and adding a stabilization agent, such as Portland cement and potentially other pozzolanic materials, to reduce or eliminate the mobility of metal constituents through chemical and physical binding into a stable mass. This option may be combined with a cover option to further reduce potential exposure pathways.

Cement-based stabilization involves mixing the materials with an appropriate ratio of cement, pozzolan, and water. The composition of the mixture determines set time, cure time, and material properties for placing the treated waste. Binder addition would increase waste volumes to be handled and disposed, typically ranging from 10 to 30% depending on the chemical nature of the waste materials. The ratio of cement and need for pozzolans to effectively treat waste materials is determined through pre-design laboratory treatability testing.

Most metals are amenable to cement-based stabilization, which tend to form insoluble hydroxides in the basic pH ranges commonly found in cement. The required proportions for the tailings at the Salt Chuck Mine site would be based on treatability testing results. Although this technology is viable, it is not retained for further consideration because leaching tests conducted on the tailings do not indicate that the waste is particularly susceptible to leaching. Elements of other technologies would still be needed such as a repository with a liner. Stabilization would only increase the volume of materials requiring disposal. Furthermore, stabilized materials are subject to weathering, so a protective cover would still be required. Hence, this technology is not retained for further consideration.

Metals Recovery. Metals recovery from mine waste materials may be achieved using various reprocessing techniques including pyrometallurgical and hydrometallurgical processes. Pyrometallurgical processes expose materials to elevated temperatures under controlled conditions to recover pure metals or metal oxides. Hydrometallurgical processes involve the dissolution of target metal species in the solid materials into a solution using pH control, followed by their precipitation as elemental or other commercially acceptable chemical forms. Both pyrometallurgical and hydrometallurgical processes are commercially available, and well understood. However, metals recovery from site waste materials is not retained for further consideration because metals concentrations in the tailings are below concentrations necessary for cost-effective use of the technology. Furthermore, this technology would not be affective for DRO contaminated materials.

Soil Washing. Soil washing is an ex-situ soil remediation technique combining aqueous extraction and constituent separation to reduce residual metal concentrations in treated materials to specified levels. The process uses mechanical and/or chemical scrubbing to remove metals by dissolving or suspending them in a wash solution, or by concentrating them into a smaller volume of soil through particle size separation techniques. Soil washing uses various additives such as surfactants, acids, or chelating agents to increase separation efficiencies. Washed soil can be returned to the site or further reclaimed if proven to pass specified chemical concentrations in post-treatment leachate tests. The recovered aqueous phase and the resulting sludge fraction may contain high concentrations of constituents, requiring additional separation or concentration, recovery, or disposal. Soil treatment verification sampling would be conducted for all contaminants the treatment system was designed to remove.

A soil analysis including soil type and organic content would have to be conducted for materials to be treated through soil washing to assess whether these materials would be amenable to the soil washing process. Materials with less than 50-70% sands, or high percentages of silt or clay, would make soil washing ineffective. Preliminary classification of the tailings indicates that they are very fine sand (similar to silt) which are not likely amenable to the soil washing technology. A treatability study would have to be completed prior to application of this technology as a remedial solution. A water source would have to be identified or water would have to be transported to the site. A soil washing unit would require a large footprint to operate. Any oversized contaminated material that could not be processed through the unit would still have to be treated or disposed of in another manner. The separated contaminants, sludge, and wastewater would have to be treated and/or disposed. Because of the obvious logistics difficulties of transporting in a unit and obtaining suitable washwater, problems and costs associated with disposal of spent washwater and sludge, overall costs due to the lack of economy of scale, as well as significant time constraints due to the need for a treatability study and verification samples, this technology has not been retained for further consideration.

4.2 REMOVAL ACTION ALTERNATIVE DEVELOPMENT

Based on the analysis of the nature and extent of contamination presented in Section 2.0 and on the RAOs developed in Section 3.0, this section identifies and assesses six action alternatives that are either appropriate for meeting RAOs, or are provided for comparative analysis purposes as required by the NCP. The alternatives identified and analyzed in the following subsections are considered well established remedies because they have been selected in the past at similar sites and/or for similar contaminants. Remedial options and technologies were screened and assembled into the following removal action alternatives identified and evaluated in this section:

- No Action Alternative
- Alternative 0 – Institutional Controls and Debris Removal (with Capping In-Place)
- Alternative 1 – Excavation, Consolidation in Mill Site Repository, and Capping
- Alternative 2 – Excavation, Consolidation in Borrow Pit Repository, and Capping

- Alternative 3 – Excavation and Off-Island Disposal
- Alternative 4 – Excavation, Consolidation in Borrow Pit Repository, and Capping utilizing Haul Road
- Alternative 5 – Excavation and Off-Island Disposal utilizing Haul Road

Physical hazards present at the site, such as those associated with the underground mine workings and glory hole, do not constitute a release of hazardous substances at the site and are outside the scope of this EE/CA report. In addition, evaluation of mitigation options associated with the acid producing potential of the existing waste rock piles is not covered by this report. However, the debris from mill ruins are located directly over materials contaminated above ADEC action levels. Therefore, debris removal is a component of each removal action alternative. An ancillary benefit to debris removal is that it removes a significant physical safety hazard to people visiting the site and has aesthetic benefits as well.

The removal action alternatives developed for consideration are summarized in Table 4-1 and are described in the following Sections. A summary of the alternative concepts and details is shown in Tables 4-2 and 4-3, respectively.

4.2.1 Common Elements to All Alternatives

Chemical hazards at the Salt Chuck Mine site include exposure of metals and petroleum hydrocarbons present in soil and tailings to human and ecological receptors. The concentrations of these constituents detected in on-site media were used to complete the SRE and to develop site-specific RAOs.

Prior to the removal action, a Confirmatory Sampling Work Plan would be prepared for Alternatives 1 through 5 that includes the following elements:

- Location and number of soil samples in removal action area;
- Location and number of background soil samples needed for additional TOC analysis and confirmation of DRO cleanup level;
- Location of monitoring wells in, downgradient, and upgradient of removal action area;
- Well installation procedures to capture potentially intermittent groundwater near interface between soils and bedrock or talus;
- Analytical program based on COCs in Table 3-1 (selected metals, DRO, and all high molecular weight PAHs); and
- Development of DQOs that consider future data use for ecological and human health risk assessment, based on ADEC (2009c) *Ecoscoping Guidance* and $1/10^{th}$ ADEC Method Two cleanup levels.

Legal and/or physical access restrictions may exist in every alternative except the no action alternative. All equipment and materials required to implement the selected removal action would be mobilized to the site, including provisions for power and fuel to operate equipment, and temporary living facilities for work crews. Equipment and unused materials would be demobilized from the site after completing the removal action.

All alternatives except Alternatives 4 and 5 assume the site would be accessed by sea via tug and barge transportation. No roads currently exist the entire way to the mill site so most alternatives assume no road access is available. Hence, assumptions on the feasibility of barge access to the site because of limited water depth in Salt Chuck apply to each of the alternatives that involve removal actions. Building a 3,800 foot single lane haul road for site access was included in Alternatives 4 and 5. Other significant common elements to the removal action alternatives are 1) tree removal with development of laydown and staging areas; 2) establishing erosion and sediment control measures and procedures including collection and temporary on-site filtration/treatment of surface and groundwater during excavation activities; 3) mill site debris removal including metal, wood, and the abandoned barge; 4) staging and placement of metal artifacts found during debris removal; 5) removal of lead acid batteries from the electric locomotive; 6) site re-vegetation; and 7) operation and maintenance of the repository and/or site restoration features for 30 years. In addition, waste rock present on-site will not be used as part of any of the alternatives because it is potentially acid producing. Trees will have to be cleared for all removal action alternatives to construct staging/laydown areas. Additional trees would be cleared to access contaminated materials in the AST / drum cache, and building C4 area in Alternatives 1, 2, and 3. Between 200 and 460 trees ranging in size from 2 to 30 inches in diameter would be cleared depending on the alternative. The species are mainly red alder, cedar, and spruce and are up to 80 feet tall. The trees cleared would either remain on-site or be sold for use by others. Trees left on-site may be chipped, staged across the site as part of site restoration, or simply stacked. For restoration purposes some logs and timber from the clearing effort could be placed strategically around the site for erosion control. For the two alternatives utilizing a haul road (Alternatives 4 and 5) approximately 1,800 additional trees are estimated to be cleared to make way for the road.

Wood and metal debris at the mill site would be removed to reduce associated physical hazards and provide access to remove contaminated material exceeding ADEC action levels at the mill site. Debris would be removed from the mill site and nearby surroundings including the abandoned barge (see Figure 3-1 for debris removal limits). Metal at the site falls into three categories: 1) scrap; 2) artifacts for salvage; and 3) metal equipment mounted on concrete foundations. Each category will be handled differently and the debris removal process will include oversight by an Archaeologist. The Archaeologist's role will be to document what is found, record its original location, and determine whether or not the item has historical significance and should remain on site as an artifact or be taken off-site as scrap metal. Any debris item that poses a substantial threat of contamination will not be left on site.

Scrap metal includes siding and roofing from the former mill building, drum carcasses, general metal with no historical significance, and mining equipment that could pose a safety hazard (i.e. sharp edges). Scrap metal will be transported off-island for recycling or disposal. Artifacts discovered during debris removal regardless of size will be temporarily staged in a designated area until all the debris and contaminated materials are removed. Once the mill site is covered and graded the artifacts will be returned to the general mill site area and strategically or aesthetically scattered across the area for viewing by site visitors in the future. The final debris category includes the large metal items mounted on concrete foundations like the ball mill crusher and the four diesel motors. These items will remain in place and be protected from further damage. The large metal items will be thoroughly inspected and if components are identified as safety hazards the unsafe components will be removed. It is believed that the concrete bases for the large metal items are founded in bedrock and that any contaminated materials around the foundations can be effectively excavated by hand.

A historical and archaeological survey of the site was performed by Bruder (2002). The actions included under the removal action alternatives require disturbance to the lower mill site, an area that has been judged eligible for placement on the National Register. Actions conducted at the site, specifically for tailings present beneath the former mill structure, would need to comply with Section 106 of the National Historic Preservation Act. The Forest Service and the contractor selected for implementing the removal action would coordinate with the State Historic Preservation Office (SHPO) to mitigate potential damage to historical features of the mill site, as appropriate. It is assumed that hand excavation work would be used to remove contaminated materials immediately surrounding any mill ruins that would need to remain in place in order to maintain the integrity of existing features.

Following implementation of Alternatives 1 through 5, sampling and analysis would be conducted to confirm action levels were met, and a Post Removal Action Report would be prepared. Groundwater monitoring wells would be installed and sampled at and downgradient of the target areas of this EE/CA. It is estimated that approximately six monitoring wells will be required. Routine inspections and O&M would be performed to confirm site restoration features are performing as expected. If the inspections indicates no continued problems the O&M frequency could be reduced or eliminated, and a 5-year review would be conducted to evaluate effectiveness and the need for implementation of a contingency plan in the event that areas require further action.

4.2.2 No Action Alternative

This alternative is retained throughout the process and represents a baseline condition against which other removal actions are compared. The No Action Alternative consists of allowing the site to remain in its present condition, with no measures taken to reduce or monitor contaminant concentrations; therefore contaminant levels would not be reduced and no short-term risk reduction would be achieved. Long-term risk reduction would occur only through natural attenuation mechanisms, but the extent of natural attenuation would be unknown since no monitoring would occur. Natural attenuation processes would primarily affect the concentration of organic contaminants. This alternative would not meet the RAOs identified for the removal action.

4.2.3 Alternative 0 – Institutional Controls and Debris Removal (with Capping In-Place)

Under this alternative, institutional controls, such as signage would be implemented at the site to minimize contact of receptors with the identified chemical hazards.

Trees would be removed for the development of staging and laydown areas necessary to complete debris removal. The mill site debris including the abandoned barge would be removed and scrap metal transported off-site for recycling. Wood debris would likely be burned at the site or taken off-site for disposal. In addition, miscellaneous metal debris at various locations surrounding the mill site would be scrapped. Estimated quantities of wood and metal debris at the site were calculated based on observations made during a site visit in October 2009. Calculations show approximately 83 tons of wood debris may be present at the site. Approximately 110 tons of metal is estimated to be at or near the mill site. Of this 48 tons is believed to be scrap, 27 tons are assumed to be cultural artifacts for temporary staging and will remain on site. In addition, the four diesel motors and the ball mill crusher will remain in place as they are mounted to concrete foundations. The wood and metal debris volume calculations are included in Appendix K and L respectively.

At the completion of debris removal the mill site would be graded and a separation layer of geotextile fabric installed. Top soil or other suitable growth media would be imported and spread across the site in a thickness of approximately 1 foot. The salvaged cultural artifacts would be placed across the earthen cap as addressed in a cultural mitigation plan and the area seeded with native seed. Some logs and timber from the clearing effort would be placed strategically around the re-vegetated site as part of site restoration for erosion control. This alternative also includes removal of the lead acid batteries present in the electric locomotive.

Appropriate signage would be posted along access points warning of the presence of COCs in soils contained beneath the former mill site. Semi-annual inspections would be performed to check the condition of the site and maintenance would be performed as necessary. Operation and Maintenance , including periodic inspection of restorations, would be performed for 30 years following implementation to confirm the site restoration is stable and to evaluate effectiveness of the removal action. If adverse impacts were identified, additional measures may be taken to mitigate potential impacts from the tailings. If annual monitoring indicates, no issues, O&M frequency can be reduced or eliminated and a 5-year review implemented.

4.2.4 Alternative 1 – Excavation, Consolidation in Mill Site Repository, and Capping

Alternative 1 includes all the activities included under Alternative 0 (institutional controls, debris removal, capping), along with the excavation of contaminated materials, collection of confirmational samples, and placement in a mill site repository. The excavation would involve removal of site soils in the DRO-contaminated AST / drum cache area, soil in the vicinity of building C4, and tailings from the mill site, followed by consolidation of the material in a mill site repository. Additional worker protection including dust suppression and proper PPE would be required during the materials handling activities. Because the removal area is expanded in this alternative, trees in the POL/C4 area would also need to be removed. The extent of site materials to be removed during this alternative is shown on Figure 3-1.

This alternative includes combining the POL contaminated material with the dominantly metals-contaminated media and placement in a mill site repository. One potentially suitable repository site was identified and is shown on Figure 4-1. The repository would be constructed with a liner, leachate collection system, and cover designed to accomplish the following objectives:

- Prevent exposure by dermal contact, inhalation, or incidental ingestion of tailings and impacted soils;
- Prevent access from burrowing animals;

- Provide stability against slope failure and resist erosion; and
- Limit infiltration and migration of water through the materials.

The institutional controls would include land use restrictions, such as limiting site access or use of on site resources, inclusion of the site in Forest Service Land Status Records, and withdrawal of specific locations from mineral entry. Physical access restrictions such as a boulder barrier or fencing around the footprint of the repository to prevent activities that could compromise the soil cover, such as damage from all-terrain vehicles (ATVs) or backhoes, would also be implemented.

A total of 4,000 cy of tailings and soil with chemical concentrations above ADEC action levels are estimated to require removal based on field measurements and visual observations during characterization investigations. Assuming a bulk density of 1.5 tons/cy, approximately 6,000 tons of material would require removal and placement in the mill site repository.

The most significant element to this alternative is identifying a suitable repository site. To accommodate the wastes, the mill site repository would require a footprint of approximately 10,000 ft^2 with 3:1 slopes, and placement of the materials to an average thickness of 10 feet. One area located between the mill site and the main adit has been identified as a potential location for the mill site repository site (Figure 4-1). This area appears to be of adequate size to develop the 10,000 ft^2 repository; however, is probably not large enough to site a repository with a substantially larger footprint. The location is relatively level although wooded with dense underbrush of vegetation, and is located over 200 feet from the waters edge. It is located only 150 feet from the mill site so the material would be transported by loader or off-road truck. An area of suitable size would be cleared of trees, brush, and other miscellaneous debris, and prepared for material placement by establishing a level ground surface. Prior to detailed design of the repository, the area would preferably undergo further investigation for suitability, including obtaining detail topographic survey information, identifying overland drainages affecting the area, checking for local fault lines, evaluating depth to groundwater, and investigating subsurface soils.

An HDPE liner would be installed over the ground surface prior to placement of materials exceeding ADEC action levels. A leachate collection system would be installed to collect leachate above the bottom liner as the soils initially drain. A temporary AST would be used to store leachate pumped from the repository during the construction period, but could likely be removed and accumulated leachate disposed off-site after the first year. It is anticipated that leachate generation in subsequent years should be negligible and would not exceed the maximum of one-foot of depth on the bottom liner. Transfer of leachate would be conducted on an annual basis until it is confirmed that leachate generation has essentially stopped.

Conceptually, the cap covering the placed materials would consist of a geotextile cushion layer over the impacted materials overlain by a 60-mil HDPE cover, a geo-composite drainage layer, a gravel drainage and erosion control layer, and an organic soil / growth media layer to support native vegetation. A conceptual drawing of the mill site repository is shown on Figure 4-2. The top soil needed to construct the final cover would be transported from an off-site borrow source. The cover would be keyed into a perimeter toe drain system designed to carry surface water away from the stockpile.

A considerable amount of heavy equipment/machinery would be necessary to efficiently implement this alternative. To construct the mill site repository, excavate and transfer impacted materials, as well as construct runon-runoff control structures as necessary, equipment requirements would include, but not be limited to, multiple bulldozers, front end loaders, and excavators. Silt fencing will need to be installed downhill from the site or other areas of Salt Chuck during excavation work. Suitable berms of clean local soils and rock or inflatable barriers would be used if evaluations show that tidal fluctuations could impact near-shore excavation areas. Floatable silt curtains may also be used to limit sediment impacts to the bay from excavation disturbance in the upland areas. In addition, surface water may need to be captured for filtration and/or other on-site treatment during construction.

The excavation work would be performed using conventional excavation and material handling equipment, and the contaminated tailings and soil would be segregated from non-impacted debris, such as waste rock, metal, logs and miscellaneous timbers. Hand excavation would be used to remove contaminated materials from around mill artifacts that are designated to remain in place to preserve their structural integrity. Material segregation would be performed to the horizontal and vertical extent of the work as established in the field through visual observations. Laboratory confirmation samples would be collected in the areas of excavation to ensure RAOs are met prior to backfill with clean fill. The excavated areas would be regraded as necessary and shaped to ensure positive drainage. Native grass seed / vegetation would be placed in regraded areas located above the high tide water line to initiate the revegetation process to the extent practicable.

Land use restrictions would be implemented at the mill site repository to prevent activities that could compromise the soil cover. Such prohibited activities would include: excavation, spreading, or disturbance of surface and subsurface soils. Periodic inspection and maintenance would be required indefinitely to verify that the cover remains intact and performs as intended.

4.2.5 Alternative 2 – Excavation, Consolidation in Borrow Pit Repository, and Capping

Alternative 2 is nearly identical to Alternative 1 with the following significant exceptions.

- The potential borrow pit repository site would be located along an existing Forest Service road less then one mile from the mill site. Note that the contaminated materials would be transported by barge to Thorne Bay and then loaded onto street legal dump trucks for the drive to the repository site. Although the potential borrow pit repository is close by, no road currently exists to the mill site, so extensive transportation is necessary under this alternative.
- Clearing of trees is not necessary at the potential borrow pit repository site
- The institutional controls would include land use restrictions, and signage at the repository site instead of the mill site. As in Alternative 1, physical access restrictions such as a boulder barrier or fencing around the footprint of the borrow pit repository would be implemented to prevent activities that could compromise the soil cover.

Two potentially suitable borrow pit repository sites were identified and are shown on Figure 4-1. Both sites are former gravel borrow pits used to construct gravel Forest Service roads. The sites are relatively flat and are virtually free of vegetation. They have the potential for significantly more capacity than is currently needed. The primary borrow pit repository site is identified as Borrow Pit West and has an estimated capacity of 11,000 cy. The alternate site has been named Borrow Pit East and has an estimated capacity of approximately 15,000 cy. Borrow Pit West was chosen as the primary site because it has no apparent surface water infiltration issues. It has a relative high ground surface elevation compared to the surroundings, so it is less likely to have significant surface water flow during rain fall events or snow melt. The alternative location has larger capacity by approximately 4,000 cy, but one side of this location rises in elevation, so that location may have more surface water run-on issues.

The borrow pit repository would be constructed with a lined base and cover system similar to Alternative 1; however virtually no clearing would be necessary and site access for construction and O&M would be much easier because both sites are accessible by road. Conversely, O&M for this alternative may be more effort because two locations; the mill site restoration and the borrow pit repository site will have to be separately inspected and maintained.

4.2.6 Alternative 3 – Excavation and Off-Island Disposal

Alternative 3 involves excavating the tailings and soils with concentrations above ADEC action levels and transporting them to a permitted off-island disposal facility. The contaminated materials would be excavated and removed from the site so signage or land use restrictions would not be needed. Confirmatory sampling would be performed to verify complete removal of materials exceeding the RAOs, and long-term monitoring and maintenance would not be required. The same volume of contaminated material would be removed as detailed in Alternatives 1 and 2 and the same methods of environmental protection and worker safety prescribed during the work activities would be used as described previously for these alternatives.

A total of approximately 4,000 cy of tailings and impacted soil (including DRO contamination) are estimated to require removal based on field measurements and visual observations during site characterization investigations. A majority of the excavation work would be performed using a conventional excavator and front-end loader, and the tailings would be segregated from other materials and debris such as waste rock, metal, logs, and miscellaneous timbers. Hand excavation work would be used as required to minimize impacts to features of historical significance, such as cultural metal artifacts mounted on concrete foundations that would be assumed to remain in place near the former mill building. Visual observations and confirmatory sampling would be used to direct the horizontal and vertical extent of the excavation.

Nearly three hundred 20-foot shipping containers would be required to transport this volume of material from the Salt Chuck Mine site to the disposal facility. The shipping containers would have impermeable liners installed and would be filled with a maximum of 25-tons of tailings each, and covered. The containers would be designed to transport the excavated tailings without the need for secondary containment in drums or other smaller containment vessels. The contaminated materials would be transported by small barge to Ketchikan then transferred to a larger barge for the voyage to Seattle. Both U.S. and Canadian manifests would be required to accompany the waste during transport through International and Canadian waters en route to Seattle. From Seattle, the material would then be transported by rail or truck to a suitable landfill. The landfill identified during this study for disposal of non-hazardous materials is the Columbia Ridge Landfill in Arlington, Oregon. Preliminary TCLP data for samples obtained from the removal action areas indicate that materials are not likely not to be considered hazardous waste.

Approximately 16 composite samples would be collected for TCLP analysis. This includes approximately 14 composite samples for the initial 2,000 cy, and then one composite sample for each additional 1,000 cy of material. Prior to shipment, a waste characterization profile would be conducted.

Laboratory confirmatory samples would be collected to ensure that RAOs are achieved in the excavated areas. The upland areas would then be regraded and shaped as necessary, to ensure positive drainage and minimize erosion. Native grass seed would be placed in regraded areas located above the high tide water line to initiate re-vegetation to the extent practicable.

4.2.7 Alternative 4 – Excavation, Consolidation in Borrow Pit Repository, and Capping utilizing Haul Road

Alternative 4 is nearly identical to Alternative 2 with the following significant exceptions.

- A haul road would be built to access the site. Depending on the alignment chosen the new road may be up to 3,800 feet long to connect the mill site to the existing Forest Service roads.
- All workers would stay in existing lodging available in Thorne Bay so there would be no need for on-site camp facilities.
- All materials, equipment and supplies would be transported to the site via the new haul road and the existing road and highway system on Prince of Wales Island. Barges would still be used to transport items to Prince of Wales, but no barges would be used in Salt Chuck.
- Large capacity (approximately 30 ton) articulated off-road style haul trucks would be used to transport material from the mill site to the borrow pit repository using the haul road.

Two potentially suitable haul road alignments (West and East) were identified and are shown on Figure 4-3. Both routes have relatively steep grades (10% on average) and start from the western side of the mill site. They share a common alignment for the first 1,000 feet from the mill site to the main adit. This route utilizes a path that was historically used by mine operations so it is relatively smooth as it increases in elevation and is covered with smaller red alder trees instead of evergreens. Based on a review of inventoried wetlands in the area (U. S. Fish & Wildlife Service [USFWS], 2009), as shown on Figure 2-4, it does not appear that either alignment would adversely impact sensitive wetland environments; with properly designed and constructed stream crossings.

Near the main adit the two alignments differ with one heading northwest (West route) and the other northeast (East route). The East route is the shorter of the two options at 2,200 feet and has a shallower maximum grade of nearly 18%. The West route is longer at 3,800 feet and has a maximum grade of approximately 20% over a short distance. Both potential alignments connect into a section of historical Forest Service road which appears to be no longer maintained. It is anticipated that these sections of former road can be improved with substantially less effort than construction of the bulk of the new haul road. The East Road alignment has a noted disadvantage over the West. Construction of the East Road may require crossing some existing waste rock piles and the former rail line used to carry ore from the main adit to the mill site. There are a number of areas of cultural interest in the vicinity of the East Road alternative that will be addressed in a cultural mitigation plan should selection of this alternative be realized. Under either alternative alignment, measures would be taken to avoid impacts to cultural resources, and ensure that no road bed materials are potential sources of acid rock drainage. The road would be constructed by removing a 50 foot wide path of trees and performing rough grading and drilling and blasting where necessary. Once the rough grade is established the road would have a 1 to 2 feet thick layer of base course rock floated onto the regraded native materials. The final road surface would consist of a top course layer consisting of approximately 12 inches of crushed rock. Improvements to the existing road which no longer appears to be maintained include clearing and placement of a 9-inch layer of top course. A conceptual drawing of the new road cross section is presented on Figure 4-4. The road would primarily be one lane approximately 16 feet wide on the surface, but would use 10 foot wide pullouts every 500 feet to facilitate multiple trucks during transport of materials to the repository. The entrance to the haul road would be gated and berms or large rock would be staged surrounding the gate to prevent unauthorized access. The road would be maintained annually during the course of the maintenance period, but only used for the removal action and subsequent O&M. Public use of the road would not be permitted.

The borrow pit repository would be constructed exactly the same as discussed in Alternative 2. However, O&M would be less effort because of easier access and should any major maintenance be necessary the materials and equipment would likely be available on Prince of Wales Island without off-island import. The mill site restoration work and the borrow pit repository site will be inspected and maintained for 30 years. This cost savings is roughly offset by the cost of maintaining the new haul road. This report assumes the haul road would be maintained for the duration of the O&M period.

4.2.8 Alternative 5 – Excavation and Off-Island Disposal utilizing Haul Road

Alternative 5 is nearly identical to Alternative 3 with the following significant exceptions.

- A haul road would be built to access the site. Depending on the alignment chosen the new road may be up to 3,800 feet long to connect the mill site to the existing Forest Service roads.
- All workers would stay in existing lodging available in Thorne Bay so there would be no need for on-site camp facilities.
- All materials, equipment and supplies would be transported to the site via the new haul road and the existing road and highway system on Prince of Wales Island. Barges would still be used to transport items to and from Prince of Wales Island, but no barges would be used in Salt Chuck.
- Transportation of contaminated material off island would be by barge through Thorne Bay or other port on Prince of Wales Island. Trucks rated for highway use would be used to transport material from the mill site to Thorne Bay pier via the new haul road.

- Materials would be bulk loaded onto one chartered barge instead of using individual shipping containers and multiple barges. One large barge would be bulk loaded in Thorne Bay into a bermed, lined, and covered temporary cell for the voyage to Seattle.
- Highway rated trucks would be loaded in Seattle for transport to the rail yard to be loaded onto gondola cars for the remaining journey to the final disposal site assumed to be Columbia Ridge Landfill in Arlington, Oregon.

Alternative 5 uses the same road construction assumptions described in Alternative 4. Other than the difference in transportation described above this alternative assumes the same final disposal site and site restoration assumptions as Alternative 3. The contaminated materials would be excavated and removed from the site so institutional controls or land use restrictions would not be needed. The same volume of contaminated material would be removed as detailed in Alternatives 1 through 4 and the same methods of environmental protection and worker safety prescribed during the work activities would be used as described previously for these alternatives.

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5.0 ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Each of the removal action alternatives considered was evaluated using criteria established in the EE/CA guidance (USEPA, 1993b). This section provides a description of these criteria and an evaluation of each removal action alternative. Potential ARARs for the site are described in Section 3.2.

5.1 EVALUATION CRITERIA

The removal action alternatives were evaluated individually with respect to effectiveness, implementability, and cost. Effectiveness is assessed based on the components of: (1) overall protectiveness of human health and the environment; (2) short-term effectiveness; (3) long-term effectiveness; (4) reduction of toxicity, mobility, or volume; and (5) compliance with ARARs.

Implementability is assessed based on the components of: (1) technical feasibility, (2) availability of services and materials, and (3) administrative feasibility.

The total project cost is comprised of estimated capital costs and the net present value of operation and maintenance costs, including environmental monitoring costs where appropriate.

5.2 ANALYSIS OF ALTERNATIVES

As specified in EE/CA guidance, the purpose of the detailed analysis is to evaluate each alternative for its effectiveness, implementability, and cost to achieve RAOs identified in Table 3-1. A brief listing and description of each of the alternatives under consideration are:

- No action, in which constituents of concern are not removed;
- Institutional controls and debris removal, where constituents of concern are not removed, but physical hazards including wood and metal debris from the mill site are removed from the site, the area is covered and vegetated, signage would be installed warning visitors of the presence of contaminated materials at the mine site and are incorporated to minimize future site development;
- Excavation, consolidation, and stockpiling of tailings and impacted soils in a central mill site repository with a cap;
- Excavation, consolidation, and stockpiling of tailings and impacted soils in a borrow pit repository with a cap, transportation of the waste with and without a newly constructed haul road;
- Excavation of tailings and impacted soils and transfer to an off-island disposal facility, transportation of the waste with and without a newly constructed haul road.

Results of the alternatives evaluation of effectiveness and implementability using the criteria identified in Section 5.1 are summarized in Table 5-1. Capital costs and annual O&M costs are summarized in Table 5-2 and Appendix M. Supporting materials including vendor quotes for the cost estimates are included in Appendix N. Alternative evaluation descriptions are provided in the following subsections.

5.2.1 No Action Alternative

Effectiveness. The No Action alternative was retained for comparison purposes. The short- and long-term effectiveness of this alternative is low. Taking no action to remove tailings and impacted soils would mean that the site remains in its present condition with no reduction in contaminant concentrations. This Alternative would not be effective because it would not achieve RAOs and thus is not protective of human health or the environment. The No Action Alternative does not comply with ARARs.

In the short-term, the No Action Alternative would likely pose no additional threats to human health or the environment compared to current site conditions. Long-term risk reduction would only occur through natural attenuation mechanisms, which are primarily associated with organic chemicals. The extent of natural attenuation would be unknown under this alternative since no monitoring would occur. It is notable that current levels of COCs represent more than 65 years of natural attenuation since the mine closed in 1941. However, since no baseline data from the 1940s are available, long-term rates of attenuation are unknown. Thus, the time required until reclamation objectives are reached by natural attenuation have not been determined.

Implementability. This alternative is technically feasible to implement and would not be dependent on the availability of services and materials. However, the No Action Alternative is unacceptable, because it would not meet RAOs and ARARs.

Cost. Neither monitoring nor operations and maintenance would be implemented under this alternative; therefore, there are no costs associated with this alternative.

Uncertainties and Assumptions. With the exception of unknown surrounding natural attenuation of petroleum hydrocarbons, there are no significant uncertainties or assumptions associated with the performance of this alternative.

5.2.2 Alternative 0 – Institutional Controls and Debris Removal (with Capping In-Place)

Effectiveness. Taking no action to remove tailings and impacted soils would mean that the chemical hazards remain in their present condition, with no reduction in contaminant concentrations. Human exposure to physical hazards would be greatly reduced with debris removal. Increased protection of human health and large mammals would be achieved as a result of the earthen cap placed to support vegetation, because direct contact with upland tailings would be minimized. Implementing specific institutional controls such as land use restrictions to prevent land development on or near the impacted areas and erecting signage to alert recreational users and future miners in these areas would be somewhat effective. These methods would minimize direct exposure to untreated tailings and impacted soils in the AST/drum cache, and building C4 Area east of the mill site ruins. Exposure pathways to groundwater and surface water would remain.

There would be no significant short-term human-health protection concerns with installing an earthen cover with vegetation. Workers would receive personnel protective equipment and training to reduce exposure to dust and dermal contact with mill site tailings exposed during debris removal.

This alternative would not reduce the toxicity, mobility, or volume of tailings, hence COCs at the site would remain. Constituent mobility would remain unchanged. The total volume of tailings and other impacted materials remaining at the site is estimated to be 4,000 cy.

This alternative has the least construction activity (excluding the No Action alternative), therefore it has the lowest level of short-term risks. Some short-term impacts to intertidal areas may occur due to the required barge access under this alternative. Construction activities are limited to debris removal above the mill site tailings and posting of signage. This alternative would not meet all RAOs and ARARs discussed in Sections 3.2 and 3.3. Long-term risk reduction would only occur through natural attenuation mechanisms, and it is possible that continued natural attenuation could result in increased threats to downgradient media. The time required until reclamation objectives are reached by natural attenuation has not been determined.

Implementability. This alternative would be feasible both technically and administratively, and would be easily implemented in general, with some uncertainties related to site access via barge. Many contractors have the experience, equipment, and personnel to perform this work. It is anticipated that construction could be completed within one construction season. Access to the site via barge could be problematic, due to limited navigability of the upper Salt Chuck.

Removal of debris, placing an earthen cap, and seeding utilize commonly practiced construction techniques. Annual visual inspections of the signage, earthen cover, and vegetation would be readily completed and repairs made as needed. These activities would be adequate and reliable to prevent direct exposure to recreational users and future miners, but would not prevent continued exposure of most ecological receptors. There would be no permanence for controlling future potential environmental impacts. Land use restrictions would be used to limit access to the tailings and contaminated soil remaining in place, but land use restrictions may be difficult to enforce due to remoteness of the Salt Chuck Mine site.

Cost. Estimated capital costs for this are $930,000 of which $660,000 are direct contractor costs. Appendix M includes additional details and supporting information for the cost estimates. This estimate includes material and equipment, mobilization, sign installation, debris removal, earthen cap placement, seeding, engineering support and construction management oversight, reporting, and a 25% contingency. O&M costs to inspect the site to ensure the integrity of the cover and site restoration components including preparation of a summary report documenting results are estimated to be $194,000. These costs reflect a 5 year inspection and 30 year O&M period.

Uncertainties and Assumptions. The uncertainties and assumptions associated with the performance of this alternative include the following. In general, these uncertainties also apply to the other removal action alternatives.

Specific historic preservation measures will be incorporated into removal action design using a cultural mitigation plan that is being developed by a Forest Service archaeologist in coordination with SHPO. For this EE/CA it is assumed nearly all metal debris posing danger to site visitors would be removed from the mill area as scrap. Items that are generally intact and safe would be temporarily staged until the debris removal is complete and an earthen cap is in place. Identified historic metal artifacts would then be distributed across the former mill site in an aesthetic manner for public viewing. Natural migration of the contaminants may continue to occur at the site, possibly creating changes in downgradient chemical concentrations; these potential effects are unknown.

The most significant uncertainty is barge access which has substantial cost implications. Without current bathymetry data to assess site-specific conditions such as channel navigability it is not clear how complicated getting equipment and materials to and from the site will be. Potential civil contractors are reluctant to provide detailed estimates for tasks to implement the alternative when barge access is questionable. Therefore, once a removal action alternative is selected, barge access should be further evaluated and the validity of the cost estimate confirmed. Additionally, some impacts to intertidal areas from barge activity are likely to occur, with potentially significant negative impacts to the environment from disturbance of contaminated or uncontaminated sediment. Bringing in a barge and off-loading equipment could cause a significant amount of contaminated sediments to become resuspended in the water column. These impacts would be difficult to control.

5.2.3 Alternative 1 – Excavation, Consolidation in Mill Site Repository, and Capping

Effectiveness. Alternative 1 would provide protection of public health and the environment and achieve RAOs. Physical hazards will be dramatically reduced with removal of the mill site debris. There would be no reduction in the mass or toxicity of COCs, because the impacted materials would still remain on-site but consolidated in a repository. This alternative would effectively reduce contaminant mobility at the site by removing the highest risk solid media contaminant sources and containing the waste in a lined and capped repository. DRO-contaminated soils from the AST and drum cache areas would be excavated and placed into the repository as well. The repository would be located and designed so that the contained materials would be protected from contact with groundwater and surface water runoff. Confirmation samples would be collected and submitted for laboratory analysis to document that all impacted materials have been removed to action levels. Long-term monitoring and control programs would be established to ensure continued effectiveness of the repository and site restoration components.

Alternative 1 would be protective of human health and the environment, because the risks associated with physical hazards and the COCs are mitigated by physically isolating the tailings and soils in a properly designed, constructed and maintained capped mill site repository. Mobility of contaminants is also further reduced by limiting potential for contaminants to leach from the soil to groundwater by placement of a bottom liner under the mill site repository. An underdrain system would be included in the design to maintain groundwater levels below the bottom liner of the mill site repository.

This alternative involves extensive construction activities in most portions of the site. Although short-term risks would be higher compared to the No Action and Debris Removal alternatives due to the large volumes of tailings and impacted soils that would have to be excavated, handled, and relocated, these risks can be controlled. Risks to workers during construction would be managed using standard health and safety practices such dust suppression to protect workers from incidental inhalation and ingestion of dust particulates. Some short-term impacts to intertidal areas may occur due to the required barge access under this alternative.

This alternative would provide a high degree of effectiveness and would achieve RAOs and ARARs discussed in Sections 3.2 and 3.3. The long-term effectiveness would depend on an O&M plan ensuring the integrity of the repository, its cover, and the site restoration components.

The use of signs and land use restrictions to prevent future excavation at the mill site repository would be effective in managing the risks posed by contaminants remaining on-site. Inspection and maintenance of the cap will be required on a regular basis to meet this criterion over the long term. The mill site repository area could have physical access restrictions to prevent damage.

Implementability. This alternative is both technically and administratively feasible, with some uncertainties related to site access via barge. Soil and geosynthetic capping technologies are reliable, and the effectiveness of this remedy can be monitored easily. The construction steps required are considered conventional construction practices. Cap construction materials would be transported in from an off-site borrow source and vendors. The existing waste rock may not be used to produce construction materials because it has been confirmed to potentially be acid producing. Conversely, chipping of logged trees may potentially be used if determined suitable for incorporation in the restoration process.

This alternative involves extensive construction activities in most portions of the site. Hand excavation would be used around mill site artifacts mounted on concrete footings. It is anticipated that construction could be completed and RAOs achieved within a single construction season.

Although some difficulty would be involved in transporting the required equipment, material, and personnel to this remote site, all the required services and materials are available by experienced contractors. Access to the site via barge could be problematic, due to limited navigability of the upper Salt Chuck. Coordination and management of equipment and supply import, as well as export of debris will be a challenge. Another potentially difficult task to implement for this alternative is surface water control and treatment. Erosion control measures such as silt fences, inflatable barriers and/or equipment to capture and treat surface water will be critical because of the typical wet weather conditions in southeast Alaska and proximity of Salt Chuck Bay to portions of the remediated area.

Site preparation work, including construction of staging, loading, and decontamination areas would be required to prepare the site for the removal action. This will include the clearing of trees. Wet contaminated materials would be staged in temporary stockpiles and allowed to drain prior to placement in the mill site repository. All contaminated effluent would be contained and handled appropriately. A stockpile area would be prepared by placing plastic sheeting in the area designated to receive the staged materials. The area would be bermed to divert runon, contain runoff and otherwise isolate the staged soil.

After excavation and loadout are complete, the upland excavated areas would be filled with a growth media layer and revegetated as appropriate. Revegetation would utilize a native seed mixture. Cover/fill soil from an off site source will be necessary in the excavated areas to level out and contour the areas to match the surrounding terrain.

Periodic inspections and maintenance, as needed, would ensure the long-term integrity and effectiveness of the mill site repository and site restoration cover.

Cost. The estimated capital cost for Alternative 1 is $2,040,000 of which $1,480,000 are direct contractor costs (Appendix M). This includes equipment and materials mobilization, on-site earthwork to prepare the staging and repository areas, construction of the mill site repository, signage, water quality control measures, debris removal, off-island disposal of metal debris, post-removal confirmatory sampling, seeding, reporting, and demobilization. This estimate includes a 25% contingency. O&M costs include cap inspections and routine leachate collection services from the mill site repository over a 30-year period. O&M costs to inspect the site to ensure the integrity of the site restoration and prepare a summary report documenting results are estimated to be $984,000. It is assumed that leachate generation from the mill site repository after the first year would be minimal and would remain that way throughout the life of the repository.

Uncertainties and Assumptions. There is uncertainty regarding selection of a suitable repository area. Although visual inspections were conducted of the area surrounding the mill site during previous investigations, the proposed repository site requires a more complete survey to assess site conditions. Issues like underlying soil conditions, topographic land survey information, significance of adjacent surface water drainages, depth to groundwater, and local or regional availability of potential cover materials are needed. In particular identification of sand and an organic substrate material for revegetation is needed.

The mill site repository cover system would be designed to intercept and divert as much of the infiltrating precipitation as possible. The design would also consider stresses imposed by snow loads and freezing ground conditions. The cover design would include a geomembrane so that the effectiveness would not depend on the physical and hydraulic properties of the earthen portions of the cover material. For this study we have assumed 60-mil HDPE will be suitable for the geomembrane component of the cover.

The availability of suitable cover material that would support vegetation at the site is suspect so other options may need to be assessed. Conceptual cap designs would be evaluated in detail during the design phase, including cap requirements to limit movement of COCs. The cover would be designed of material that would not degrade the quality of run-off water as it flows from the repository.

Specific historic preservation measures will be incorporated into removal action design using a cultural mitigation plan that is being developed by a Forest Service archaeologist in coordination with SHPO. For this EE/CA it is assumed nearly all metal debris posing danger to site visitors would be removed from the mill area as scrap. Items that are generally intact and safe would be temporarily staged until the debris removal is complete and an earthen cap is in place. Identified historic metal artifacts would then be distributed across the former mill site in an aesthetic manner for public viewing.

There is some uncertainty regarding the volume of materials within the removal area, particularly with tailings under the mill debris. Tailing thickness is highly variable throughout the removal area and largely unknown because it is currently covered with mine debris.

The most significant uncertainty is barge access which has substantial cost implications. Without current bathymetry data to assess site-specific conditions such as channel navigability it is not clear how complicated getting equipment and materials to and from the site will be. Potential civil contractors are reluctant to provide detailed estimates for tasks to implement the alternative when barge access is questionable. Therefore, once a removal action alternative is selected, barge access should be further evaluated and the validity of the cost estimate confirmed. Additionally, some impacts to intertidal areas from barge activity are likely to occur, with potential negative impacts to the environment from disturbance of contaminated or uncontaminated sediment.

5.2.4 Alternative 2 – Excavation, Consolidation in Borrow Pit Repository, and Capping

Effectiveness. Alternative 2 would provide protection of public health and the environment and generally achieve RAOs and ARARs discussed in Sections 3.2 and 3.3. Physical hazards will be dramatically reduced with removal of the mill site debris. There would be no reduction in the mass or toxicity of COCs since the impacted materials would still remain near the site, but consolidated in a repository. This alternative would effectively reduce contaminant mobility at the site by removing the highest risk solid media contaminant sources and containing the waste in a lined and capped borrow pit repository. DRO-contaminated soils from the AST/drum cache areas would be excavated and placed into the borrow pit repository as well. Confirmation samples would be collected and submitted for laboratory analysis to document that all impacted materials have been removed to cleanup levels. Long-term monitoring and control programs would be established to ensure continued effectiveness of the borrow pit repository and site restoration components.

Alternative 2 would be protective of human health and the environment, because the risks associated with physical hazards and the COCs are mitigated by physically isolating the tailings and contaminated soils in a properly designed, constructed and maintained capped borrow pit repository. Mobility of contaminants is also reduced by limiting potential for contaminants to leach from the soil to groundwater by placement of a bottom liner in the repository.

This alternative involves extensive construction activities in most portions of the site and at the repository. Although short-term risks would be high compared to the No Action and Debris Removal alternatives because of the large volumes of tailings and impacted soils that would be excavated, handled, and relocated; these risks can be controlled. In addition, the transport of the large volumes of materials to the borrow pit repository increases the potential for exposure to workers and the public compared to other alternatives. Some short-term impacts to intertidal areas may occur due to the required barge access under this alternative. Short-term effectiveness is achieved through typical dust control and other best management practices identified and implemented as required, as well as the use of appropriate personnel protective equipment (PPE) to reduce exposure to tailings and other impacted materials.

This alternative would provide a high degree of effectiveness and would achieve RAOs and ARARs. The long-term effectiveness would depend on an O&M plan ensuring the integrity of the borrow pit repository, cover, and the site restoration components.

The use of signs and land use restrictions to prevent future excavation at the borrow pit repository location would be effective in managing the risks posed by contaminants there. Inspection and maintenance of the borrow pit repository cap will be required on a regular basis to meet this criterion over the long term. The borrow pit repository area would have physical access restrictions to prevent damage and signage would be posted.

Implementability. This alternative is both technically and administratively feasible, with some uncertainties related to site access via barge. Soil and geosynthetic capping technologies are reliable, and the effectiveness of this remedy can be readily monitored. The construction steps required are considered conventional construction practices. Cap construction materials would be transported in from an off-site borrow source and vendors. It is possible some rock and gravel materials may be present in a former borrow pit located near the area selected for the borrow pit repository site that could be used. Trees cut down to perform the work may be useful for incorporation in the site restoration work.

This alternative involves extensive construction activities in most portions of the site. Hand excavation would be used around the mill site artifacts mounted on concrete footings. It is anticipated that construction could be completed and RAOs achieved within a single construction season.

Although some difficulty would be involved in transporting the required equipment, material, and personnel to this remote site, all the required services and materials are available. Access to the site via barge could be problematic, due to limited navigability of the upper Salt Chuck. Coordination and management of import of equipment and supplies, as well as export of debris and contaminated materials will be a challenge. This alternative uses lined shipping containers to transport the materials to help simplify transfer procedures; however, the logistics of loading, transferring them to the barge, and use of multiple barges is complicated.

Another potentially difficult task to implement for this alternative is surface water control and treatment. Erosion control measures such as silt fences, inflatable barriers and/or equipment to capture and treat surface water will be critical because of the typical wet weather conditions in southeast Alaska and proximity of portions of the site to Salt Chuck. Additional precautions will be implemented to make sure no release of contaminants occurs during barge and truck transport.

Site preparation work, including construction of staging, loading, and decontamination areas would be required to prepare the site for removal actions. This will include the clearing of trees. Temporary stockpiles of contaminated materials would be created prior to load out to the borrow pit repository. A stockpile area would be prepared by placing plastic sheeting in the area designated to receive the staged materials. The area would be bermed to divert runon, contain runoff and otherwise isolate the staged soil.

After excavation and loadout are complete, the upland excavated areas would be filled with a growth media layer and revegetated as appropriate. Revegetation would utilize a native seed mixture. Cover/fill soil will be necessary in the excavated areas to level out and contour the areas to match the surrounding terrain.

Periodic inspections and maintenance, as needed, would ensure the long-term integrity and effectiveness of the borrow pit repository and site restoration cover.

Cost. The estimated total capital cost for Alternative 2 is $2,700,000 of which $2,020,000 are direct contractor costs (Appendix M). This includes equipment and materials mobilization, earthwork to prepare the staging and borrow pit repository areas, construction of the borrow pit repository, signage, water quality control measures, debris removal, off-island disposal of metal debris, transportation of contaminated materials, post-removal confirmatory sampling, seeding, demobilization, and reporting. This estimate includes a 25% contingency. O&M costs to inspect the site to ensure the integrity of the site restoration and prepare a summary report documenting results are estimated to be $987,000. These costs reflect a 5 year inspection and 30 year O&M period. It is assumed that leachate generation after the first year would be minimal and would remain that way throughout the life of the repository.

Uncertainties and Assumptions. There is uncertainty regarding selection of a suitable borrow pit repository area. Although visual inspections were conducted near the Forest Service roads surrounding the Mine during previous investigations, the proposed borrow pit repository site requires a more complete survey to assess site conditions. Issues like underlying soil conditions, topographic land survey information, proximity to significant surface water drainages, and depth to groundwater are largely unknown.

The borrow pit repository cover system would be designed to divert as much precipitation as possible from the contaminants. The design would also consider stresses imposed by snow loads and freezing ground conditions which have not been evaluated at this point. Cover design depends on the physical and hydraulic properties of the selected cover materials which are currently not known.

Specific historic preservation measures will be incorporated into removal action design using a cultural mitigation plan that is being developed by a Forest Service archaeologist in coordination with SHPO. For this EE/CA it is assumed nearly all metal debris posing danger to site visitors would be removed from the mill area as scrap. Items that are generally intact and safe would be temporarily staged until the debris removal is complete and an earthen cap is in place. Identified historic metal artifacts would then be distributed across the former mill site in an aesthetic manner for public viewing.

There is also some uncertainty regarding the volume of materials within the removal area, particularly with tailings under the mill debris. Tailing thickness is highly variable throughout the removal area. Conceptual cap designs would be evaluated in detail during the design phase, including borrow pit repository cap requirements to limit movement of COCs. The cover membrane would be designed of material that would not degrade the quality of runoff water as it flows from the repository. For this study was have assumed 60-mil HDPE will be suitable.

The most significant uncertainty is barge access which has substantial cost implications. Without current bathymetry data to assess site-specific conditions such as channel navigability it is not clear how complicated getting equipment and materials to and from the site will be. Potential civil contractors are reluctant to provide detailed estimates for tasks to implement the alternative when barge access is questionable. Therefore, once a removal action alternative is selected, barge access should be further evaluated and the validity of the cost estimate confirmed. Additionally, some impacts to intertidal areas from barge activity are likely to occur, with potential negative impacts to the environment from disturbance of contaminated or uncontaminated sediment.

5.2.5 Alternative 3 – Excavation and Off-Island Disposal

Effectiveness. This alternative would effectively reduce contaminant mobility at the site by completely removing all solid media contaminant sources from the upland site. Contaminant toxicity and volume at the site would be reduced by transferring the risk to a managed off-island disposal facility.

This alternative would meet RAOs, and be compliant with the ARARs. Confirmation samples would be collected and submitted for laboratory analysis to document that impacted materials have been removed to cleanup levels. Excavation and off-island disposal protects human health and the environment by removing impacted materials with metals concentrations above RAOs, and placing them into a licensed and properly managed disposal facility.

Short-term risks of exposure to the contaminated material would be present during excavation and transport of the large volume of materials to the disposal facility and are considered one of the highest of the alternatives evaluated. Some short-term impacts to intertidal areas may occur due to the required barge access under this alternative. Short-term effectiveness is achieved through typical dust control and other best management practices identified and implemented as required, as well as the use of appropriate PPE to reduce exposure to tailings and other impacted materials.

Long-term effectiveness and permanence would be insured through removal of impacted materials.

The tailings are derived from the beneficiation and extraction of ores and are therefore presumed to be exempt from classification as a hazardous waste by federal regulations under RCRA, 42 USC 6921 (b)(3)(A)(iii)(1994).

Implementability. Alternative 3 is technically feasible and readily implementable, with some uncertainties related to site access via barge. Equipment and labor resources necessary for excavation, removal, transportation and disposal would be available in the region. Conventional earth moving equipment would be used for excavation and placement of materials within prepared containers. Both U.S. and Canadian manifests would be required prior to transport to Seattle via cargo vessel/barge.

Some difficulty would be involved in transporting the required equipment, material and personnel to this remote site; however all the required services and materials are available. Access to the site via barge could be problematic, due to limited navigability of the upper Salt Chuck. Coordination and management of equipment and supply import as well as export of debris and the contaminated media will be a challenge. This alternative uses shipping containers to contain the waste during transport, therefore once the barge successfully leaves the bay with the containers the work is simplified to a relatively straightforward shipping exercise.

Another potentially difficult component to this alternative is surface water control during excavation and transport. Erosion control measures such as silt fences, inflatable barriers and/or equipment to capture and treat surface water will be critical because of the typical wet weather conditions in southeast Alaska and proximity of Salt Chuck to portions of the site. Additional precautions will need to be implemented to make sure no release of potentially contaminated water occurs during transport. Lined steel shipping containers will be used during barge transport to mitigate this risk.

After excavation and loadout are complete, the upland excavated areas would be filled with a growth media layer and revegetated as appropriate. Revegetation would utilize a native seed mixture. Cover/fill soil will be necessary in the excavated areas to level out and contour the areas to match the surrounding terrain. This alternative is expected to be completed within one construction season.

Periodic inspections and maintenance, as needed, would ensure the long-term integrity and effectiveness of the site restoration cover.

Cost. Estimated capital costs for Alternative 3 would be approximately $3,580,000 of which $3,111,000 are direct contractor costs (Appendix M). This includes equipment mobilization, debris removal, on-site earthwork, transportation, disposal, and reporting costs. Also included in the cost are engineering support, construction management oversight, and a 22.5% contingency. A lower contingency is used for this alternative because there is less uncertainty associated with transportation and disposal costs once the waste is placed onto barges. O&M costs for site inspection and reporting are estimated to be $185,000. It is assumed that the O&M is performed over a 30-year period.

Uncertainties and Assumptions. Specific historic preservation measures will be incorporated into removal action design using a cultural mitigation plan that is being developed by a Forest Service archaeologist in coordination with SHPO. For this EE/CA it is assumed nearly all metal debris posing danger to site visitors would be removed from the mill area as scrap. Items that are generally intact and safe would be temporarily staged until the debris removal is complete and an earthen cap is in place. Identified historic metal artifacts would then be distributed across the former mill site in an aesthetic manner for public viewing.

There is uncertainty with the volume of materials within the removal area, particularly with tailings under the mill debris. Tailing thickness is highly variable throughout the removal area and largely unknown because it is currently covered with mine debris.

There may be uncertainty associated with the classification of the waste materials. Analytical results show that the contaminated materials are classified as non-hazardous. Even if the materials were profiles as hazardous they would be exempt in the State of Alaska from classification as a hazardous waste by federal regulations. However this exemption would likely not apply to the tip fees charged by a disposal facility in Washington or Oregon. Therefore, if a hot spot is encountered during the removal action which changes the material's classification to Hazardous for disposal purposes, then the disposal fees would escalate substantially. The cost estimate prepared for Alternative 3 assumes that all material being disposed off-island would incur non-hazardous disposal fees.

The most significant uncertainty is barge access which has substantial cost implications. Without current bathymetry data to assess site-specific conditions such as channel navigability it is not clear how complicated getting equipment and materials to and from the site will be. Potential civil contractors are reluctant to provide detailed estimates for tasks to implement the alternative when barge access is questionable. Therefore, once a removal action alternative is selected, barge access should be further evaluated and the validity of the cost estimate confirmed. Additionally, some impacts to intertidal areas from barge activity are likely to occur, with potential negative impacts to the environment from disturbance of contaminated or uncontaminated sediment.

5.2.6 Alternative 4 – Excavation, Consolidation in Borrow Pit Repository, and Capping Utilizing Haul Road

Effectiveness. Alternative 4 would provide protection of public health and the environment and generally achieve RAOs and ARARs. Physical hazards will be dramatically reduced with removal of the mill site debris. There would be no reduction in the mass or toxicity of COCs since the impacted materials would still remain near the site, but consolidated in a repository. This alternative would effectively reduce contaminant mobility at the site by removing the highest risk solid media contaminant sources and containing the waste in a lined and capped borrow pit repository. DRO-contaminated soils from the AST/drum cache areas would be excavated and placed into the borrow pit repository as well. Confirmation samples would be collected and submitted for laboratory analysis to document that impacted materials have been removed to cleanup levels. Long-term monitoring and control programs would be established to ensure continued effectiveness of the borrow pit repository and site restoration components.

Alternative 4 would be protective of human health and the environment, because the risks associated with physical hazards and the COCs are mitigated by physically isolating the tailings and contaminated soils in a properly designed, constructed and maintained capped borrow pit repository. Mobility of contaminants is also reduced by limiting potential for contaminants to leach from the soil to groundwater by placement of a bottom liner in the repository.

This alternative involves extensive construction activities because work will be performed at three locations; the road, the site, and the repository location. Although short-term risks are higher compared to the No Action and Debris Removal alternative because of the large volumes of tailings and impacted soils that would be excavated, handled, and relocated, these risks can be controlled. In addition, the transport of the large volumes of materials to the borrow pit repository increases the potential for exposure to workers and the public compared to other alternatives. Short-term effectiveness is achieved through typical dust control and other best management practices identified and implemented as required, as well as the use of appropriate PPE to reduce exposure to tailings and other impacted materials. No environmental long-term impacts are anticipated to result from the implementation of the removal action.

This alternative would provide a high degree of effectiveness and would achieve RAOs and ARARs. The long-term effectiveness would depend on an O&M plan ensuring the integrity of the borrow pit repository, its cover, and the site restoration components.

The use of signs and to prevent future excavation at the borrow pit repository location would be effective in managing the risks posed by contaminants there. Inspection and maintenance of the borrow pit repository cap will be required on a regular basis to meet this criterion over the long term. The borrow pit repository area would have physical access restrictions to prevent damage and signage would be posted.

Implementability. This alternative is both technically and administratively feasible. Road construction services on Prince of Wales Island can be easily provided by multiple contractors. Soil capping technologies are reliable, and the effectiveness of this remedy can be readily monitored. The construction steps required are considered conventional construction practices. Cap construction materials would be transported in from a borrow source and vendors. It is assumed most road building materials will be present in a former borrow pit located near the area selected for the repository.

This alternative involves extensive construction activities. Hand excavation would be used around the mill site artifacts mounted on concrete footings. It is anticipated that construction could be completed and RAOs achieved within a single construction season.

Some difficulty would be involved in construction of a haul road in a steep area; however, once complete, transporting the required equipment, material, and personnel to this remote site is simplified. All the required services and materials are available. Use of a haul road simplifies implementation of the borrow pit repository alternative.

Another potentially difficult task to implement for this alternative is surface water control and treatment. Erosion control measures such as silt fences, inflatable barriers and/or equipment to capture and treat surface water will be critical because of the typical wet weather conditions in southeast Alaska and proximity of portions of the site to Salt Chuck. Excavated material will be dewatered as necessary. Additional precautions will be implemented to make sure no release of contaminants occurs during truck transport.

Site preparation work, including construction of staging, loading, and decontamination areas would be required to prepare the site for removal actions. This will include the clearing of trees. Wet contaminated materials would be staged in temporary stockpiles and allowed to drain prior to loadout to the borrow pit repository. A stockpile area would be prepared by placing plastic sheeting in the area designated to receive the staged materials. The area would be bermed to divert runon, contain runoff and otherwise isolate the staged soil.

After excavation and loadout are complete, the upland excavated areas would be filled with a growth media layer and revegetated as appropriate. Revegetation would utilize a native seed mixture. Cover/fill soil will be necessary in the excavated areas to level out and contour the areas to match the surrounding terrain.

Periodic inspections and maintenance, as needed, would ensure the long-term integrity and effectiveness of the borrow pit repository and site restoration cover.

Cost. The estimated total capital cost for Alternative 4 is $2,740,000 of which $1,960,000 are direct contractor costs (Appendix M). This includes equipment and materials mobilization, earthwork to build a haul road, preparing the staging and borrow pit repository areas, construction of the borrow pit repository, signage, water quality control measures, debris removal, off-island disposal of metal debris, transportation of contaminated materials, post-removal confirmatory sampling, seeding, demobilization, and reporting. This estimate includes a 20% contingency. A lower contingency is used because less uncertainty with transportation exists using a road. O&M costs include cap inspections over a 30-year period. O&M costs to inspect the site to ensure the integrity of the site restoration and prepare a summary report documenting results are estimated to be $971,000. It is assumed that leachate generation after the first year would be minimal and would remain that way throughout the life of the repository.

Uncertainties and Assumptions. There is uncertainty regarding selection of a suitable borrow pit repository area. Although visual inspections were conducted near the Forest Service roads surrounding the Mine during previous investigations, the proposed borrow pit repository site requires a more complete survey to assess site conditions. Issues like underlying soil conditions, topographic land survey information, proximity to significant surface water drainages, and depth to groundwater are largely unknown.

The borrow pit repository cover system would be designed to divert as much precipitation as possible from the contaminants. The design would also consider stresses imposed by snow loads and freezing ground conditions. Cover design depends on the physical and hydraulic properties of the selected cover materials, which are currently not known.

Specific historic preservation measures will be incorporated into removal action design using a cultural mitigation plan that is being developed by a Forest Service archaeologist in coordination with SHPO. For this EE/CA it is assumed nearly all metal debris posing danger to site visitors would be removed from the mill area as scrap. Items that are generally intact and safe would be temporarily staged until the debris removal is complete and an earthen cap is in place. Identified historic metal artifacts would then be distributed across the former mill site in an aesthetic manner for public viewing.

There is also some uncertainty regarding the volume of materials within the removal area, particularly with tailings under the mill debris. Tailing thickness is highly variable throughout the removal area. Conceptual cap designs would be evaluated in detail during the design, including borrow pit repository cap requirements to limit movement of COCs. The cover membrane would be designed of material that would not degrade the quality of runoff water as it flows from the repository. For this study it was assumed 60-mil HDPE will be suitable.

The other uncertainty is with road construction issues. A detailed survey of the potential road alignments has not been done. Therefore the exact grades, obstacles, stream crossing details, and potential impacts on historical artifacts are not clearly defined. Furthermore, wildlife considerations may exist which would affect the road alignment, such as the location of eagle nests.

5.2.7 Alternative 5 – Excavation and Off-Island Disposal Utilizing Haul Road

Effectiveness. This alternative would effectively reduce contaminant mobility at the site by completely removing all solid media contaminant sources from the upland site. Contaminant toxicity and volume at the site would be reduced by transferring the risk to a managed off-island disposal facility.

This alternative would meet site-specific RAOs and ARARs. Confirmation samples would be collected and submitted for laboratory analysis to document that all impacted materials have been removed to cleanup levels. Excavation and off-island disposal protects human health and the environment by removing impacted materials with metals concentrations above RAOs, and placing them into a licensed and properly managed disposal facility.

Short-term risks of exposure to the contaminated material may occur during excavation and transport of the large volume of materials to the disposal facility. Short-term effectiveness is achieved through typical dust control and other best management practices identified and implemented as required, as well as the use of appropriate PPE to reduce exposure to tailings and other impacted materials. Short-term risks associated with barge access to the site, including potentially significant sediment resuspension issues, would be avoided by this alternative.

Long-term effectiveness and permanence would be insured through removal of impacted materials.

The tailings are derived from the beneficiation and extraction of ores and are therefore exempt in the State of Alaska from classification as a hazardous waste by federal regulations under RCRA, 42 USC 6921 (b)(3) (A)(iii)(1994).

Implementability. Alternative 5 is technically feasible and readily implementable since the equipment and labor resources necessary for road construction, excavation, removal, transportation and disposal is available in the region. It is assumed road construction materials will be present from one of the former borrow pits located within a few miles of the site. Conventional earth moving equipment would be used for excavation and placement of materials into highway rated trucks. The trucks would transport the materials to a chartered barge, where it would be bulk loaded. Both U.S. and Canadian manifests would be required prior to transport to Seattle via cargo vessel / barge. Once in Seattle the barge would be offloaded into highway trucks for a short drive to a rail transfer station. There the soil would be transferred into large capacity gondola cars for rail travel to the disposal site assumed to be in Arlington, Oregon.

Although some difficulty would be involved constructing the haul road in a relatively steep area, once complete, transporting the required equipment, material and personnel to this remote site is simplified. All the required services and materials are available. Coordination and management of equipment and supply import as well as export of debris and the contaminated media may be a challenge, but bulk loading of one barge simplifies the process.

Another potentially difficult component to this alternative is surface water control during excavation and transport. Erosion control measures such as silt fences, inflatable barriers and/or equipment to capture and treat surface water will be critical because of the typical wet weather conditions in southeast Alaska and proximity of Salt Chuck to portions of the site. Additional precautions will be implemented to make sure no release of potentially contaminated water occurs during transport. Lined steel containers will be used during barge transport to mitigate this risk.

After excavation and loadout are complete, the upland excavated areas would be filled with a growth media layer and revegetated as appropriate. Revegetation would utilize a native seed mixture. Cover/fill soil will be necessary in the excavated areas to level out and contour the areas to match the surrounding terrain. This alternative is expected to be completed within one construction season. Periodic inspections and maintenance would ensure integrity of the site restoration cover.

Cost. Estimated capital costs for Alternative 5 are approximately $3,180,000 of which $2,656,000 are direct contractor costs (Appendix M). This includes equipment mobilization, haul road construction, debris removal, on-site earthwork, transportation, and disposal costs. Also included in the cost are engineering support, construction management oversight, reporting, and a 20% contingency. A lower contingency is used for this alternative because there is less uncertainty associated with transportation costs using a road and bulk loading of one barge. O&M costs for site inspection, road maintenance, and reporting are estimated to be $184,000. It is assumed that the O&M is performed over a 30-year period.

Uncertainties and Assumptions. Specific historic preservation measures will be incorporated into removal action design using a cultural mitigation plan that is being developed by a Forest Service archaeologist in coordination with SHPO. For this EE/CA it is assumed nearly all metal debris posing danger to site visitors would be removed from the mill area as scrap. Items that are generally intact and safe would be temporarily staged until the debris removal is complete and an earthen cap is in place. Identified historic metal artifacts would then be distributed across the former mill site in an aesthetic manner for public viewing.

There is uncertainty with the volume of materials within the removal area, particularly with tailings under the mill debris. Tailing thickness is highly variable throughout the removal area and largely unknown because it is currently covered with mine debris. There may be uncertainty associated with the classification of the waste materials. Analytical results show that the contaminated materials are classified as non-hazardous. Even if the materials were profiles as hazardous they would be exempt in the State of Alaska from classification as a hazardous waste by federal regulations. However this exemption would likely not apply to the tip fees charged by a disposal facility in Washington or Oregon. Therefore, if a hot spot is encountered during the removal action which changes the materials classification to Hazardous for disposal purposes, then the disposal fees would escalate substantially. The cost estimate prepared for Alternative 5 assumes that all material being disposed off-island would incur non-hazardous disposal fees.

The other uncertainty with this alternative is road construction issues. A detailed survey of the potential road alignments has not been done. Therefore the exact grades, obstacles, stream crossing details, and potential impacts on historical artifacts are not clearly defined. Furthermore, wildlife considerations may exist which would affect the road alignment, such as the location of eagle nests.

5.3 COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis of alternatives to identify relative advantages and disadvantages of each is made in this section based on their effectiveness, implementability, and costs. Although the No Action

Alternative fails to meet threshold criteria of protection of human health and compliance with ARARs, this alternative is used as a baseline comparison with the other alternatives.

5.3.1 Effectiveness

The No Action alternative is the least effective action in reducing potential risks to human health and the environment. Alternative 0 would not meet RAOs and would not be compliant with ARARs. This alternative is more effective than No Action, but would not provide a suitable level of protection for human receptors, and would thus not comply with ARARs.

Alternative 1, 2, and 4 essentially have the same rank for nearly all effectiveness criteria. The only effectiveness criterion that differs is that the additional transportation effort for Alternatives 2 and 4 increases the short-term exposure to site workers and the public. Therefore Alternative 1 ranks slightly higher than Alternative 2 and 4 in short-term effectiveness. Alternatives 1, 2, and 4 all rank higher than Alternative 0 in effectiveness, because they both would physically isolate contaminants from receptor contact in a capped repository and would comply with ARARs. Exposure pathways to receptors would be eliminated by reducing direct contact with, and mobility of, the COCs.

Alternative 3 and 5 rank the highest for protection of human health and the environment and long-term effectiveness, because they remove the sources of COCs from the site. Alternative 3 and 5 would comply with all ARARs. Alternatives 3 and 5 pose higher short-term risks to the community, workers, and environment compared to other alternatives because of the longer transportation distance. Potential hazards are from airborne dust, erosion, and material contact with site workers during excavation, multiple material loading and unloading events and other transportation activities. Alternatives 0, 1, 2, and 3 pose some short-term risk to intertidal zones due to the use of a barge to access the site, while Alternatives 4 and 5 utilize a road, thereby shifting potential short-term impacts to less sensitive upland areas.

The factors that most distinguish Alternatives 3 and 5 from the other alternatives are the impacts to toxicity and volumes of waste. Under the other alternatives, toxicity and volume on-site are not reduced; rather, they are consolidated and isolated or simply left in place. Under Alternative 3 and 5, they are reduced on-site through removal and disposal in a permitted, managed disposal facility off-island, but there would be no reduction in toxicity or volume of the original material. Alternatives 1 through 5 all reduce or eliminate potential exposure pathways to human and ecological receptors.

5.3.2 Implementability

The No Action Alternative would be feasible from a technical and administrative perspective and would be easily implemented in general, because no actions would be taken. Of the five remaining alternatives, Alternative 0 would be the most technically implementable. Even though all alternatives can be completed in one construction season, this alternative requires the least construction activities of any of the alternatives, excluding the No Action alternative. Alternative 0 is administratively feasible with land use restrictions on land use. This alternative would not, however, meet RAOs.

Alternative 1 and 2 are implementable. The construction methods used for these repository alternatives rely on available technologies for which experienced contractors are available within the region. Further investigation may be necessary to verify suitable locations for a mill site or borrow pit repository. There appears to be sufficient space to construct a mill site repository northwest of the mill site and two potential borrow pit repository sites were identified in former borrow pits along Forest Service roads approximately ½ mile north of the site. The mill site repository area is however, heavily timbered with dense underbrush and has a slight slope.

All alternatives have technical feasibility challenges which must be met in transporting equipment and materials to the Salt Chuck Mine site. However, the two alternatives which include construction of a haul road for site access and transportation of contaminated materials reduce the risk and substantial uncertainty of accessing the site by barge. Transport of shallow-draft barges can only occur during conditions of high tide. It is possible that pre-work dredging would be required to make barge access to the site workable. Dredging activities would entail substantial difficulty, given permitting requirements, environmental protection, and dredge spoil containment and disposal issues. Some excavation work around the mill area will likely have to be conducted by hand to remove contaminants from around historical artifacts that are located on concrete foundations.

Alternatives 1, 2, and 4 are administratively feasible, although coordination would be needed to locate the repositories. Land use restrictions would be implemented to prevent future excavation in the repositories. Alternative 2 and 4 have additional implementability issues associated with transportation so these alternatives are rated lower than Alternative 1 with regard to implementation. However, Alternative 4 is rated higher than Alternative 2 for implementability because the road simplifies the transportation of contaminated materials to the borrow pit repository.

Alternative 3 poses similar technical transportation challenges to Alternative 2 with regard to transporting the quantity of containers required to transfer materials by barge. A staging area would have to be created to store containers, excavated material, and equipment necessary to excavate the contaminated materials and load them into the containers. Limited numbers of containers can be transported to the site and stored there at any one time. Alternative 2 and 3 have a lower implementability rating than Alternative 1 because of the logistical complexity of transporting equipment and containers to and from the site, and time required to complete the action. All alternatives are administratively feasible.

Off-island disposal is not rated high for implementability in Alternative 3 because the remote location of the Salt Chuck Mine site, its distance to a suitable landfill, concerns over safe loading and transportation of the waste materials, and numerous transfers of shipping containers during the process of off-island transportation.

Alternative 5 is rated much higher for implementability than Alternative 2 or 3 because the construction of a road greatly simplifies the transportation process and eliminates substantial uncertainty. Having a road available to transport contaminated materials from the site to Thorne Bay (or other port) for bulk loading minimizes the number of transfers needed and difficulties associated with staging a large quantity of shipping containers.

5.3.3 Cost

This section describes the total present worth costs for all of the removal action alternatives. The costs shown include all capital and O&M costs using a 5% discount rate and assuming construction would occur during the summer of 2011. The costs also include a contingency line item to account for uncertainty associated with Feasibility Level (+50/-30%) cost estimates and unlisted items. Contingency is included as a percentage of project costs and ranges from 20 to 25% depending on the complexity and unknowns related to the alternative. O&M costs were calculated over a 30-year post-removal period. The detailed cost estimates are included in Appendix M. A summary comparison of alternative costs including select direct cost categories is presented in Table 5-2. Backup materials and vendor quotes used to prepare the cost estimates are included in Appendix N. There are no associated costs with the No Action alternative, since there are no activities associated with this alternative.

The estimated net present value cost for Alternative 0, Institutional Controls and Debris Removal is $1,052,000. Capital costs include debris removal from the mill site area, signage installation, and placement of an earthen cover with seeding. O&M would consist of periodic inspections of the cover, signs, and replacement/maintenance as required. All of the impacted media would be left in place under Alternative 0, but physical hazards would be removed.

Alternative 1, Excavation, Consolidation in Mill Site Repository and Capping has a total estimated net present value cost of $2,691,000. The estimated capital cost includes debris removal, signage installation, consolidation of tailings and DRO contaminated material and assumes that cap material soil components would be imported from off-site sources. Monitoring would consist of periodic inspections of the repository cap, site restoration vegetation, signage, and replacement/maintenance as required.

Alternative 2, Excavation, Consolidation in Borrow Pit Repository and Capping has a total estimated net present value cost of $3,352,000. The estimated capital cost includes debris removal, signage installation, consolidation of tailings and DRO contaminated material, transportation to the borrow pit repository and assumes that all repository cap materials are imported from an off-site source. Monitoring is slightly higher for this alternative because it consists of periodic inspections at two locations. Both the repository and the site restoration components of this alternative will be inspected. O&M will also include sign inspection and replacement/maintenance as required.

Alternative 3, Excavation and Off-Island Disposal has a total estimated net present value cost of $3,696,000 and is the most expensive because of the high material transport and disposal costs. Alternative 3 involves the permanent removal of impacted media from the removal action areas, so the effectiveness of this alternative with regard to the removed material is not expected to change over time. This estimate includes debris removal and all work associated with excavation, transportation, and disposal of the tailings and DRO contaminated materials and site restoration. There is minimal O&M associated with this alternative as only inspection of the site restoration vegetation cover is included.

Alternative 4, Excavation, Consolidation in Borrow Pit Repository and Capping utilizing a Haul Road has a total estimated net present value cost of $3,383,000. This is approximately the same as Alternative 2 which means the increased cost to build the road off-sets the inefficiencies to barge and truck the contaminated materials to the borrow pit repository. The estimated capital cost includes haul road construction, debris removal, signage installation, consolidation of tailings and DRO contaminated material, transportation to the borrow pit repository and assumes that all repository cap materials are imported from an off-site source. In general, monitoring is slightly higher for this alternative than others because it consists of periodic inspections at two locations. However, O&M is reduced compared to Alternative 2. Both the repository and the site restoration components of this alternative will be inspected. O&M will also include annual road maintenance, sign inspection, and replacement/maintenance as required. Total O&M costs are lower than Alternative 2 because the cost savings associated with better site access offsets the annual road maintenance costs.

Alternative 5, Excavation and Off-Island Disposal utilizing a Haul Road has a total estimated net present value cost of $3,298,000 and is the second most expensive because of the high material transport and disposal costs. Overall cost is less than Alternative 3, thus construction of a haul road is beneficial to the project and could have other potential uses in the future. In addition, construction of a road reduces uncertainty with the other components of the alternative. Alternative 5 includes the permanent removal of impacted media from the removal action areas, so the effectiveness of this alternative with regard to the removed material is not expected to change over time. This estimate includes road construction, debris removal and all work associated with excavation, transportation, and disposal of the tailings and DRO-contaminated materials. There is lower O&M associated with this alternative as only annual road maintenance and inspection of the site restoration vegetation cover is included. O&M costs are reduced when compared to Alternative 3 because the cost savings associated with easier site access offsets the annual road maintenance costs.

5.4 RECOMMENDED ALTERNATIVE

Based on the evaluation of alternatives using EE/CA guidance, and from the comparative analysis of the removal action alternatives, Alternative 5 is recommended. Alternative 5 involves construction of a haul road from the existing Forest Service road to the mill site, excavation of impacted media, and transport to an appropriate off-island disposal facility. This alternative is protective of human health, and complies with ARARs.

The following are the primary features of Alternative 5 that result in its selection as the recommended alternative:

- Alternative 5 has the least uncertainty of alternatives that would meet the RAOs within the removal action areas.
- Alternative 5 substantially reduces the uncertainty, logistical challenges, potentially project cost impacts, and environmental risks associated with mobilizing equipment to the site and removing waste by barge through Salt Chuck.
- Alternative 5 provides a high degree of short- and long-term effectiveness.
- Alternative 5 substantially reduces long-term O&M costs and related uncertainty over other alternatives due to the lack of an on-site repository.

- Alternative 5 includes site development that will be greatly beneficial to future site activities as the overall site moves into the NPL process.

The following steps are recommended to implement Alternative 5:

- Perform a detailed site topographic land survey to confirm the location of site features and identify a suitable road alignment.
- Conduct a site visit for prospective contractors so they may obtain site specific information first hand.
- Confirm SHPO requirements for handling metal artifacts salvaged from the mill site debris.
- Pursue Forest Service input regarding the cutting and management of downed trees.
- Evaluate Jurisdictional Determination for wetlands.
- Complete a detailed engineer’s cost estimate following the removal action design.
- Contract for construction.

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6.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2008a. 18 AAC 75, Oil and Other Hazardous Substances Pollution Control. Revised as of October 9. http://www.dec.state.ak.us/regulations/pdfs/18AAC75.pdf

———. 2008b. Cumulative Risk Guidance. http://www.dec.state.ak.us/spar/csp/guidance/cumul_risk.pdf. June 9.

———. 2008c. Guidelines For Data Reporting, Data Reduction, And Treatment Of Non-Detect Values. http://www.dec.state.ak.us/spar/csp/guidance/tech-memo-data-reporting-and-ND.pdf. August 12.

_____. 2008e. Cleanup Levels Guidance. June 9. 25 pp.

———. 2009a. Method Three calculator. www.dec.state.ak.us/spar/csp/webcalc/index.htm. Accessed November 2009.

———. 2009b. Risk Assessment Procedures Manual. Draft, February 18.

———. 2009c. Ecoscoping Guidance. 38 pp., March.

Alaska Department of Fish and Game (ADFG). 2009. Alaska Department of Fish and Game. Endangered Species in Alaska. Updated December 29, 2009.

Alaska Department of Natural Resources (ADNR). 1998. Prince of Wales Island Area Plan. ADNR Div. Of Mining, Land, and Water, Resource Assessment and Development Section. Originally approved June 1985, revised October 1998.

———. 2008. A Revegetation Manual for Alaska. August 2008 Update.

Alaska State Climate Center (ASCC). 1992. Local Climatological Data, Annual Summary with Comparative Data for Annette, Alaska. Environmental and Natural Resources Institute, Univ. of Alaska Anchorage. 9 p.

Bruder, S.J. 2002. Pilot Field Study Results: Historic Context for Mining Properties, Chugach and Tongass National Forests, Alaska, 1850s-1950s. Prepared for Michael L. Foster and Associates under contract to the USDA Forest Service, Alaska Region. Contract No. 53-0109-1-00568.

Centers for Disease Control and Prevention (CDC). 2004. Why Not Change the Blood Level of Concern at This Time? U.S. Dept. of Health and Human Services. http://www.cdc.gov/nceh/lead/policy/changeBLL.htm. October 4.

Gough, L.P., R.C. Severson, and H.T. Shacklette. 1988. Element Concentrations in Soils and Other Surficial Materials of Alaska. USGS Professional Paper 1458. 53 p.

Himmelberg, Glen R. and Robert A. Loney, 1995. Characteristics and Petrogenesis of Alaskan-Type Ultramafic-Mafic Intrusions, Southeastern Alaska. U. S. Geological Survey Professional Paper 1564, 47 pages.

Maas, K.E., P.E. Bittenbender, and J.C. Still. 1995. Mineral Investigations in the Ketchikan Mining District, Southeastern Alaska. U.S. Dept. of Interior, Bureau of Mines, Open File Report 11-95. 606 pp.

Montgomery Watson. 1999. Final Investigation of Third Part Liability, Salt Chuck Mine. Prepared for the U.S. Department of Agriculture, Forest Service, Region 10. September.

National Oceanic and Atmospheric Administration (NOAA). 2002. Tides Online. NOAA National Ocean Service, Center for Operational Oceanographic Products and Services. www.co-ops.nos.noaa.gov

Nevada Star Resource Corporation. 2007. Salt Chuck Project. www.nevadastar.com/s/SaltChuckProject.asp. Accessed March 12.

Palmieri, A.G., ADEC. 2009. Email communication regarding alternate cleanup level calculation in URS (2007) draft EE/CA report, and discussion with Earl Crapps, ADEC, on input parameters.

Pure Nickel Inc. 2008. News Releases - June 24, 2008, Pure Nickel Exploration Update. www.purenickel.com/s/NewsReleases.asp?ReportID=308816. Accessed October 29, 2009.

_____. 2009. Salt Chuck Project. www.purenickel.com/s/salt_chuck.asp. Accessed October 29.

Santoy Resources Ltd. 2007. Base - PGM Metals, Salt Chuck Property, Alaska. www.santoy.ca/s/BaseMetals.asp?ReportID=74696&_Type=Base-PGM-Metals&_Title=Salt-Chuck-Property-Alaska. Accessed March 12.

Schoeny, R. and K. Poirier. 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. U.S. Environmental Protection Agency, Office of Research and Development, Office of Health and Environmental Assessment, Washington, DC, EPA/600/R-93/089 (NTIS PB94116571).

Skousen, J., Renton, J., Brown, H., Evans, P., Leavitt, B., Brady, K., Cohen, L. and Ziemkiewicz, P. 1997. Neutralization Potential of Overburden Samples containing Siderite, Journal of Environmental Quality, v26, n3, p673-681.

Sobek, A.A., Schuller, W.A., Freeman, J.R. and Smith, R.M. 1978. Field and laboratory methods applicable to overburden and minesoils, EPA 600/2-78-054, 203pp.

Szumigala, D.J., R.C. Swainbank, M.W. Henning, and F.M. Pillifant. 2000. Alaska's Mineral Industry 2000. Alaska Div. of Geological & Geophysical Surveys Special Report 55.

URS Corporation (URS)/Dames & Moore. 2001. Final Report, Engineering Evaluation/Cost Analysis (EE/CA) For Gold Standard Mine. Report prep. For USDA Forest Service - Alaska Region. Project No. 74-F0361921.00. 59 pp. June.

_____. 2002. Final Work Plan, Engineering Evaluation/Cost Analysis (EE/CA) for Salt Chuck Mine Tongass National Forest, Alaska. Work Plan prepared for USDA Forest Service – Alaska Region. Project No. 74-FFS20021.00. 42 pp. July.

_____. 2006. Final Work Plan Addendum for Salt Chuck Mine, Tongass National Forest, Alaska. Prepared for USDA Forest Service. 44 p. September.

_____. 2007. Draft Report, Engineering Evaluation/Cost Analysis (EE/CA), Salt Chuck Mine, Tongass National Forest, Alaska. Prepared for USDA Forest Service, 101 pp, March.

_____. 2009. Memorandum, Strategy Meeting Summary and Conceptual Plan, Salt Chuck Mine. 2 p. September 9.

U.S. Bureau of Land Management (USBLM). 1998. Final Report, Removal Preliminary Assessment. Salt Chuck Mine. Ketchikan Ranger District, Tongass National Forest, Region 10 – Alaska. Prepared by USBLM, Juneau Field Office, Interagency Agreement No. 961A-10-012. April 1998.

_____. 2009. Spatial Database Management System, BLM-Alaska: Federal Mining Claims Map Layer. http://sdms.ak.blm.gov/isdms/imf.jsp?site=sdms. Accessed November 3.

U.S. Department of Agriculture, Forest Service (Forest Service). 1991a. Color aerial photographs of Salt Chuck area at low tide. Flight USDA-F 16-610054A L33, Frames 290-114 and -115. August 6.

_____. 1991b. Color aerial photographs of Salt Chuck area at approximately mean high tide. Flight USDA-F, 16 610054A L32, Frames 690-136 and -137. August 12.

———. 2002. Written Comments to Draft Work Plan, EE/CA for Salt Chuck Mine. 6 pp. July 9.

U. S. Environmental Protection Agency (USEPA). 1989. Risk Assessment Guidance for Superfund (RAGS), Vol. 1, Human Health Evaluation Manual.

———. 1993a. Data Quality Objectives Process for Superfund. EPA Directive No. 9355. 9-02.

———. 1993b. Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA. Publication 9360.0-32. EPA/540-R-93-057. August.

———. 2002. Guidance for Comparing Backgroundand Chemical Concentrations in Soilfor CERCLA Sites, Office of Emergency and Remedial Response U.S. Environmental Protection Agency, Washington, DC 20460 , EPA 540-R-01-003 OSWER 9285.7-41, September.

———. 2009. Risk Screening Levels. April.

U. S. Fish & Wildlife Service (USFWS). 2009. National Wetlands Inventory. http://www.fws.gov/wetlands/Data/GoogleEarth.html. Accessed February 2, 2010.

Western Regional Climate Center (WRCC). 1999a. Annette WB Airport, Alaska (500352), Period of Record Monthly Climate Summary, Period of Record: 9/1/1949 to 12/31/1998. http://www.wrcc.dri.edu/cgi-bin/cliRECtM.pl?akbeav, 1999.

———. 1999b. Beaver Falls, Alaska (500657), Period of Record Monthly Climate Summary, Period of Record: 9/1/1949 to 12/31/1998. http://www.wrcc.dri.edu/cgi-bin/cliRECtM. pl?akbeav, 1999.

———. 1999c. Ketchikan, Alaska (504590), Period of Record Monthly Climate Summary, Period of Record: 9/1/1949 to 5/31/1999. http://www.wrcc.dri.edu/cgi-bin/cliRECtM. pl?akbeav, 1999.

TABLES

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TABLE 2-1
COMMON FOREST PLANT SPECIES, SOUTHEAST ALASKA
Salt Chuck Mine – Tongass National Forest, Alaska

Common Name	Scientific Name
Trees	
Sitka spruce	*Picea sitchensis*
Western hemlock	*Tsuga heterophylla*
Western red cedar	*Thuja placata*
Shore pine	*Pinus contorta*
Alaska cedar	*Chamaecyparis nootkatensis*
Red alder	*Alnus rubra*
Black cottonwood	*Populus trichocarpa*
Oregon crabapple	*Malus fuscus*
Shrubs	
Sitka alder	*Alnus sinuata*
Sitka willow	*Salix sitchensis*
Diamondleaf willow	*Salix planifolia*
Feltleaf willow	*Salix alexensis*
Pacific willow	*Salix lasiandra*
Bebb willow	*Salix bebbiana*
Douglas maple	*Acer douglassii*
Devil's club	*Oplopanax horridus*
Salmonberry	*Rubus spectabilis*
False azalea	*Menziesia ferruginea*
Alaska blueberry	*Vaccinium alaskensis*
Early blueberry	*Vaccinium ovalifolium*
Red huckleberry	*Vaccinium parvifolia*
Dwarf blueberry	*Vaccinium caespitosum*
Bog blueberry	*Vaccinium uliginosum*
Salal	*Gaultheria shallon*
Stink current	*Ribes bracteosum*
Skunk current	*Ribes glandulosum*
Black current	*Ribes hundsonianum*
Deer cabbage	*Fauria cristi-galli*
Bog rosemary	*Andromeda polifolia*
Kalmia	*Kalmia polifolia*
Fiveleaf bramble	*Rubus pedatus*
Thimbleberry	*Rubus parviflorus*
Grasses	
Pacific reedgrass	*Calamagrostis canadensis*
Red fescue	*Festuca rubra*
Tufted hairgrass	*Deschampsia caespitosa*
Spike trisetum	*Trisetum spicatum*

TABLE 2-1 (CONTINUED)
COMMON FOREST PLANT SPECIES, SOUTHEAST ALASKA
Salt Chuck Mine – Tongass National Forest, Alaska

Common Name	Scientific Name
Forbs	
Field horsetail	*Equisetum arvense*
Lady fern	*Athyrium felix-femina*
Mountain fern	*Gymnocarpium expansa*
Deer fern	*Blechnum spicant*
Sword fern	*Polystichum munitum*
Oak fern	*Dryoteris gymnocarpium*
Bracken fern	*Pteridium aquilinum*
Yarrow	*Achillea borealis*
Pearly everlasting	*Anaphalis margaritacea*
Goat’s beard	*Aruncus dioicus*
Queen’s cup	*Clintonia uniflora*
Bunchberry	*Cornus canadensis*
Dwarf cornel	*Cornus suecica*
Fernleaf goldthread	*Coptis aspleniifolia*
Threeleaf goldthread	*Coptis trifolia*
Sweet-scented bedstraw	*Galium triflorum*
Twinflower	*Linnaea borealis*
Skunk cabbage	*Lysichiton americanum*
False lily-of-the-valley	*Maianthemum dilatatum*
Pink wintergreen	*Pyrola ascarifolia*
Sidebells wintergreen	*Pyrola secunda*
Rose twiststalk	*Streptopus rosea*
Foam flower	*Tiarella trifoliata*

TABLE 2-2
COMMON BIRD SPECIES, SOUTHEAST ALASKA
Salt Chuck Mine – Tongass National Forest, Alaska

Common Name	Scientific Name	Feeding Habits	Habitat
Loons and Grebes			
Pacific Loon	*Gavia pacifica*	Carnivorous	Lakes/inshore and offshore marine waters
Red-necked Grebe	*Podiceps grisegena*	Carnivorous	Nearshore marine/lakes and streams
Cormorants			
Pelagic Cormorant	*Phalacrocorax pelagicus*	Carnivous/Picivous	Inshore/offshore marine waters
Herons			
Great Blue Heron*		Carnivorous	Lakes/intertidal waters
Ducks, Geese and Swans			
Tundra Swan	*Cygnus columbianus*	Herbivorous	Inshore marine waters
Trumpeter Swan	*Cygnus buccinator*	Herbivorous	Inshore marine waters
Canada Goose*	*Branta canadensis*	Herbivorous	Lakes/intertidal wetlands
Mallard	*Anas platyrhynchos*	Omnivorous	Lakes/inshore marine waters
Harlequin Duck	*Histrionicus histrionicus*	Carnivorous	Inshore/offshore/intertidal
Surf Scoter	*Melanitta perspicillata*	Carnivorous	Inshore/offshore/intertidal
Bufflehead	*Bucephala albeola*	Carnivorous	Lakes/ nearshore marine
Barrow's Goldeneye	*Bucephala islandica*	Carnivorous	Lakes/ nearshore marine
Common Merganser	*Mergus merganser*	Piscivorous	Lakes/streams
Red-breasted Merganser	*Mergus serrator*	Piscivorous	Lakes/nearshore marine
Hawks and Eagles			
Bald Eagle*	*Haliaeetus leucocephalus*	Carnivorous/ scavenger	Coniferous forests
Sharp-shined Hawk	*Accipiter striatus*	Carnivorous	Coniferous/mixed deciduous-
Northern Goshawk	*Accipiter gentilis*	Carnivorous	Coniferous forests
Red-tailed Hawk	*Buteo jamaicensis*	Carnivorous	Coniferous/mixed deciduous-coniferous forest
Grouse			
Blue Grouse	*Dendragapus obscurus*	Herbivorous	Coniferous forests
Shorebirds			
Greater Yellowlegs	*Tringa melanoleuca*	Carnivorous	Muskegs
Spotted Sandpiper	*Actitis macularia*	Carnivorous	Rivers and streams
Black Turnstone	*Arenaria melanocephala*	Carnivorous	Intertidal
Common Snipe	*Gallinago gallinago*	Carnivorous	Rivers and streams/muskegs
Gulls and Terns			
Mew Gull	*Larus canus*	Carnivorous	Inshore/offshore/intertidal/
Herring Gull	*Larus argentatus*	Carnivorous/ scavenger	Inshore/offshore/intertidal/
Glaucous-winged Gull	*Larus glaucescens*	Carnivorous/ scavenger	Inshore/offshore/intertidal/
Arctic Tern	*Sterna paradisaea*	Carnivorous	Inshore/offshore/intertidal/
Alcids			
Marbled Murrelet	*Brachyramphus marmoratus*	Carnivourous	Inshore/offshore/intertidal/
Owls			
Great Horned Owl	*Bubo virginianus*	Carnivorous	Coniferous/mixed deciduous-coniferous forests

TABLE 2-2 (CONTINUED)
COMMON BIRD SPECIES, SOUTHEAST ALASKA
Salt Chuck Mine – Tongass National Forest, Alaska

Common Name	*Scientific Name*	Feeding Habits	Habitat
Northern Pygmy Owl	*Glaucidium gnoma*	Carnivorous	Coniferous forest
Hummingbirds			
Rufous Hummingbird	*Selasphorus rufus*	Herbivorous	Coniferous/mixed deciduous-coniferous forests
Kingfishers			
Belted Kingfisher*	*Ceryle alcyon*	Carnivorous	Rivers/lakes/estuaries
Woodpeckers			
Red-headed Sapsucker	*Sphyrapicus ruber*	Carnivorous/ Insectivorous	Coniferous/mixed deciduous-coniferous forests
Flycatchers			
Pacific-slope Flycatcher	*Empidonax difficilis*	Carnivorous/ Insectivorous	Coniferous/mixed deciduous-coniferous forests
Swallows			
Tree Swallow	*Tachycineta bicolor*	Carnivorous/ Insectivorous	Coniferous/mixed deciduous-coniferous forests
Corvids			
Steller's Jay	*Cyanocitta stelleri*	Omnivorous	Coniferous/mixed deciduous-coniferous
Common Raven	*Corvus corax*	Omnivorous/ scavenger	Coniferous/mixed deciduous-coniferous
Northwestern Crow*	*Corvus caurinus*	Omnivorous	Coniferous/mixed deciduous-coniferous
Chickadees			
Chestnut-backed Chickadee	*Poecile rufescens*	Herbivorous/ Insectivorous	Coniferous/mixed deciduous-coniferous forests
Dippers			
American Dipper	*Cinclus mexicanus*	Carnivorous/ Piscivorous	Stream banks
Wrens			
Winter Wren	*Troglodytes troglodytes*	Carnivorous	Coniferous/mixed deciduous-coniferous forests
Thrushes and Kinglets			
Golden-crowned Kinglet	*Regulus satrapa*	Carnivorous	Coniferous forest
Ruby-crowned Kinglet	*Regulus calendula*	Carnivorous	Coniferous/mixed deciduous-
Swainson's Thrush	*Catharus ustulatus*	Omnivorous	coniferous forests
Hermit Thrush	*Catharus guttatus*	Omnivorous	Coniferous/mixed deciduous-coniferous
American Robin	*Turdus migratorius*	Omnivorous	Coniferous/mixed deciduous-coniferous
Warblers and Sparrows			
Orange-crowned Warbler	*Vermivora celata*	Carnivorous/	Coniferous/mixed deciduous-
Yellow-rumped Warbler	*Dendroica coronata*	Insectivorous	Coniferous/mixed deciduous-coniferous forests
Townsend's Warbler	*Dendroica townsendi*	Insectivorous	Coniferous forests

TABLE 2-2 (CONTINUED)
COMMON BIRD SPECIES, SOUTHEAST ALASKA
Salt Chuck Mine – Tongass National Forest, Alaska

Common Name	*Scientific Name*	Feeding Habits	Habitat
Wilson's Warbler	*Wilsonia pusilla*	Insectivorous	Coniferous/mixed deciduous-coniferous forests
Savannah Sparrow	*Passerculus sandwichensis*	Herbivorous	Coniferous/mixed deciduous-coniferous forests
Fox Sparrow	*Passerella iliaca*	Herbivorous	Coniferous/mixed deciduous-coniferous forests
Warblers and Sparrows (Cont.)			
Song Sparrow	*Melospiza melodia*	Omnivorous	Coniferous/mixed deciduous-coniferous forests
Lincoln's Sparrow	*Melospiza lincolnii*	Herbivorous	Shrub communities/grasslands
Golden-crowned Sparrow	*Zonotrichia atricapilla*	Herbivorous	Coniferous/mixed deciduous-coniferous forests
Dark-eyed Junco	*Junco hyemalis*	Herbivorous	Coniferous/mixed deciduous-coniferous forests
Finches			
Red Crossbill	*Loxia curvirostra*	Herbivorous	Coniferous/mixed deciduous-coniferous forests
Pine Siskin	*Carduelis pinus*	Herbivorous	Coniferous/mixed deciduous-coniferous forests

* Observed in Salt Chuck area by URS during 2006 field work.

TABLE 2-3
COMMON TERRESTRIAL MAMMALS, SOUTHEAST ALASKA
Salt Chuck Mine – Tongass National Forest, Alaska

Common name	Scientific name	Feeding Habits	Habitat
Dusky shrew	*Sorex monticolus*	Insectivorous	Muskegs/coniferous forests/dry hillsides
Northern water shrew	*Sorex palustris*	Insectivorous	Small streams/muskegs
Keen's myotis	*Myotis keenii*	Carnivorous/ insectivorous	Caves/mine tunnels/tree cavities
Little brown bat	*Myotis lucifigus*	Carnivorous/ Insectivorous	Caves/mine tunnels/tree cavities
Red fox	*Vulpes vulpes*	Carnivorous	Coniferous forests
Wolf	*Canis lupis*	Carnivorous	Coniferous forests
River otter**	*Lontra canadensis*	Carnivorous	Coniferous forests
Marten	*Martes americana*	Carnivorous	Coniferous forests
Ermine	*Mustela erminea*	Carnivorous	Coniferous forests
Mink	*Mustela vison*	Carnivorous	Coniferous forests along streams
Black bear*	*Ursus americanus*	Omnivorous	Coniferous forests
Brown bear	*Ursus arctos*	Omnivorous	Coniferous forests
Hoary marmot	*Marmota caligata*	Herbivorous	Alpine shrub
Red squirrel	*Tamiasciurus hudsonicus*	Herbivorous	Coniferous/mixed deciduous-coniferous forests
Northern flying squirrel	*Glaucomys sabrinus*	Herbivorous	Coniferous/mixed deciduous-coniferous forests
Beaver	*Castor canadensis*	Herbivorous	Streams and lakes in mixed deciduous-coniferous forests
Northern bog lemming	*Synaptomys borealis*	Herbivorous	Low moist areas near streams and lakes.
Meadow vole	*Microtus pennsylvanicus*	Herbivorous	Low moist areas near streams and lakes.
Muskrat	*Ondatra zibethicus*	Herbivorous	Marshes/weedy borders of lakes
Norway rat	*Rattus norvegicus*	Omnivorous	Coniferous/mixed deciduous-coniferous forests
House mouse	*Mus musculus*	Omnivorous	Coniferous/mixed deciduous-coniferous forests
Heather vole	*Phenacomys intermedius*	Herbivorous	Coniferous forest
Porcupine	*Erethizon dorsatum*	Herbivorous	Mixed deciduous-coniferous forests
Sitka black-tailed deer*	*Odocoileus hemionus sitkensis*	Herbivorous	Coniferous forest/alpine/subalpine

* Scat and tracks observed in Salt Chuck area (USBLM, 1998).
** Observed in Salt Chuck area by URS during 2006 field work.

TABLE 2-4
TOTAL METALS DATA FOR SOIL – BUILDING C4 AND BACKGROUND
Salt Chuck Mine – Tongass National Forest, Alaska

Media			Site Soil				Background Soil				
Sample Location			Adjacent to Building C4				West Side of Salt Chuck Bay	East of Unnamed Island	Trailhead Near Power Lake	East Side of Lake No. 3	700' North of Gloryhole
Sample Number			SCSS-1	SCSS-2	SCSS-26a/26b[1]		SCSSBG-1	SCSSBG-2	SCSSBG-3	SCSSBG-4	SCSSBG-5
Date Collected			7/23/02		9/27-28/06		7/23-26/02				
Units			mg/kg								
Analyte	EPA Method 2002 Samples	EPA Method 2006 Samples	Metals								
Antimony	6020	6020	ND(1.32)[J]	15.4[J]	0.164	0.122	ND(0.355)[J]	ND(0.367)[J]	ND(0.359)[J]	ND(0.342)[J]	ND(0.384)
Arsenic	6020	6020	ND(4.40)	4.95	4.31	4.51	2.57	4.06	ND(1.20)	3.10	3.86
Beryllium	6020	6020	ND(0.440)	ND(0.118)	--	--	ND(0.118)	0.173	ND(0.120)	0.272	0.201
Cadmium	6020	6020	ND(0.880)	ND(0.236)	--	--	ND(0.237)	ND(0.245)	ND(0.239)	ND(0.228)	ND(0.256)
Chromium	6020	6020	ND(4.40)	8.09	--	--	5.58	17.5	ND(1.20)	14.0	40.0
Copper	6020	6020	825	7,320	59.3	72.3	10.2	45.6	ND(2.39)	21.5	23.0
Lead	6020	6020	651	6,170	13.8	17.0	16.1	3.23	0.286	3.40	8.26
Mercury	7471A	1631E	25.3	311	0.212[J]	0.143	ND(4.65)[J]	ND(4.78)[J]	ND(4.52)[J]	ND(4.56)[J]	0.0922
Nickel	6020	6020	ND(8.80)	16.0	--	--	3.10	11.1	ND(2.39)	7.71	6.59
Selenium	6020	7742	ND(4.40)	8.36	0.13	0.25	ND(1.18)	ND(1.22)	ND(1.20)	ND(1.14)	ND(1.28)
Silver	6020	6020	0.497	17.8	--	--	ND(0.118)	ND(0.122)	ND(0.120)	ND(0.114)	0.205
Thallium	6020	6020	ND(0.0880)	0.0624	--	--	ND(0.0237)	ND(0.0245)	ND(0.0239)	ND(0.0228)	ND(0.0256)
Vanadium	6020	6020	24.7	237	138	138	13.2	62.6	36.3	76.2	460
Zinc	6020	6020	290[J]	215[J]	38.6	38.9	12.0[J]	30.2[J]	ND(1.20)	30.9[J]	21.1

Notes:

--	=	Not analyzed or available
( )	=	Detection limits shown in parentheses
J	=	2002 data qualified as estimated due to matrix spike recoveries outside of laboratory QC criteria, or high bias due to matrix interference (SCSS-26a Hg only).
EPA	=	U.S. Environmental Protection Agency
mg/kg	=	Milligrams per kilogram
ND	=	Not detected
QC	=	Quality control
RPD	=	Relative % difference
1	=	Duplicate samples

Source: URS (2007)

TABLE 2-5
TCLP DATA FOR SOIL – BUILDING C4
Salt Chuck Mine – Tongass National Forest, Alaska

	Media	Soil	Toxicity Characteristic for Leachate[2]
	Sample Location	Adjacent to Building C4	
	Sample Number	SCSS-25[1]	
	Date Collected	9/27/06	
	Units	mg/L	
	EPA Method	TCLP	
Arsenic	1311/6010B	ND (0.05)	5.0
Barium	1311/6010B	0.5[J]	10.0
Cadmium	1311/6010B	ND (0.003)	1.0
Chromium	1311/6010B	ND (0.005)	5.0
Copper	1311/6010B	--	NE
Lead	1311/6010B	0.78	5.0
Mercury	1311/7470A	0.0008[J]	0.20
Nickel	--	--	NE
Selenium	1311/6010B	ND (0.04)	1.0
Silver	1311/6010B	ND (0.01)	5.0
Vanadium	--	--	NE
Zinc	1311/6010B	--	NE

Notes:
-- = Not analyzed or available.
( ) = Detection limits shown in parentheses.
J = Data is estimated; result is greater than the method detection limit, but less than method reporting limit.
EPA = U.S. Environmental Protection Agency
ND = Not detected
NE = Not established
mg/L = Milligrams per liter
TCLP = Toxicity Characteristic Leaching Procedure
1 = Sample collected at former location of SCSS-2 (Table 2-4).
2 = Regulatory level for toxicity characteristic solid waste, Federal hazardous waste regulations (40CFR261.24).
Source: URS (2007)

TABLE 2-6
ORGANICS DATA FOR SOIL – AST/DRUM CACHE AREA AND BACKGROUND
Salt Chuck Mine – Tongass National Forest, Alaska

Media			Site Soil														Background Soil				
			Upper AST Area						Fuel Drum Cache Composite	Lower AST Area							West Side of Salt Chuck Bay	East of Unnamed Island	Trailhead Near Power Lake	East Side of Lake No. 3	700' North of Gloryhole
										Near Upper Drum Cache	Between Drum Caches					Near Lower Drum Cache					
Sample Number			SO07[1]	SCSS-14	SCSS-16/17[2]		SCSS-20	SCSS-22	SO06[1]	SCSS-15	SCSS-18	SCSS-19	SCSS-21	SCSS-23		SCSS-24	SCSSBG-1	SCSSBG-2	SCSSBG-3	SCSSBG-4	SCSSBG-5
Date Collected			7/25/1997	7/25/2002					7/25/1997	7/25-26/02											
Units[3]			mg/kg																		
Analyte	Method: 1997 Samples	Method: 2002 Samples	Analytical Results																		
Hydrocarbon Mixtures																					
DRO/EPH	--	AK 102/103	--	6,680 [J,4]	ND(26.1)	335[4]	2,270 [J,5]	5,500 [J,4]	--	2,180 [J,4]	7,290 [J,4]	17,400 [J,4]	1,120 [J,5]	1,120 [J,4]	8,540 [J,4]	ND(24.0)	251 [J,5]	685 [J,5]	ND(23.2)	304 [5]
DRO Silica Gel	--	AK 102/103SG	--	4,150 [J,4]	ND(25.8)	ND(33.8)	--	4,580 [J,4]	--	2,210 [J,4]	--	--	--	--	--	--	--	--	--	--
RRO	--	AK 102/103	--	693 [J,4]	ND(32.0)[5,6]	373[5]	3,530 [J,5]	1,640 [J,4]	--	593 [J,4]	6,290 [J,5]	7,400 [J,5]	1,570 [J,5]	1,010 [J,5]	6,390 [J,5]	ND(26.2) [5]	392 [J,5]	907 [J,5]	ND(25.5) [5]	384 [J,5]
RRO Silica Gel	--	AK 102/103SG	--	375 [J,4]	ND(25.8)	ND(33.8)	--	1,210 [J,4]	--	509 [J,4]	--	--	--	--	--	--	--	--	--	--
TRPH	EPA 418.1	--	9,100	--	--	--	--	--	ND(2,600)	--	--	--	--	--	--	--	--	--	--	--
TOC	--	TOC CTE SOP	--	37,370	19,510 [J]	36,130 [J]	457,500	66,680	--	35,850	178,100	503,600	151,100	122,000	529,600	63,160	132,500	94,760	30,170	59,640
PAHs																				
High Molecular Weight PAHs:																				
Benzo(a)anthracene	--	PAH SIM	--	0.0103	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	PAH SIM	--	0.00844	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	PAH SIM	--	ND(0.00646)	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	--	PAH SIM	--	ND(0.00646)	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	--	PAH SIM	--	ND(0.00646)	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	--	PAH SIM	--	0.0256	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	--	PAH SIM	--	ND(0.00646)	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	--	PAH SIM	--	ND(0.00646)	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	--	PAH SIM	--	ND(0.00646)	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
BaP Equivalent[7,8]	--	--	--	0.0134	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Low Molecular Weight PAHs:																				
Acenaphthene	--	PAH SIM	--	ND(0.0646)	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthylene	--	PAH SIM	--	ND(0.0646)	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	--	PAH SIM	--	ND(0.00646)	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	--	PAH SIM	--	ND(0.00646)	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Fluorene	--	PAH SIM	--	ND(0.0646)	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Napthalene	--	PAH SIM	--	ND(0.00646)	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	--	PAH SIM	--	ND(0.00646)	--	--	--	ND(0.0759)	--	--	--	--	--	--	--	--	--	--	--	--
Microbiology and Nutrients																				
Heterotrophic Plate Count (MPN/gm)	--	SM19 9215	--	210,000 [J]	--	--	--	1,100,000 [J]	--	--	--	--	--	--	--	--	--	--	--	--
Oil Degrading Bacteria (MPN/gm)	--	Sheen Screen	--	3,400	--	--	--	17,000	--	--	--	--	--	--	--	--	--	--	--	--
Nitrate	--	EPA 300.0	--	ND(2.60)	--	--	--	2.90	--	--	--	--	--	--	--	--	--	--	--	--
Nitrite	--	EPA 300.0	--	ND(2.60)	--	--	--	ND(2.85)	--	--	--	--	--	--	--	--	--	--	--	--
Phosphorus	--	ASA 1982:24-5	--	6.97	--	--	--	3.36	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
- -- = Not analyzed or available
- ( ) = Detection limits shown in parentheses
- ADEC = Alaska Department of Environmental Conservation
- BaP = Benzo(a)pyrene
- CTE = CT&E Laboratory
- DRO = Diesel Range Organics
- EPA = U.S. Environmental Protection Agency
- EPH = Extractable Petroleum Hydrocarbons
- J = Data qualified as estimated: DRO and RRO results biased high due to surrogate recoveries above laboratory QC criteria; plate count samples exceeded holding time; RPD for duplicate TOC samples >50%.
- mg/kg = Milligrams per kilogram
- MPN/gm = Most Probable Number per gram
- ND = Not detected
- NE = Not established
- PAHs = Polynuclear Aromatic Hydrocarbons
- RPD = Relative percent difference
- RRO = Residual Range Organics
- QC = Quality control
- SG = Silica Gel cleanup procedure
- SIM = Selective Ion Monitoring
- SOP = Standard Operating Procedure
- TEF = Toxicity Equivalency Factor
- TOC = Total Organic Carbon
- TRPH = Total Recoverable Petroleum Hydrocarbons

1 = Composite sample.
2 = Duplicate samples.
3 = All results are in mg/kg unless otherwise noted.
4 = Chromatograph pattern is consistent with highly weathered middle distillate.
5 = Chromatograph contains unknown hydrocarbon with several peaks.
6 = Data qualified as nondetected due to concentrated <5x method blank
7 = Sum of seven high molecular weight PAHs times analyte-specific TEFs (ADEC, 2009). TEFs from Schoeny and Poirer (1993): benzo(a)anthracene 0.1, benzo(a)pyrene 1.0, benzo(b)fluoranthene 0.1, benzo(k)fluoranthene 0.01, chrysene 0.001, dibenzo(a,h)anthracene 1.0, and indeno(1,2,3-cd)pyrene 0.1/
8 = Summation calculated using ½ detection limit for ND results.

Sources: 1995-1997 data from USBLM(1998); 2002 data from URS (2007).

TABLE 2-7
TOTAL METALS DATA FOR UNSATURATED TAILINGS [1] - MILL AREA
Salt Chuck Mine – Tongass National Forest, Alaska

		Media	Unsaturated Tailings						
			Mill Area[2]						
		Sample Location	SW of Mill – Base of Slope at Edge of Intertidal Zone	SW Corner of Mill		South of Mill	SE of Mill Next to Barge	SE Corner of Mill Tailings[6]	
		Sample Number	SCUT-3	SCUT-4/5[5]		S003[3,4]	SCUT-6	SCSS-27a/27b[5]	
		Date Collected	7/25/2002			9/15/1995	7/25/2002	8/27-28/06	
		Units	mg/kg or ppm						
Analyte	Method		Metals						
	1995 Samples	2002/2006 Samples							
Antimony	NS	EPA 6020	4.93[J]	8.97[J]	1.25[J]	8	2.51[J]	2.36[J]	0.342[J]
Arsenic	NS	EPA 6020	8.89	1.89	1.42	4	10.2	3.83[J]	1.64[J]
Barium	NS	--	--	--	--	30	--	--	--
Beryllium	NS	EPA 6020	ND(0.116)	ND(0.111)	ND(0.107)	ND(0.5)	ND(0.119)	--	--
Cadmium	NS	EPA 6020	0.35	0.97	0.981	1	0.832	--	--
Chromium	NS	EPA 6020	3.72	2.34	2.11	21	5.87	--	--
Copper	NS	EPA 6020	53,400	9,760	9,350	>10,000	11,000	7,260[J]	4,270[J]
Iron	NS	--	--	--	--	95,600	--	--	--
Lead	NS	EPA 6020	83.9	87.6	58.7	98	143	351[J]	16.7[J]
Mercury	NS	EPA 7471A	ND(4.69)	ND(4.41)	ND(4.15)	0.13	ND(4.65)	20.7[J]	0.318[J]
Nickel	NS	EPA 6020	14.6	12	11.8	21	17.1	--	--
Selenium	--	EPA 6020	65.4	8.63	8.12	--	11.3	1.88	1.32
Silver	NS	EPA 6020	34.1	6.18	5.25	43	7.86	--	--
Thallium	NS	EPA 6020	ND(0.0233)	ND(0.0221)	ND(0.0213)	ND(10)	ND(0.0237)	--	--
Vanadium	NS	EPA 6020	290	211	229	401	314	188	219
Zinc	NS	EPA 6020	82.7[J]	268[J]	243[J]	230	266[J]	68	61.2

Notes:

--	=	Not analyzed or available
( )	=	Detection limits shown in parentheses
J	=	2002 data qualified as estimated due to matrix spike recoveries outside of Laboratory QC criteria. 2006 data estimated due to duplicate RPD outside of control limits, or result less than reporting limit (SCSS-27b As only).
EPA	=	U.S. Environmental Protection Agency
mg/kg	=	Milligrams per kilogram
ND	=	Not detected
NS	=	Non-standardized geochemical assay test: CVAA-type method used for mercury; ICP-type method used for all other metals.
ppm	=	Part per million. All character sample data reported in ppm.
QC	=	Quality control
1	=	Includes tailings above high tide.
2	=	Material in mill area is mixture of waste rock and tailings; samples are from tailings fraction.
3	=	Composite sample.
4	=	Character sample; non-standardized laboratory methods used.
5	=	Duplicate samples.
6	=	Samples consist of mixture of soil and tailings, but are mostly tailings.

Sources: 1995 data from USBLM (1998); 2002 data from URS (2007).

TABLE 2-8
ORGANICS DATA FOR SLUDGE AND UNSATURATED TAILINGS[1] – MILL AREA
Salt Chuck Mine – Tongass National Forest, Alaska

		Media	Sludge	Unsaturated Tailings			
				Mill Area			
		Sample Location	NW Floor of Mill Below Diesel Engines	SW of Mill – Base of Slope at Edge of Intertidal Zone	SW Corner of Mill		SE of Mill Next to Barge
		Sample Number	SO01[2]	SCUT-3	SCUT-4/5[3]		SCUT-6
		Date Collected	9/15/95	7/25/02			
		Units	mg/kg				
Analyte	Method		Analytical Results				
	1995 Sample	2002 Samples					
Petroleum Hydrocarbon Mixtures							
DRO	AK102 EPH	AK 102/103	163,000[4]	247	197	1,500[J]	ND(23.9)
RRO	--	AK 102/103	--	529	465	5,370[J]	ND(27.7) [5]
PAHs							
High Molecular Weight PAHs:							
Benzo(a)anthracene	--	PAH SIM	--	4.05	0.00837	0.00625	1.50
Benzo(a)pyrene	--	PAH SIM	--	2.69	0.0174	0.00124	2.22
Benzo(b)fluoranthene	--	PAH SIM	--	4.87	ND(0.00560)	ND(0.00548)	2.34
Benzo(k)fluoranthene	--	PAH SIM	--	3.13	ND(0.00560)	ND(0.00548)	1.77
Benzo(g,h,i)perylene	--	PAH SIM	--	3.37	0.0195	0.0162	2.07
Chrysene	--	PAH SIM	--	5.68	0.0202	0.0183	2.19
Dibenzo(a,h)anthracene	--	PAH SIM	--	0.0772	ND(0.00560)	ND(0.00548)	ND(0.00587)
Indeno(1,2,3-cd)pyrene	--	PAH SIM	--	3.41	0.0162	0.0139	1.82
Pyrene	--	PAH SIM	--	13.4	0.0189	0.0137	3.17
BaP Equivalent[6,7]	--	--	--	4.04	0.0230	0.00631	2.81
Lower Molecular Weight PAHs:							
Acenaphthene	--	PAH SIM	--	ND(0.0577)	ND(0.00560)	ND(0.00548)	ND(0.00587)
Acenaphthylene	--	PAH SIM	--	0.0657	ND(0.00560)	ND(0.00548)	0.0827
Anthracene	--	PAH SIM	--	0.0589	0.00591	ND(0.00548)	0.0877
Fluoranthene	--	PAH SIM	--	14.8	0.0142	0.00955	2.46
Fluorene	--	PAH SIM	--	ND(0.0577)	ND(0.00560)	ND(0.00548)	ND(0.0587)
Napthalene	--	PAH SIM	--	0.0579	ND(0.00560)	ND(0.00548)	ND(0.0587)
Phenanthrene	--	PAH SIM	--	ND(0.0577)	ND(0.00560)	ND(0.00548)	1.26
PCBs							
Arochlor 1016	--	EPA 8082	--	ND(0.0349)	ND(0.0334)	ND(0.0324)	ND(0.0358)
Arochlor 1221	--	EPA 8082	--	ND(0.0349)	ND(0.0334)	ND(0.0324)	ND(0.0358)
Arochlor 1232	--	EPA 8082	--	ND(0.0349)	ND(0.0334)	ND(0.0324)	ND(0.0358)
Arochlor 1242	--	EPA 8082	--	ND(0.0349)	ND(0.0334)	ND(0.0324)	ND(0.0358)
Arochlor 1248	--	EPA 8082	--	ND(0.0349)	ND(0.0334)	ND(0.0324)	ND(0.0358)
Arochlor 1254	--	EPA 8082	--	0.120	0.375	0.112	ND(0.0358)
Arochlor 1260	--	EPA 8082	--	0.121	0.237	0.112	ND(0.0358)
Total PCBs[7]	--	EPA 8082	--	0.329	0.696	0.305	ND(0.125)

TABLE 2-8 (CONTINUED)
ORGANICS DATA FOR SLUDGE AND UNSATURATED TAILINGS[1] – MILL AREA
Salt Chuck Mine – Tongass National Forest, Alaska

Notes:

--	=	Not analyzed or available
( )	=	Detection limits shown in parentheses
ADEC	=	Alaska Department of Environmental Conservation
BaP	=	Benzo(a)pyrene
DRO	=	Diesel Range Organics
EPA	=	U.S. Environmental Protection Agency
EPH	=	Extractable Petroleum Hydrocarbons
J	=	Data qualified as estimated: results for SCUT-5 biased high due to surrogate recoveries above laboratory QC criteria.
mg/kg	=	Milligrams per kilogram
ND	=	Not detected
NE	=	Not established
PAHs	=	Polynuclear Aromatic Hydrocarbons
PCBs	=	Polychlorinated Biphenyls
QC	=	Quality control
TEF	=	Toxicity Equivalency Factor
1	=	Includes tailings above high tide.
2	=	Composite sample.
3	=	Duplicate samples.
4	=	Chromatograph pattern is consistent with lube oil.
5	=	Data qualified as non-detect due to concentration <5x method blank.
6	=	Sum of seven high molecular weight PAHs times analyte-specific TEFs (ADEC, 2009). TEFs from Schoeny and Poirer (1993): benzo(a)anthracene 0.1, benzo(a)pyrene 1.0, benzo(b)fluoranthene 0.1, benzo(k)fluoranthene 0.01, chrysene 0.001, dibenzo(a,h)anthracene 1.0, and indeno(1,2,3-cd)pyrene 0.1.
7	=	Summation calculated using ½ detection limits for ND results.
Sources:		1995 data from USBLM (1998); 2002 data from URS (2007).

TABLE 2-9
PRELIMINARY REMOVAL ACTION GOALS (PRAGs)
FOR PROTECTION OF HUMAN HEALTH
Salt Chuck Mine – Tongass National Forest, Alaska

Chemical	ADEC Soil Cleanup Levels[a]		
	Direct Contact (mg/kg)	Inhalation (mg/kg)	Migration to Groundwater (mg/kg)
Metals			
Antimony	33	NE	3.6
Arsenic	3.7	NE	3.9
Barium	16,600	NE	1,100
Beryllium	170	NE	42
Cadmium	65	NE	5.0
Chromium, total[b]	250	NE	25
Copper	3,300	NE	460
Iron	NE (55,000)	NE	NE (640)
Lead	400[c]	NE	NE
Mercury	25	13	1.4
Nickel	1,700	NE	86
Selenium	410	NE	3.4
Silver	410	NE	11.2
Thallium	6.6	NE	1.9
Vanadium	580	NE	3,400
Zinc	24,900	NE	4,100
Organics			
DRO	8,250	12,500	230
RRO	8,300	22,000	9,700
PAHs			
Benzo(a)anthracene	4.0	NE	3.6
Benzo(a)pyrene	0.4	NE	2.1
Benzo(b)fluoranthene	4.0	NE	12
Benzo(k)fluoranthene	40	NE	120
Benzo(g,h,i)perylene	1,100	NE	38,700
Chrysene	400	NE	360
Dibenzo(a,h)anthracene	0.4	NE	4.0
Indeno(1,2,3-cd)pyrene	4.0	NE	41
Pyrene	1,100	NE	1,000
BaP Equivalent	0.4	NE	2.1
Acenaphthene	2,300	NE	180
Acenaphthylene	2,300	NE	180
Anthracene	16,800	NE	3,000
Fluoranthene	1,500	NE	1,400
Fluorene	1,900	NE	220
Naphthalene	1,100	21	20
Phenanthrene	16,800	NE	3,000
Total PCBs	1	NE	NE

Notes:
AAC = Alaska Administrative Code
ADEC = Alaska Department of Environmental Conservation
BaP = Benzo(a)pyrene
Cr VI = Chromium as hexavalent chromium
DRO = Diesel range organics
mg/kg = Milligrams per kilogram
NE = Not established

TABLE 2-9 (CONTINUED)
PRELIMINARY REMOVAL ACTION GOALS (PRAGs)
FOR PROTECTION OF HUMAN HEALTH
Salt Chuck Mine – Tongass National Forest, Alaska

	PCBs	=	Polychorinated biphenyls
	RRO	=	Residual range organics
	USEPA	=	United States Environmental Protection Agency
References:	a	=	ADEC 18 AAC 75 (October 9, 2008) Tables B1 and B2 – Method Two Soil Cleanup Levels and Petroleum Cleanup Tables for over 40-inch zone. Where ADEC values not established, numbers in parentheses are USEPA (2009) Regional Screening Levels for residential exposure or protection of groundwater.
	b	=	Industrial processes for development of Cr VI at this site are not suspected.
	c	=	Lead cleanup level for residential land use as listed in ADEC 18 AAC 75 (October 9, 2008) Table B1.

TABLE 2-10
HUMAN HEALTH SRE RESULTS FOR SOIL
Salt Chuck Mine – Tongass National Forest, Alaska

Compound	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Detection Frequency[1]	Range of Detection Limits (mg/kg)[2]	Background Concentration (mg/kg)[3]	PRAG		Detection Frequency Above PRAG[5]	Retained for Further Evaluation?	Rationale[6]
						mg/kg	Source[4]			
Total Metals										
Antimony	0.164	15.4	2/3	1.32	ND (0.384)	3.6 (33)	a	1/3	**Yes**	**>PRAG**
Arsenic	3.83	4.95	2/3	4.40	4.06	3.7 (3.9)	b	2/3	**Yes**	**>BKGD**
Beryllium	ND	ND	0/2	0.118-0.440	0.272	42	a	0/2	No	<PRAG
Cadmium	ND	ND	0/2	0.236-0.880	ND (0.256)	5.0	a	0/3	No	<PRAG
Chromium	8.09	8.09	1/2	4.40	40.0	25 (250)	a	1/3	No	<PRAG
Copper	72.3	7,320	3/3	NA	45.6	460 (3,300)	a	2/3	**Yes**	**>PRAG**
Lead	17.0	6,170	3/3	NA	16.1	400	c	2/3	**Yes**	**>PRAG**
Mercury	0.212	311	3/3	NA	0.0922	1.4(25)	a	2/3	**Yes**	**>PRAG**
Nickel	16.0	16.0	1/2	8.80	11.1	86	a	1/2	No	<PRAG
Selenium	0.25	8.36	2/3	4.40	ND (1.28)	3.4 (410)	a	1/3	**Yes**	**>PRAG**
Silver	0.497	17.8	2/2	NA	0.205	11.2 (410)	a	1/2	**Yes**	**>PRAG**
Thallium	0.0624	0.0624	1/2	0.0880	ND (0.0256)	1.9	a	0/2	No	<PRAG
Vanadium	24.7	237	3/3	NA	460	580	b	0/3	No	<PRAG
Zinc	38.9	290	3/3	NA	30.9	4,100	a	0/3	No	<PRAG
Petroleum Hydrocarbon Mixtures										
DRO/EPH	335	17,400	10/10	NA	NA	230 (8,250)	a	10/10	**Yes**	**>PRAG**
DRO Silica Gel	2,210	4,580	3/4	29.8	NA	230 (8,250)	a	3/4	**Yes**	**>PRAG**
RRO	373	7,400	10/10	NA	NA	8,300	d	0/10	No	<PRAG
RRO Silica Gel	375	1,210	3/4	29.8	NA	8,300	d	0/4	No	<PRAG
TRPH	9,100	9,100	1/1	NA	NA	230 (8,250)	a,e	1/1	**Yes**	**>PRAG**
PAHs										
High Molecular Weight PAHs:										
Benzo(a)anthracene	0.0103	0.0103	1/2	0.0759	NA	3.6	a	0/2	No	<PRAG
Benzo(a)pyrene	0.00844	0.00844	1/2	0.0759	NA	0.4	b	0/2	No	<PRAG
Benzo(b)fluoranthene	ND	ND	0/2	0.00646-0.0759	NA	4.0	b	0/2	No	<PRAG
Benzo(k)fluoranthene	ND	ND	0/2	0.00646-0.0759	NA	40	b	0/2	No	<PRAG
Benzo(g,h,i)perylene	ND	ND	0/2	0.00646-0.0759	NA	1,100	b	0/2	No	<PRAG
Chrysene	0.0256	0.0256	0/2	0.0759	NA	360	a	0/2	No	<PRAG
Dibenzo(a,h)anthracene	ND	ND	0/2	0.00646-0.0759	NA	0.4	b	0/2	No	<PRAG
Indeno(1,2,3-cd)pyrene	ND	ND	0/2	0.00646-0.0759	NA	4.0	b	0/2	No	<PRAG
Pyrene	ND	ND	0/2	0.00646-0.0759	ND	1,000	a	0/2	No	<PRAG
BaP Equivalents	ND	0.0134	1/2	0.0759	ND	0.4	b	0/2	No	<PRAG

TABLE 2-10 (CONTINUED)
HUMAN HEALTH SRE RESULTS FOR SOIL
Salt Chuck Mine – Tongass National Forest, Alaska

Compound	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Detection Frequency[1]	Range of Detection Limits (mg/kg)[2]	Background Concentration (mg/kg)[3]	PRAG		Detection Frequency Above PRAG[5]	Retained for Further Evaluation?	Rationale[6]
						mg/kg	Source[4]			
Low Molecular Weight PAHs:										
Acenaphthene	ND	ND	0/2	0.0646-0.0759	NA	180	a	0/2	No	<PRAG
Acenaphthylene	ND	ND	0/2	0.0646-0.0759	NA	180	a	0/2	No	<PRAG
Anthracene	ND	ND	0/2	0.00646-0.0759	NA	3,000	a	0/2	No	<PRAG
Fluoranthene	ND	ND	0/2	0.00646-0.0759	NA	1,400	a	0/2	No	<PRAG
Fluorene	ND	ND	0/2	0.0646-0.0759	NA	220	a	0/2	No	<PRAG
Naphthalene	ND	ND	0/2	0.00646-0.0759	NA	20	a	0/2	No	<PRAG
Phenanthrene	ND	ND	0/2	0.00646-0.0759	NA	3,000	a	0/2	No	<PRAG

Notes:
1 = One sample point was considered in the frequency of detection analysis for locations where both a normal and duplicate sample were collected.
2 = Provided when the minimum and/or maximum concentration was not detected.
3 = Maximum background soil concentration (EPA 2002).
4 = Most conservative human health value listed in Table 2-9:
a = ADEC (2008a) Method Two soil cleanup level for over 40-inch zone: migration-to-groundwater pathway. (Value for direct contact or inhalation shown in parentheses where migration-to-groundwater value is exceeded. For DRO, the value in parenthesis is for ingestion.)
b = ADEC (2008a) Method Two soil cleanup level for direct contact for over 40-inch zone. For arsenic, the migration-to-groundwater pathway value is listed in parentheses.
c = Cleanup level for residential land use as listed in ADEC 18 AAC 75 (October 9, 2008) Table B1.
d = ADEC (2008a) Method Two soil cleanup level for ingestion ADEC 18 AAC 75 (October 9, 2008) Table B2.
e = No PRAG established for TRPH; PRAG for DRO is listed.
5 = Maximum selected as representative value at duplicate locations.
6 = **>BKGD**=Retained because MDC is greater than background.
>PRAG = Retained because MDC is greater than the PRAG.
<PRAG = Not retained because MDC is less than the PRAG.

ADEC= Alaska Department of Environmental Conservation
BaP = Benzo(a)pyrene
BKGD = Background
CL = Confidence level
DRO = Diesel range organics
EPH = Extractable Petroleum Hydrocarbons
MDC = Maximum detected concentration
mg/kg = Milligrams per kilogram
NA = Not analyzed or not applicable
ND = Not detected
PAHs = Polynuclear aromatic hydrocarbons
PRAG = Preliminary removal action goal
RRO = Residual Range Organics
SRE = Streamlined Risk Evaluation
TRPH = Total Recoverable Petroleum Hydrocarbons

TABLE 2-11
HUMAN HEALTH RISK SRE RESULTS FOR UNSATURATED TAILINGS AND SLUDGE
Salt Chuck Mine – Tongass National Forest, Alaska

Compound	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)		Detection Frequency[1]		Range of Detection Limits (mg/kg)[3]	Background Concentration (mg/kg)[4]	PRAG		Detection Frequency Above PRAG[6]		Retained for Further Evaluation?	Rationale[7]
		All Samples	Non-Character Samples Only[2]	All Samples	Non-Character Samples Only[2]			mg/kg	Source[5]	All Samples	Non-Character Samples Only[2]		
Total Metals													
Antimony	2.51	8.97	5.11	5/5	4/4	NA	ND (0.384)	3.6 (33)	a	3/5	2/4	**Yes**	**>PRAG**
Arsenic	1.89	10.2	10.2	5/5	4/4	NA	4.06	3.7 (3.9)	b	4/5	3/4	**Yes**	**>BKGD**
Beryllium	ND	ND	ND	0/4	0/3	0.107-0.5	0.272	42	a	0/4	0/3	No	**>PRAG**
Cadmium	0.350	1.0	0.976	4/4	3/3	NA	ND (0.256)	5.0	a	0/4	0/3	No	**>PRAG**
Chromium	2.34	21	5.87	4/4	3/3	NA	40.0	25 (250)	a	0/4	0/3	No	**>PRAG**
Copper	9,760	53,400	53,400	5/5	4/4	NA	45.6	460 (3,300)	a	5/5	4/4	**Yes**	**>PRAG**
Iron	95,600	95,600	NA[7]	1/1	NA	NA	NA	640 (55,000)	a	1/1	NA	**Yes**	**>PRAG**
Lead	58.7	351	351	5/5	4/4	NA	16.1	400	c	0/5	0/4	No	<PRAG
Mercury	0.13	20.7	ND	2/5	1/4	4.28-4.69	0.0922	1.4(25)	a	1/5	1/4	**Yes**	**>PRAG**
Nickel	12.0	21	17.1	4/4	3/3	NA	11.1	86	a	0/4	0/3	No	<PRAG
Selenium	8.63	65.4	65.4	5/5	4/4	NA	ND (1.28)	3.4 (410)	a	3/5	3/4	**Yes**	**>PRAG**
Silver	6.18	43	34.1	4/4	3/3	NA	0.205	11.2 (410)	a	2/4	1/3	**Yes**	**>PRAG**
Thallium	ND	ND	ND	0/4	0/3	0.0213-10	ND (0.0256)	1.9	a	0/4	0/3	No	<PRAG
Vanadium	229	401	314	5/5	4/4	NA	460	580	b	0/5	0/4	No	<PRAG
Zinc	82.7	268	268	5/5	4/4	NA	30.9	4,100	a	0/5	0/4	No	<PRAG
Petroleum Hydrocarbon Mixtures[7]													
DRO (unsaturated tailings)	247	1,500		2/3		23.9	NA	230 (8,250)	a	2/3		**Yes**	**>PRAG**
DRO (sludge)	NA	163,000		1/1		NA	NA	230 (8,250)	a	1/1		**Yes**	**>PRAG**
RRO	529	5,370		2/3		27.7	NA	8,300	d	0/3		No	<PRAG
PAHs[7]													
High Molecular Weight PAHs:													
Benzo(a)anthracene	0.00873	4.05		3/3		NA	NA	3.6	a	1/3		**Yes**	**>PRAG**
Benzo(a)pyrene	0.0174	2.69		3/3		NA	NA	0.4	b	2/3		**Yes**	**>PRAG**
Benzo(b)fluoranthene	2.34	4.87		2/3		0.00554	NA	4.0	b	1/3		**Yes**	**>PRAG**
Benzo(k)fluoranthene	1.77	3.13		2/3		0.00554	NA	40	b	0/3		No	<PRAG
Benzo(g,h,i)perylene	0.0195	3.37		3/3		NA	NA	1,100	b	0/3		No	<PRAG
Chrysene	0.0202	5.68		3/3		NA	NA	360	a	0/3		No	<PRAG
Dibenzo(a,h)anthracene	0.0772	0.0772		1/3		0.00554-0.0587	NA	0.4	b	0/3		No	<PRAG
Indeno(1,2,3-cd)pyrene	0.0162	3.41		3/3		NA	NA	4.0	b	0/3		No	<PRAG

TABLE 2-11 (CONTINUED)
HUMAN HEALTH RISK SRE RESULTS FOR UNSATURATED TAILINGS AND SLUDGE
Salt Chuck Mine – Tongass National Forest, Alaska

Compound	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)		Detection Frequency[1]		Range of Detection Limits (mg/kg)[3]	Background Concentration (mg/kg)[4]	PRAG		Detection Frequency Above PRAG[6]		Retained for Further Evaluation?	Rationale[7]
		All Samples	Non-Character Samples Only[2]	All Samples	Non-Character Samples Only[2]			mg/kg	Source[5]	All Samples	Non-Character Samples Only[2]		
Pyrene	0.0189	13.4		3/3		NA	NA	1,000	a	0/3		No	<PRAG
BaP Equivalents[8]	0.0063	4.04		3/3		NA	NA	0.4	b	2/3		**Yes**	**>PRAG**
Low Molecular Weight PAHs:													
Acenaphthene	ND	ND		0/3		0.00554-0.0587	NA	180	a	0/3		No	<PRAG
Acenaphthylene	0.0657	0.0827		2/3		0.00554	NA	180	a	0/3		No	<PRAG
Anthracene	0.00591	0.0877		3/3		NA	NA	3,000	a	0/3		No	<PRAG
Fluoranthene	0.0142	14.8		3/3		NA	NA	1,400	a	0/3		No	<PRAG
Fluorene	ND	ND		0/3		0.00554-0.0587	NA	220	a	0/3		No	<PRAG
Naphthalene	0.0579	0.0579		1/3		0.00554-0.0587	NA	20	a	0/3		No	<PRAG
Phenanthrene	1.26	1.26		1/3		0.00554-0.0577	NA	3,000	a	0/3		No	<PRAG
PCBs:[8]													
Total PCBs[9]	0.329	0.696		2/3		NA	NA	1	b	0/3		No	<PRAG

Notes:
1 = One sample point was considered in the frequency of detection analysis for locations where both a normal and duplicate sample were collected.
2 = Non-standardized laboratory methods used for character samples.
3 = DLs not available for some character sample analytes.
4 = Maximum background soil concentration (EPA 2002).
5 = Most conservative human health value listed in Table 2-9:
a = ADEC (2008a) Method Two soil cleanup level for over 40-inch zone: migration-to-groundwater pathway. (Value for direct contact shown in parentheses where migration-to-groundwater value is exceeded. For DRO, the value in parenthesis is for ingestion.)
b = ADEC (2008a) Method Two soil cleanup level for direct contact for over 40-inch zone. For arsenic, the migration-to-groundwater pathway value is listed in parentheses.
c = Cleanup level for residential land use as listed in ADEC 18 AAC 75 (October 9, 2008) Table B1.
d = ADEC (2008a) Method Two soil cleanup level for ingestion ADEC 18 AAC 75 (October 9, 2008) Table B2.
6 = Maximum selected as representative value at duplicate locations.
7 = The following rationale codes were used:
>BKGD = Retained because MDC is greater than background.
>PRAG = Retained because MDC is greater than the PRAG.
<PRAG = Not retained because MDC is less than the PRAG.
8 = All data are from non-character samples.
9 = Summation includes one-half the detection limit for non-detected Aroclors.

TABLE 2-11
HUMAN HEALTH RISK SRE RESULTS FOR UNSATURATED TAILINGS AND SLUDGE
Salt Chuck Mine – Tongass National Forest, Alaska

Notes: (continued)

ADEC	=	Alaska Department of Environmental Conservation
	=	Benzo(a)pyrene
BKGD	=	Background
CL	=	Confidence level
DRO	=	Diesel range organics
MDC	=	Maximum detected concentration
mg/kg	=	Milligrams per kilogram
NA	=	Not analyzed or not applicable
ND	=	Not detected
PAHs	=	Polynuclear aromatic hydrocarbons
PCBs	=	Polychlorinated Biphenyls
PRAG	=	Preliminary removal action goals
RRO	=	Residual Range Organics
SRE	=	Streamlined Risk Evaluation

BaP

TABLE 3-1
TARGET REMOVAL ACTION OBJECTIVES (RAOs)
Salt Chuck Mine – Tongass National Forest, Alaska

Receptor	Exposure Pathway	COC	Target RAO	Basis	Location Where RAO Exceeded
Surface Soils (mg/kg)					
Future Miner/ Recreational User	Incidental soil ingestion, direct contact	Arsenic	4.1	Site-specific background	**Building C4**[1]: SCSS-2
		Lead	400	ADEC residential value	**Building C4**: SCSS-1 and SCSS-2
		DRO	1,250	ADEC Method Three soil cleanup level[2]	**AST Area:** SCSS 14 through 20, SCSS-22, and SCSS-24
		Mercury	25	ADEC Method Two Soil Cleanup Level	**Building C4**: SCSS-1, SCSS-2
	Migration to groundwater, transport to surface water	Antimony	3.6	ADEC Method Two Soil Cleanup Level	**Building C4**: SCSS-2
		Copper	460	ADEC Method Two Soil Cleanup Level	**Building C4**: SCSS-1, SCSS-2 and SCSS-27
Unsaturated Tailings/Sludge (mg/kg)					
Future Miner/ Recreational User	Incidental soil/tailings ingestion, direct contact	BaP equivalent[3]	0.4	ADEC Method Two - Ingestion	**Mill Tailings:** SCUT-3 and SCUT-6
	Migration to groundwater, transport to surface water	DRO	230	ADEC Method Two Soil Cleanup Level	**Mill Floor/Tailings:** Sludge SO01, SCUT-3, and SCUT-5
		Benzo(a) anthracene	3.6	ADEC Method Two Soil Cleanup Level	**Mill Tailings:** SO03, SCUT-3, SCUT-4/5
		Antimony	3.6	ADEC Method Two Soil Cleanup Level	**Mill Tailings:** SO03, SCUT-3, SCUT-4/5
		Arsenic	4.1	Site-specific background	**Mill Tailings:** SCUT-3 and SCUT-6
		Copper	460	ADEC Method Two Soil Cleanup Level	**Mill Tailings:** SCUT-3, SCUT-4/5, SO03 and SCUT-6
		Mercury	1.4	ADEC Method Two Soil Cleanup Level	**Mill Tailings:** SCSS-27
		Selenium	3.4	ADEC Method Two Soil Cleanup Level	**Mill Tailings:** SCUT-3, SCUT-4/5, and SCUT-6
		Silver	11.2	ADEC Method Two Soil Cleanup Level	**Mill Tailings:** SO03 and SCUT-3

Notes:

1 = Although As concentrations also slightly exceed background at SCSS-26, this location not targeted for removal given slight exceedance likely within range of data variability; ratio of site concentration to background is 1.1 at this location.

2 = Calculated for residential scenario, and modified by reduction of DAF parameter by factor of 13 (Section 2.5.2.2 and Appendix G).

3 = Includes high molecular weight PAHs (benzo(a)anthracene and benzo(b)fluoranthene) that had maximum site concentrations greater than direct contact RAOs. Therefore, separate target RAOs were not identified for these individual PAHs.

TABLE 3-1 (CONTINUED)
TARGET REMOVAL ACTION OBJECTIVES (RAOs)
Salt Chuck Mine – Tongass National Forest, Alaska

Notes (continued):

ADEC	=	Alaska Department of Environmental Conservation
As	=	Arsenic
AST	=	Aboveground storage tank
BaP	=	Benzo(a)pyrene
COC	=	Chemical of concern
DAF	=	Dilution attentuation factor
DRO	=	Diesel range organics
mg/kg	=	Milligrams per kilogram
RAO	=	Removal action objective

TABLE 3-2
POTENTIAL FEDERAL AND STATE ARARS AND GUIDANCE TO BE CONSIDERED
Salt Chuck Mine – Tongass National Forest, Alaska

Citation	Description	Potential ARAR	To Be Considered	Rationale
Chemical-Specific				
Alaska Solid Waste Regulations (18 AAC 60)	Regulations set forth standards for waste disposal facilities, including accumulation and storage limitations, land spreading restrictions, and requirements for special waste disposal. Permitting standards as well as monitoring and reporting requirements are also set forth in these regulations.	X		Solid waste regulations are applicable to the storage and disposal of solid waste such as soils and tailings materials.
Alaska Hazardous Waste Regulations (18 AAC 62 and 63)	Defines solid wastes that are hazardous waste; establishes standards for generators, transporters, and disposal facilities. Alaska Hazardous Waste Management Regulations include the federal RCRA Subtitle C requirements with additional criteria and standards promulgated by the State of Alaska.	X		Hazardous waste regulations may be applicable to the management and disposal of wastes at the site and wastes generated during the project.
Alaska Water Quality Standards (18 AAC 70)	Water quality standards identify desired uses for water in the State and establish in-stream criteria for inorganic constituents which are deemed necessary for the protection of the designated uses of that water body.	X		Water quality standards are applicable to discharges to surface water present onsite that could occur during the removal action.
Alaska Oil and Other Hazardous Substance Pollution Control Regulations (18 AAC 75)	These regulations govern discharge of oil and hazardous substances, and related cleanup requirements. They also provide standards and guidance for site characterization, soil and groundwater cleanup levels, risk assessment, and the classification of groundwater as drinking water.	X		Soil and groundwater cleanup levels in these regulations are applicable to onsite media.
Alaska Drinking Water Standards (18 AAC 80)	Establishes drinking water standards for the state of Alaska.	X		All groundwater is considered drinking water unless specifically classified otherwise under 18 AAC 75.345.

TABLE 3-2 (CONTINUED)
POTENTIAL FEDERAL AND STATE ARARS AND GUIDANCE TO BE CONSIDERED
Salt Chuck Mine – Tongass National Forest, Alaska

Citation	Description	Potential ARAR	To Be Considered	Rationale
National Primary Drinking Water Standards (40 CFR Part 141)	Establishes standards for public water systems and specifies maximum contaminants levels (MCLs), also known as drinking water standards.	X		MCLs are valid because all groundwater in the state of Alaska is considered potential drinking water until proven otherwise. NCP regulations require that MCLs typically be ARARs for groundwater.
Resource Conservation and Recovery Act (40 CFR Part 261)	The Federal regulations in 40 CFR Part 261 address the requirements for identification of hazardous wastes, which is critical during any remediation activity that may result in generation of hazardous wastes.	X		Onsite tailings materials may contain constituent concentrations exhibiting hazardous characteristics under RCRA. Soils at Building C4 do not exceed RCRA toxicity characteristics for disposal purposes.
Land Disposal Restrictions (40 CFR Part 268)	Requires treatment standards for certain wastes generated during remedial actions.	X		Not applicable to mine waste and tailings currently onsite (see Action-Specific ARARs below). Standards are potentially applicable to any treatment residuals.
Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. OSWER Directive No. 9355.4-12 July 14, 1994	Describes methodology for developing site-specific preliminary remediation goals and media-specific cleanup standards for lead.		X	Potentially applicable, soils and tailings at the site contain elevated lead concentrations.
EPA Strategy for Reducing Lead Exposures EPA, February 21, 1991	Presents a strategy to reduce lead exposure, particularly for young children and reduce the amount of lead introduced into the environment.		X	Potentially applicable, soils and tailings at the site contain elevated lead concentrations and recreational use of the site has been reported.
ADEC Risk Assessment Procedures Manual, Draft, February 2009	Provides risk assessment guidance for use in preparing human health and ecological risk assessments under 18 AAC 75.		X	Human receptors could be in contact with site media as detailed in Human Health SRE. Ecological risks deferred to site-wide RI/FS to be conducted after NPL listing.
ADEC Guidance Document on Determining Background Concentrations in Soil, June 13, 2003	Provides guidance on the use of background concentrations at sites		X	In some cases, site-specific background concentrations (e.g., arsenic, DRO) are above ADEC cleanup levels.

TABLE 3-2 (CONTINUED)
POTENTIAL FEDERAL AND STATE ARARS AND GUIDANCE TO BE CONSIDERED
Salt Chuck Mine – Tongass National Forest, Alaska

Citation	Description	Potential ARAR	To Be Considered	Rationale
Location-Specific				
Alaska Coastal Management Regulations (6 AAC 80 and 85)	Provides for the regulated use of coastal areas and their resources.	X		These regulations are applicable if site activities such as barge landings affect the coastal environment. This regulation is most likely not appropriate to the potential actions.
Alaska Department of Fish and Game Requirements (Title 16.05.870 Anadromous Fish Stream Permit)	Permit required for actions in or affecting anadromous fish streams; including tidelands to mean low water at the mouth (MLW).	X		Actions are adjoining designated anadromous fish stream, Lake Ellen Creek.
Protection of Wetlands (Executive Order No. 11990, 40 CFR Part 6)	Mandates that federal agencies avoid, to the extent possible, adverse impacts associated with the destruction or modification of wetlands. The order also provides that activities avoid construction in wetlands if a practicable alternative exists.	X		Inventoried wetlands may exist within site boundaries.
Alaska Hazardous Waste Management Facilities Siting Regulations (18 AAC 63)	Restricts placement of hazardous waste management facilities in floodplains and other sensitive areas.	X		These regulations may be applicable to alternatives incorporating the storage of tailings and/or soils onsite.
National Historic Preservation Act (32 CFR Part 229, 40 CFR § 6.301(b), 36 CFR Part 800)	Establishes a requirement for federal agencies to take into account the effect of any federally-assisted undertaking or licensing on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historical Places.	X		Applicable based on results of site archeological survey conducted in 2002. Archeological report (Bruder, 2002) indicates Salt Chuck Mine site is eligible for inclusion in the National Register.
Preservation of Historical and Archeological Data (40 CFR § 6.301(c))	Establishes procedures to provide for preservation of historical and archeological data which might be destroyed through alterations of terrain as a result of a federal construction project or a federally licensed activity or program.	X		Applicable to actions affecting potential archaeological data.

TABLE 3-2 (CONTINUED)
POTENTIAL FEDERAL AND STATE ARARS AND GUIDANCE TO BE CONSIDERED
Salt Chuck Mine – Tongass National Forest, Alaska

Citation	Description	Potential ARAR	To Be Considered	Rationale
Endangered Species Act (16 USC 1531-1544 et seq. 16 USC 4201-4245, 50 CFR Parts, 17, 222, 227, and 402) AS 16/ 5 AAC 95	Provides for protection and conservation of various species of fish, wildlife, and plants. Establishes requirements for actions to conserve endangered species within critical habitats upon which endangered species depend.	X		Endangered species were not observed at the site during the 2006 site investigation; however, certain requirements may be appropriate, such as timing of removal actions to avoid impacts to wildlife.
Bald Eagle Protection Act (16 USC 668 et seq.)	Establishes a federal responsibility for protection of bald and golden eagles.	X		Upland areas of the site may be potential bald eagle habitat.
The General Mining Law of 1872, as amended (30 USC 29 and 43 CFR 3860)	Governs U.S.BLM issuances of mining claims and deeds on Federally managed lands and related land use restrictions.	X		Unpatented claims at proposed repository sites may require Forest Service withdrawal of area from mineral entry.
Management of Federal Lands (13 USC § 1700)	Establishes requirements concerning utilization of public lands, particularly rights-of-way regulation, land use planning and land acquisition and appropriation of waters on public lands.	X		May be relevant depending on land types and features present at the site.
Action-Specific				
Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR Part 257)	Establishes Federal criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health or the environment, and thereby prohibits open dumps.	X		Regulations apply to solid waste present at the site.
Identification and Listing of Hazardous Waste (40 CFR Part 261) (18 AAC 62)	Defines solid wastes that are subject to regulation as hazardous waste.	X		Not applicable to mine waste and tailings currently onsite. Mining waste disposed prior to 1989 are excluded from regulation as hazardous waste (Bevill Amendment). It is only the active management of mine waste which falls out of current exclusion, that is potentially regulated as hazardous waste. Standards are potentially applicable to any treatment residuals. Potentially applicable to battery removal.

TABLE 3-2 (CONTINUED)
POTENTIAL FEDERAL AND STATE ARARS AND GUIDANCE TO BE CONSIDERED
Salt Chuck Mine – Tongass National Forest, Alaska

Citation	Description	Potential ARAR	To Be Considered	Rationale
Standards Applicable to Generators of Hazardous Waste (40 CFR Part 262) (18 AAC 62)	Establishes standards for Generators of Hazardous Waste	X		Not applicable to mine waste and tailings currently onsite. Mining waste disposed prior to 1989 are excluded from regulation as hazardous waste (Bevill Amendment). The tailings at the site were the beneficiation product of a mining practice, and therefore potentially applicable for exclusion under the Bevill Amendment regulations. Potentially applicable to battery removal.
Hazardous Materials Transportation Act (49 CFR Parts 107, 171-180, 383, 391-397)	Provides adequate protection against the risks to life and property inherent in the transportation of hazardous material in commerce.	X		Limited quantities of defined hazardous materials may be generated (e.g. batteries).
Land Disposal Restrictions Program (40 CFR Part 268)	Sets treatment standards for hazardous wastes based on the levels achievable by current technology; sets two-year national variances from the statutory effective dates due to insufficient treatment capacity.	X		Not applicable to mine waste and tailings currently onsite. Mining waste disposed prior to 1989 are excluded from regulation as hazardous waste (Bevill Amendment). The tailings at the site were the beneficiation product of a mining practice, and therefore potentially applicable for exclusion under the Bevill Amendment regulation.
Alaska Solid Waste Regulations (18 AAC 60)	Criteria and permitting requirements for landfills; define solid waste disposal requirements.	X		Solid waste generated during the removal needs to be managed in accordance with these regulations.
Clean Water Act (33 USC 1251 et seq. Section 404, 33 CFR Part 323, 40 CFR Part 230, 33 USC 1341, Sect. 401, 33 CFR Parts 320-330) (AS 46.03/ 18 AAC 15, 18 AAC 70, 18 AAC 72)	Prohibits discharge of dredged or fill material into wetlands without a permit. Requires Jurisdictional Determination for wetlands for proposed material stockpile locations. Obtain certification for any discharge into a waterway that may be considered a pollutant.	X		The CWA regulations that most likely apply are control of discharges of fill material into surface waters (including wetlands), and storm water management requirements.
Clean Water Act: NPDES Requirements (40 CFR Parts 122 – 125)	Establishes a program for controlling stormwater discharges from inactive mine sites.	X		Applicable to the inactive mine site, although permitting not required to execute removal actions.

TABLE 3-2 (CONTINUED)
POTENTIAL FEDERAL AND STATE ARARS AND GUIDANCE TO BE CONSIDERED
Salt Chuck Mine – Tongass National Forest, Alaska

Citation	Description	Potential ARAR	To Be Considered	Rationale
Alaska Pollutant Discharge Elimination System (APDES) Program (18 AAC 83)	Establishes a program for controlling stormwater discharges from inactive mine sites. State primacy for inactive mine sites to take effect October 31, 2010.		X	Applicable to the inactive mine site, although permitting not required to execute removal actions.
Comprehensive Environmental Response, Compensation, and Liability Act ("Offsite Rule") (Section 121(d)(3))	Requires that CERCLA wastes may only be placed in a facility operating in compliance with RCRA or other applicable Federal or State requirements.	X		Two alternatives considered include offsite disposal of waste.
Invasive Species (Executive Order 13112)	Prevents the introduction of invasive species and provides for their control and minimizes the economic, ecological, and human health impacts that invasive species cause.		X	A potential exists for the introduction of non-native invasive species.

TABLE 4-1
REMOVAL ALTERNATIVES SUMMARY
Salt Chuck Mine – Tongass National Forest, Alaska

Alternative Number	Alternative Name	Process Options Included
--	No Action	No removal action No institutional controls
0	Institutional Controls and Debris Removal (with Capping In-Place)	Land use restrictions (access, Land Status Records, mineral entry) Signage Installed Erosion control with water filtration Tree removal for staging area Mill site wood and metal debris removed Scrap metal recycled off-site Locomotive batteries removed Clean fill import Site restoration including seeding Site O&M for 30 years (inspection/maintenance, reporting)
1	Excavation, Consolidation in Mill Site Repository, and Capping	Land use restrictions (access, Land Status Records, mineral entry) Signage Installed Physical access restrictions to mill site repository Erosion control with water filtration Tree removal for staging area Mill site wood and metal debris removed Scrap metal recycled off-site Staging area for temporary stockpile(s) Excavation and grading of uplands tailings and soil Hand excavation at the mill site around items on foundations On-site transportation to repository Construct mill site repository Consolidation of materials on the site Confirmatory sampling Locomotive batteries removed Clean fill import Cap mill site with growth medium Site restoration including seeding Site O&M for 30 years (inspection/maintenance, reporting)
2	Excavation, Consolidation in Borrow Pit Repository, and Capping	Land use restrictions (access, Land Status Records, mineral entry) Signage Installed Physical access restrictions to borrow pit repository Erosion control with water filtration Tree removal for staging area Mill site wood and metal debris removed Scrap metal recycled off-site Staging area for temporary stockpile(s) Excavation and grading of uplands tailings and soil Hand excavation at the mill site around items on foundations Barge and truck transportation to repository via Thorne Bay Construct borrow pit repository Consolidation of materials at borrow pit location Confirmatory sampling Locomotive batteries removed Clean fill import Site restoration including seeding Site O&M for 30 years (inspection/maintenance, reporting)

TABLE 4-1 (CONTINUED)
REMOVAL ALTERNATIVES SUMMARY
Salt Chuck Mine – Tongass National Forest, Alaska

Alternative Number	Alternative Name	Process Options Included
3	Excavation and Off-Island Disposal	Erosion control with water filtration Tree removal for staging area Mill site wood and metal debris removed Scrap metal recycled off-site Staging area for temporary stockpile(s) Excavation and grading of uplands tailings and soil Hand excavation at the mill site Off-Island transportation via barge through Ketchikan Off-Island disposal Confirmatory and profile sampling Locomotive batteries removed Clean fill import Site restoration including seeding Site O&M for 30 years (inspection/maintenance, reporting)
4	Excavation, Consolidation in Borrow Pit Repository, and Capping utilizing Haul Road	Land use restrictions (access, Land Status Records, mineral entry) Signage Installed Tree removal for access road Reopen existing borrow pit for road materials Access road with security gate constructed Physical access restrictions to borrow pit repository & access road Erosion control with water filtration Tree removal for staging area Mill site wood and metal debris removed Scrap metal recycled off-site Staging area for temporary stockpile(s) Excavation and grading of uplands tailings and soil Hand excavation at the mill site around items on foundations Off-road truck transportation to repository via access road Construct borrow pit repository Consolidation of materials at borrow pit location Confirmatory sampling Locomotive batteries removed Clean fill import Site restoration including seeding Site O&M for 30 years (inspection/maintenance, reporting)
5	Excavation and Off-Island Disposal utilizing Haul Road	Tree removal for access road Reopen existing borrow pit for road materials Access road with security gate constructed Erosion control with water filtration Tree removal for staging area Mill site wood and metal debris removed Scrap metal recycled off-site Staging area for temporary stockpile(s) Excavation and grading of uplands tailings and soil Hand excavation at the mill site around items on foundations Off-Island transportation via access road and barge from Thorne Bay Off-Island disposal Confirmatory and profile sampling Locomotive batteries removed Clean fill import Site restoration including seeding Site O&M for 30 years (inspection/maintenance, reporting)

TABLE 4-2
COMPARISON OF ALTERNATIVE TASKS
Salt Chuck Mine - Tongass National Forest, Alaska

Conceptual Tasks	Common to all Alternatives	Differences from other Alternatives						Comments
		Alternative '0': Institutional Controls and Debris Removal	Alternative 1: Excavation, Consolidation in Mill Site Repository, and Capping	Alternative 2: Excavation, Consolidation in Borrow Pit Repository, and Capping	Alternative 3: Excavation and Off-Island Disposal	Alternative 4: Excavation, Consolidation in Borrow Pit Repository, and Capping utilizing Haul Road	Alternative 5: Excavation and Off-Island Disposal utilizing Haul Road	
Tree Removal	**YES**	--	--	--	--	--	--	
Create Staging / Laydown Area	**YES**	--	--	--	--	--	--	
Access Road Construction	NO	NO	NO	NO	NO	**YES**	**YES**	Site accessed by barge for Alt 0 - 3
Borrow Pit Operated	NO	NO	NO	NO	NO	**YES**	**YES**	Existing borrow pit re-opened
Mill Site Debris Removal	**YES**	--	--	--	--	--	--	
Excavation of Contaminated Materials	NO	NO	**YES**	**YES**	**YES**	**YES**	**YES**	Same volume for Alt 1, 2, & 3
Confirmation Sampling	NO	NO	**YES**	**YES**	**YES**	**YES**	**YES**	No sampling for Alt 0
Waste Profile Sampling	NO	NO	NO	NO	**YES**	NO	**YES**	
Create Repository for Contaminated Materials	NO	NO	**YES**	**YES**	NO	**YES**	NO	
Off-Site Disposal of Contaminated Materials	NO	NO	NO	NO	**YES**	NO	**YES**	
Drainage Rock Import	**YES**	--	--	--	--	--	--	Waste rock will not be used
Top Soil / Growth Media Import	**YES**	--	--	--	--	--	--	
Site Restoration (seeding)	**YES**	--	--	--	--	--	--	
Site Inspection and O&M Needed	**YES**	--	--	--	--	--	--	Primarily site cover inspections
Land Use Restrictions	NO	**YES**	**YES**	**YES**	NO	**YES**	NO	

"--" - Task is common to all alternatives

NO - Task does not apply to all alternatives or for the alternative indicated

YES - Task applies to either all alternatives or for the alternative indicated

TABLE 4-3
COMPARISON OF ALTERNATIVE DETAILS
Salt Chuck Mine - Tongass National Forest, Alaska

Site Work Details	Quantity is Common to all Alternatives	Quantity for all Alternatives	Quantities						Comments
			Alternative '0': Institutional Controls and Debris Removal	Alternative 1: Excavation, Consolidation in Mill Site Repository, and Capping	Alternative 2: Excavation, Consolidation in Borrow Pit Repository, and Capping	Alternative 3: Excavation and Off-Island Disposal	Alternative 4: Excavation, Consolidation in Borrow Pit Repository, and Capping utilizing Haul Road	Alternative 5: Excavation and Off-Island Disposal utilizing Haul Road	
Access Road length (FT)	NO	NA	NA	NA	NA	NA	**3,500**	**3,500**	General area with metal scrap
Trees to be Removed (EA)	NO	NA	**220**	**460**	**460**	**420**	**2,260**	**2,220**	Trees in work areas & road alignment
Debris Removal Area (SF)	**YES**	**90,000**	--	--	--	--	--	--	General area with metal scrap
Mill Site Tailings Area (SF)	NO	NA	NA	**27,600**	**27,600**	**27,600**	**27,600**	**27,600**	Approximate limits of Mill Site Tailings
AST / Drum Cache Removal Area (SF)	NO	NA	NA	**8,000**	**8,000**	**8,000**	**8,000**	**8,000**	
Building C4 Removal Area (SF)	NO	NA	NA	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	
Staging / Laydown Areas (SF)	NO	NA	**12,500**	**17,500**	**17,500**	**17,500**	**17,500**	**17,500**	Estimated area used for staging
Repository Area (SF)	NO	NA	NA	**10,000**	**10,000**	**NA**	**10,000**	**NA**	Footprint of Repository Sites
Site Restoration Area (SY)	NO	NA	**5,900**	**8,170**	**10,000**	**8,170**	**10,000**	**8,170**	Area planned for seeding
Active Work Area (Acre)	NO	NA	**1.2**	**1.7**	**2.2**	**1.7**	**4.6**	**4.1**	
Road Materials Needed (TN)	NO	NA	NA	NA	NA	NA	**9,000**	**9,000**	Generated at borrow site
Total Metal Debris (TN)	**YES**	**170**	--	--	--	--	--	--	
Metal - Scrap for Recycling (TN)	**YES**	**50**	--	--	--	--	--	--	Recycled off-island
Metal - Artifacts to Salvage (TN)	**YES**	**30**	--	--	--	--	--	--	Remains on site
Metal - Remains in Place (TN)	**YES**	**90**	--	--	--	--	--	--	Remains in place
Wood Debris Volume (cy)	**YES**	**219**	--	--	--	--	--	--	Does not include cleared trees
POL / C4 Excavation (cy)	NO	NA	NA	**900**	**900**	**900**	**900**	**900**	
Tailings Excavation (cy)	NO	NA	NA	**3,100**	**3,100**	**3,100**	**3,100**	**3,100**	
Contaminated Material Volume (cy)	NO	NA	NA	**4,000**	**4,000**	**4,000**	**4,000**	**4,000**	Combined volume of waste materials
Drain Rock Needed (cy)	NO	NA	**500**	**1,530**	**1,600**	**930**	**1,600**	**930**	Waste rock will not be used
Top Soil / Growth Media Import (cy)	NO	NA	**1,000**	**1,600**	**2,375**	**1,360**	**2,375**	**1,360**	Cover Soil

"--" - Quantity is common to all alternatives
cy - Cubic Yards
EA - Each
FT - Feet
NA - Not Applicable
SF - Square Feet
SY - Square Yards
TN - Tons

TABLE 5-1
SUMMARY EVALUATION OF REMOVAL ALTERNATIVES FOR EFFECTIVENESS, IMPLEMENTABILITY, AND COST
Salt Chuck Mine – Tongass National Forest, Alaska

Evaluation Criterion	No Action Alternative	Alternative 0 Institutional Controls and Debris Removal (with Capping in-Place)	Alternative 1 Excavation, Consolidation in Mill Site Repository, and Capping	Alternative 2 Excavation, Consolidation in Borrow Pit Repository, and Capping	Alternative 3 Excavation and Off-Island Disposal	Alternative 4 Excavation, Consolidation in Borrow Pit Repository, and Capping Utilizing Haul Road	Alternative 5 Excavation and Off-Island Disposal Utilizing Haul Road
EFFECTIVENESS							
Protection of human health and the environment	Not protective of human or ecological receptors.	Limited protection of human health. Removes physical hazards and some exposure pathways. Not protective of ecological receptors.	Protective; eliminates exposure pathways and physical hazards.	Protective; eliminates exposure pathways and physical hazards.	Protective; eliminates exposure pathways and physical hazards.	Protective; eliminates exposure pathways and physical hazards.	Protective; eliminates exposure pathways and physical hazards.
Short-term effectiveness; protection of public health and workers during implementation	Not applicable.	Short-term impacts may include exposure to tailings and other impacted materials during debris removal. OSHA standards would be followed. Sediment resuspension issues and potential impacts to the marine environment may be substantial.	Short-term impacts may include dust-generated during area grading operations, excavation, transfer of materials, and cap construction. Potential risks could be managed with appropriate dust control and erosion control measures. OSHA standards would be followed. Sediment resuspension issues and potential impacts to the marine environment may be substantial.	Short-term impacts may include dust-generated during area grading operations, excavation, transfer of materials, and cap construction. Also risk for release during material transport. Potential risks could be managed with appropriate dust control and erosion control measures. OSHA standards would be followed. Sediment resuspension issues and potential impacts to the marine environment may be substantial.	Short-term impacts may include dust-generated during excavation and potential for release of materials during transport. Potential risks could be managed with appropriate dust control and erosion control measures. OSHA standards would be followed. Sediment resuspension issues and potential impacts to the marine environment may be substantial.	Short-term impacts may include dust-generated during area grading operations, excavation, transfer of materials, and cap construction. Also risk for release during material transport. Potential risks could be managed with appropriate dust control and erosion control measures. OSHA standards would be followed.	Short-term impacts may include dust-generated during excavation and potential for release of materials during transport. Potential risks could be managed with appropriate dust control and erosion control measures. OSHA standards would be followed.
Long-term effectiveness and permanence	Not effective and permanent; short- and long-term risks remain onsite.	Somewhat effective and permanent of human receptors. Not effective and permanent for ecological receptors. Limited by lifespan of cap.	Effective and permanent for human receptors, isolates impacted materials with cap. Depending on condition of the cap, this may not be permanent for terrestrial receptors in the case of burrowing animals. Limited by lifespan of cap.	Effective and permanent for human receptors, isolates impacted materials with cap. Depending on condition of the cap, this may not be permanent for terrestrial receptors in the case of burrowing animals. There is also an increased potential for vandalism because the repository is more accessible to the public. Limited by lifespan of cap.	Effective and permanent; impacted materials disposed of offsite in a permitted managed facility.	Effective and permanent for human receptors, isolates impacted materials with cap. Depending on condition of the cap, this may not be permanent for terrestrial receptors in the case of burrowing animals. There is also an increased potential for vandalism because the repository is more accessible to the public. Limited by lifespan of cap.	Effective and permanent; impacted materials disposed of offsite in a permitted managed facility.
Reduction of toxicity, mobility, or volume through treatment	No reduction of toxicity, mobility, or volume would be achieved.	No reduction in toxicity, mobility or volume would be achieved.	No reduction in toxicity or volume onsite. Reduction in mobility by physical isolation of materials and COCs by means of a cap.	No reduction in toxicity or volume onsite. Reduction in mobility by physical isolation of materials and COCs by means of a cap.	Reduction in constituent mobility and volume onsite through proper management at off-island disposal facility; no change in volume or toxicity of original material.	No reduction in toxicity or volume onsite. Reduction in mobility by physical isolation of materials and COCs by means of a cap.	Reduction in constituent mobility and volume onsite through proper management at off-island disposal facility; no change in volume or toxicity of original material.
Level or degree of treatment	No treatment provided.	No treatment provided.	No treatment provided.	No treatment provided.	No treatment provided.	No treatment provided.	No treatment provided.
Timeliness with which alternative can mitigate threats	Not applicable.	Estimated to be one construction season.	Estimated to be one construction season.	Estimated to be one construction season.	Estimated to be one construction season.	Estimated to be one construction season.	Estimated to be one construction season.
Ability to comply with ARARs	Would not comply with potential ARARs.	Would not comply with potential ARARs.	Would comply with potential ARARs.	Would comply with potential ARARs.	Would comply with potential ARARs..	Would comply with potential ARARs.	Would comply with potential ARARs..

TABLE 5-1
SUMMARY EVALUATION OF REMOVAL ALTERNATIVES FOR EFFECTIVENESS, IMPLEMENTABILITY, AND COST
Salt Chuck Mine – Tongass National Forest, Alaska

Evaluation Criterion	No Action Alternative	Alternative 0 Institutional Controls and Debris Removal (with Capping in-Place)	Alternative 1 Excavation, Consolidation in Mill Site Repository, and Capping	Alternative 2 Excavation, Consolidation in Borrow Pit Repository, and Capping	Alternative 3 Excavation and Off-Island Disposal	Alternative 4 Excavation, Consolidation in Borrow Pit Repository, and Capping Utilizing Haul Road	Alternative 5 Excavation and Off-Island Disposal Utilizing Haul Road
TECHNICAL IMPLEMENTABILITY							
Constructability	There are no construction aspects to this alternative.	All prescribed actions would be readily constructable. Barge access issues will complicate transport of equipment and supplies.	All prescribed actions would be readily constructable. Barge access issues will complicate transport of equipment and supplies. Need to verify potential mill site repository sites are suitable.	All prescribed actions would be readily constructable. Barge access issues will complicate transport of equipment and supplies. Need to verify potential borrow pit repository sites are suitable. Material export may only be possible at extreme high tides.	All prescribed actions would be readily constructable. Barge access issues will complicate transport of equipment and supplies. Material export may only be possible at extreme high tides.	All prescribed actions would be readily constructable. Need to verify potential borrow pit repository sites are suitable. Field survey for road needed to confirm alignment.	All prescribed actions would be readily constructable. Material export may only be possible at extreme high tides. Field survey for road needed to confirm alignment.
O&M considerations	There are no O&M considerations associated with this alternative.	Routine inspections of signage and earthen cap readily implementable.	Routine inspections of cap and site restoration work readily implementable. Difficult to inspect liner under cap. Leachate collection system O&M may be problematic.	Routine inspections of cap and site restoration work readily implementable. Difficult to inspect liner under cap. Leachate collection system O&M may be problematic.	Only routine inspection of site restoration component would be necessary.	Routine inspections of cap and site restoration work readily implementable. Difficult to inspect liner under cap. Leachate collection system O&M may be problematic. Maintenance, if needed would be substantially easier with road access.	Only routine inspection of site restoration component would be necessary. Maintenance, if needed would be substantially easier with road access.
Demonstrated performance/useful life	Not applicable.	ICs and debris removal will not protect ecological receptors.	Useful life of access controls and cap indefinite with proper routine inspection and maintenance.	Useful life of access controls and cap indefinite with proper routine inspection and maintenance.	Material permanently removed from site. Useful life of off-island disposal facility indefinite with proper management of disposal facility.	Useful life of access controls and cap indefinite with proper routine inspection and maintenance.	Material permanently removed from site. Useful life of off-island disposal facility indefinite with proper management of disposal facility.
Adaptability to environmental conditions	Not applicable.	Readily adaptable. Enhanced erosion and sediment control needed for wet climate. Concerns working around tide schedule.	Enhanced erosion and sediment control needed for wet climate. Concerns working around tide schedule.	Enhanced erosion and sediment control needed for wet climate. Concerns working around tide schedule.	Enhanced erosion and sediment control needed for wet climate. Concerns working around tide schedule.	Readily adaptable. Enhanced erosion and sediment control needed for wet climate.	Readily adaptable. Enhanced erosion and sediment control needed for wet climate.
Reliability	Not applicable.	Debris removal is reliable at removing physical hazards. Earthen cap associated with site restoration has limited reliability. Barge access to perform the work is questionable.	Capping is a proven and reliable technology. Barge access to perform the work is questionable.	Capping is a proven and reliable technology. Barge access to perform the work is questionable.	Off-island removal and disposal are reliable. Barge access to perform the work is questionable.	Capping is a proven and reliable technology. Construction of an access road is also reliable.	Off-island removal and disposal are reliable. Construction of an access road is also reliable.
Availability of equipment, technologies, personnel, and services	Not applicable.	Readily available.	Readily available.	Readily available.	Readily available.	Readily available.	Readily available.
Outside laboratory testing capacity	Not applicable.	Not applicable.	Requires laboratory confirmatory testing for metals and organics; laboratory capacity readily available.	Requires laboratory confirmatory testing for metals and organics; laboratory capacity readily available.	Requires laboratory confirmatory and profile testing for metals and organics; laboratory capacity readily available.	Requires laboratory confirmatory testing for metals and organics; laboratory capacity readily available.	Requires laboratory confirmatory and profile testing for metals and organics; laboratory capacity readily available.
Off-site treatment and disposal capacity	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Permitted disposal facilities are located in Oregon and Washington.	Not applicable.	Permitted disposal facilities are located in Oregon and Washington.

TABLE 5-1
SUMMARY EVALUATION OF REMOVAL ALTERNATIVES FOR EFFECTIVENESS, IMPLEMENTABILITY, AND COST
Salt Chuck Mine – Tongass National Forest, Alaska

Evaluation Criterion	No Action Alternative	Alternative 0 Institutional Controls and Debris Removal (with Capping in-Place)	Alternative 1 Excavation, Consolidation in Mill Site Repository, and Capping	Alternative 2 Excavation, Consolidation in Borrow Pit Repository, and Capping	Alternative 3 Excavation and Off-Island Disposal	Alternative 4 Excavation, Consolidation in Borrow Pit Repository, and Capping Utilizing Haul Road	Alternative 5 Excavation and Off-Island Disposal Utilizing Haul Road
Availability of necessary post-removal site control	Not applicable.	Requires land use restrictions and use agreements (e.g., limiting site access or use of on site resources, inclusion of the site in Forest Service Land Status Records, or withdrawal of specific locations from mineral entry) for protection of materials left onsite and routine site inspections, and to reduce likelihood of exposures.	Requires land use restrictions and use agreements (e.g., limiting site access or use of on site resources, inclusion of the site in Forest Service Land Status Records, or withdrawal of specific locations from mineral entry) for protection of materials left onsite and routine site inspections, and to reduce likelihood of exposures.	Requires land use restrictions and use agreements (e.g., limiting site access or use of on site resources, inclusion of the site in Forest Service Land Status Records, or withdrawal of specific locations from mineral entry) for protection of materials left onsite and routine site inspections, and to reduce likelihood of exposures.	Requires post-removal inspections for site restoration components.	Requires land use restrictions and use agreements (e.g., limiting site access or use of on site resources, inclusion of the site in Forest Service Land Status Records, or withdrawal of specific locations from mineral entry) for protection of materials left onsite and routine site inspections, and to reduce likelihood of exposures. Easier to inspect site with road access.	Requires post-removal inspections for site restoration components. Easier to inspect site with road access.

TABLE 5-1
SUMMARY EVALUATION OF REMOVAL ALTERNATIVES FOR EFFECTIVENESS, IMPLEMENTABILITY, AND COST
Salt Chuck Mine – Tongass National Forest, Alaska

Evaluation Criterion	No Action Alternative	Alternative 0 Institutional Controls and Debris Removal (with Capping in-Place)	Alternative 1 Excavation, Consolidation in Mill Site Repository, and Capping	Alternative 2 Excavation, Consolidation in Borrow Pit Repository, and Capping	Alternative 3 Excavation and Off-Island Disposal	Alternative 4 Excavation, Consolidation in Borrow Pit Repository, and Capping Utilizing Haul Road	Alternative 5 Excavation and Off-Island Disposal Utilizing Haul Road
ADMINISTRATIVE IMPLEMENTABILITY							
Permitting requirements	No special permits required.	No special permits required. Tree removal plan needed.	Jurisdictional Determination for wetlands may be required. Tree removal plan needed.	Jurisdictional Determination for wetlands may be required. Tree removal plan needed.	Jurisdictional Determination for wetlands may be required. U.S. and Canadian manifests required for transportation to Oregon or Washington State. Tree removal plan needed.	Jurisdictional Determination for wetlands may be required. Tree removal plan needed. Road approval including ecological evaluation required.	Jurisdictional Determination for wetlands may be required. U.S. and Canadian manifests required for transportation to Oregon or Washington State. Tree removal plan needed. Road approval including ecological evaluation required.
Easements or rights-of-way	None required.	Easements may be necessary for access to private portions of the site for possible future development.	Easements may be necessary for access to private portions of the site for possible future development.	Easements may be necessary for access to private portions of the site for possible future development.	Easements may be necessary for access to private portions of the site for possible future development.	Easements may be necessary for access to private portions of the site for possible future development.	Easements may be necessary for access to private portions of the site for possible future development.
Ability to impose institutional controls	Not applicable.	Institutional controls readily implementable.	Institutional controls readily implementable.	Institutional controls readily implementable.	Institutional controls would not be required following completion of removal action.	Institutional controls readily implementable. May be easier to implement because site access improved.	Institutional controls would not be required following completion of removal action.
Potential impacts on adjacent properties	Not applicable.	Mitigation measures and contingency plans would be implemented to minimize impacts to surrounding USFS land. Debris removal would be aesthetic improvement.	Mitigation measures and contingency plans would be implemented to minimize impacts to surrounding USFS land. Debris removal would be aesthetic improvement.	Mitigation measures and contingency plans would be implemented to minimize impacts to surrounding USFS land. Debris removal would be aesthetic improvement.	Mitigation measures and contingency plans would be implemented to minimize impacts to surrounding USFS land. Debris removal would be aesthetic improvement.	Mitigation measures and contingency plans would be implemented to minimize impacts to surrounding USFS land. Debris removal would be aesthetic improvement. Lower potential for impact to property along the Bay and shore of POW Island.	Mitigation measures and contingency plans would be implemented to minimize impacts to surrounding USFS land. Debris removal would be aesthetic improvement. Lower potential for impact to property along the Bay and shore of POW Island.
Likelihood of public acceptance	Low.	Low / Medium.	Medium / High.	Medium.	High.	Medium.	High.
COST							
Total Project Cost	Lowest.	Low	Medium.	Medium / High.	Highest.	Medium / High.	High.

TABLE 5-2
COMPARISON OF ALTERNATIVE COSTS
Salt Chuck Mine - Tongass National Forest, Alaska

Task	Alternative '0' Institutional Controls and Debris Removal	Alternative 1: Excavation, Consolidation in Mill Site Repository, and Capping	Alternative 2: Excavation, Consolidation in Borrow Pit Repository, and Capping	Alternative 3: Excavation and Off-Island Disposal	Alternative 4: Excavation, Consolidation in Borrow Pit Repository, and Capping Utilizing Haul Road	Alternative 5: Excavation and Off-Island Disposal Utilizing Haul Road
Select Direct Cost						
Mobilization	$217,500	$272,500	$325,000	$272,500	$301,608	$269,108
Site Preparation	$118,600	$196,630	$293,500	$306,630	$268,500	$196,630
Haul Road Construction	NA	NA	NA	NA	$323,310	$323,310
Mill Area Debris Removal	$50,000	$52,500	$52,500	$52,500	$51,000	$51,000
Excavate and Place in Repository	NA	$307,916	$332,875	NA	$256,869	NA
Excavate for Offsite Disposal	NA	NA	NA	$403,500	NA	$169,500
Transportation	NA	NA	$176,000	$969,000	$12,000	$672,000
Disposal	NA	NA	NA	$162,000	NA	$162,000
Site Restoration	$119,750	$122,709	$188,623	$153,178	$187,123	$152,678
Confirmation Sampling	NA	$184,525	$184,525	$169,750	$173,525	$158,750
Construction Oversight	$25,407	$50,814	$59,283	$50,814	$58,056	$58,056
Contingency/Unlisted Items	$132,814	$296,899	$403,076	$571,471	$326,398	$442,606
Subtotals						
Capital Direct Costs	$660,000	$1,480,000	$2,020,000	$3,111,000	$1,960,000	$2,656,000
Unit Cost ($/CY)	NA	$370	$505	$778	$490	$664
Contingency Assumed (%)	25%	25%	25%	22.5%	20%	20%
Capital Indirect Costs	$200,000	$410,000	$480,000	$368,000	$580,000	$435,000
Site Inspection and Overhead	$68,800	$151,200	$200,000	$104,370	$203,200	$92,730
Total Capital Costs	$930,000	$2,040,000	$2,700,000	$3,580,000	$2,740,000	$3,180,000
Totals						
Total O&M Costs (30 years)	$194,000	$984,000	$987,000	$185,000	$971,000	$184,000
Total Capital and O&M Costs	$1,120,000	$3,020,000	$3,687,000	$3,765,000	$3,711,000	$3,364,000
Total Project Present Worth [a]	$1,052,000	$2,691,000	$3,352,000	$3,696,000	$3,383,000	$3,298,000

[a] Present worth costs were calculated using a 5% discount rate.

CY - cubic yards
NA - Not Applicable
O&M - Operation and Maintenance

FIGURES

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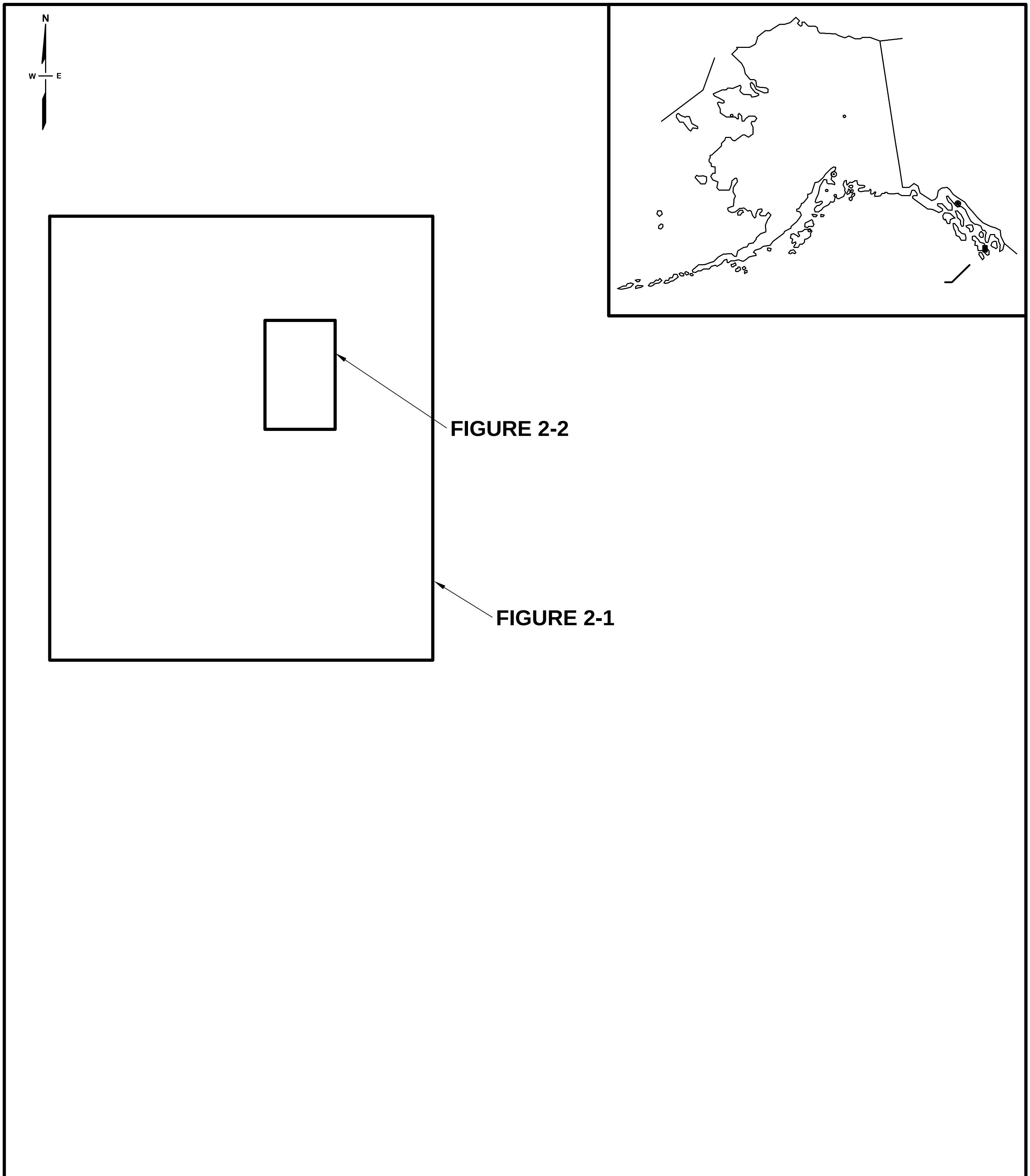


SOURCE: USDA FOREST SERVICE,
1:63,360 SERIES (TOPOGRAPHIC),
CRAIG (C-2) QUADRANGLE

0 2,000 4,000 8,000

SCALE IN FEET

USDA FOREST SERVICE - ALASKA REGION
FOCUSED UPLAND EE/CA

SITE LOCATION MAP

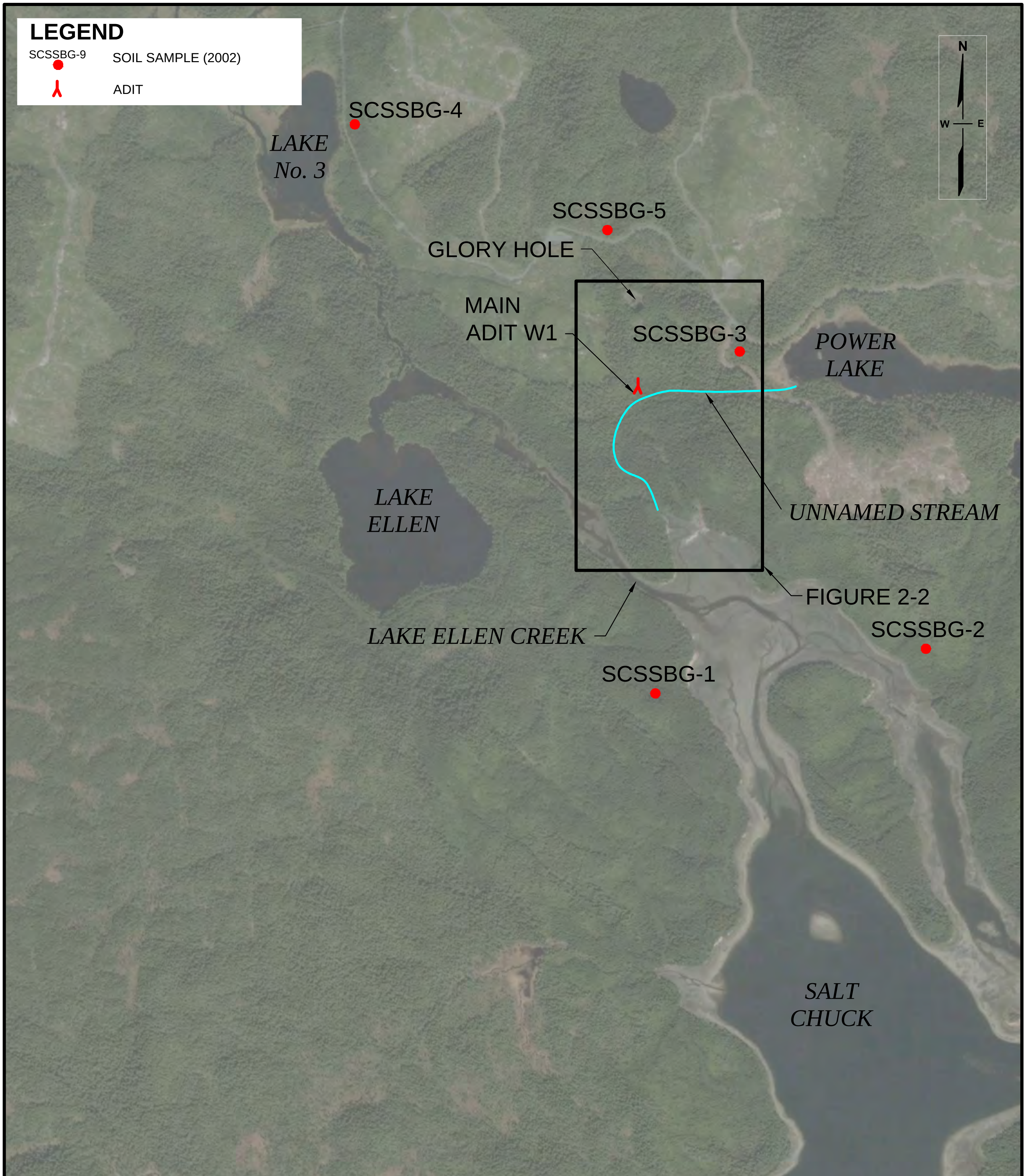
SALT CHUCK MINE
TONGASS NATIONAL FOREST, ALASKA

URS

JOB NO: 26219785	DRAWN: ELK
DATE: MARCH 2010	FILE: 26219785 EECA 2009.DWG

FIGURE 1-1

G:\PROJECTS\26219785 SALT CHUCK MINE\2009\26219785 EECA 2009.DWG ; Revised 3/3/2010 3:04:03 PM



SOURCE:
US FOREST SERVICE (1991b), US BLM (1998), URS (2003), GOOGLE EARTH (2009)

0 750 1,500 3,000
APPROXIMATE SCALE IN FEET

USDA FOREST SERVICE - ALASKA REGION
FOCUSED UPLAND EE/CA

BACKGROUND SOIL AND SURFACE WATER SAMPLE LOCATIONS

SALT CHUCK MINE
TONGASS NATIONAL FOREST, ALASKA

URS

JOB NO: 26219785	DRAWN: ELK
DATE: MARCH 2010	FILE: 26219785 EECA 2009.DWG

FIGURE 2-1

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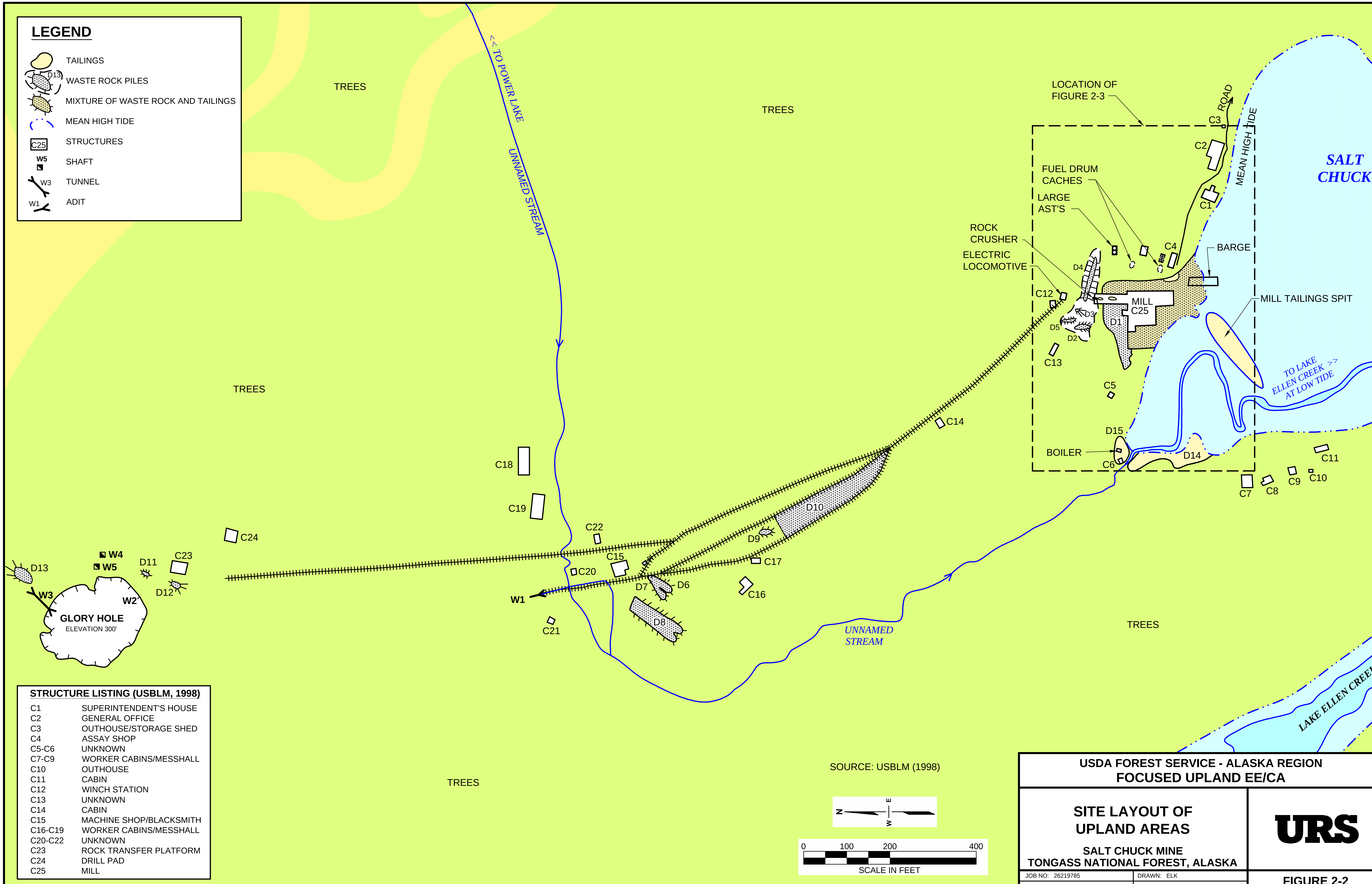


STRUCTURE LISTING (USBLM, 1998)

C1	SUPERINTENDENT'S HOUSE
C2	GENERAL OFFICE
C3	OUTHOUSE/STORAGE SHED
C4	ASSAY SHOP
C5-C6	UNKNOWN
C7-C9	WORKER CABINS/MESSHALL
C10	OUTHOUSE
C11	CABIN
C12	WINCH STATION
C13	UNKNOWN
C14	CABIN
C15	MACHINE SHOP/BLACKSMITH
C16-C19	WORKER CABINS/MESSHALL
C20-C22	UNKNOWN
C23	ROCK TRANSFER PLATFORM
C24	DRILL PAD
C25	MILL

USDA FOREST SERVICE - ALASKA REGION
FOCUSED UPLAND EE/CA

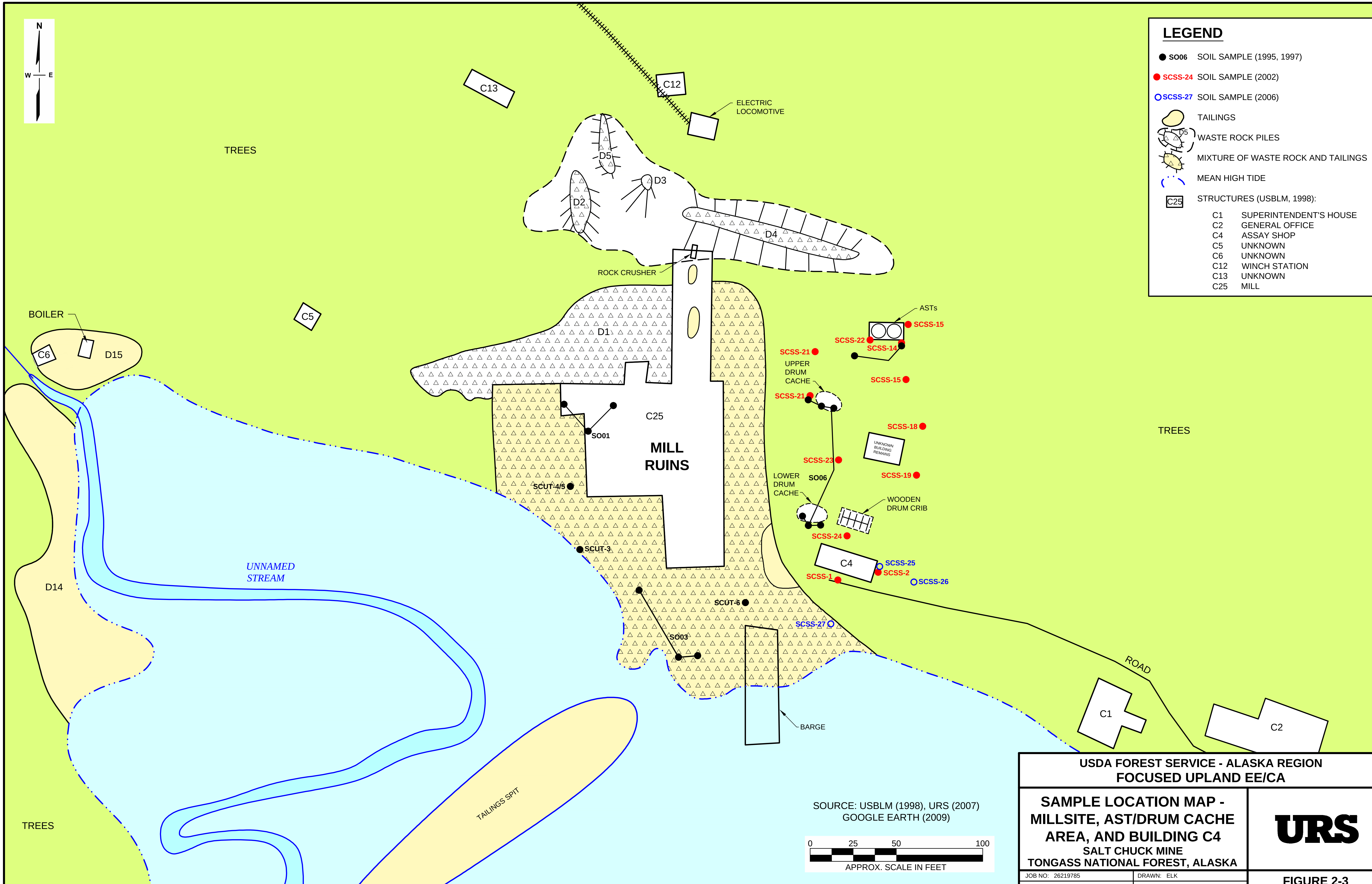
SITE LAYOUT OF UPLAND AREAS

SALT CHUCK MINE
TONGASS NATIONAL FOREST, ALASKA

URS

JOB NO: 26219785 DRAWN: ELK
DATE: MARCH 2010 FILE: 26219785 EECA 2009.DWG

FIGURE 2-2



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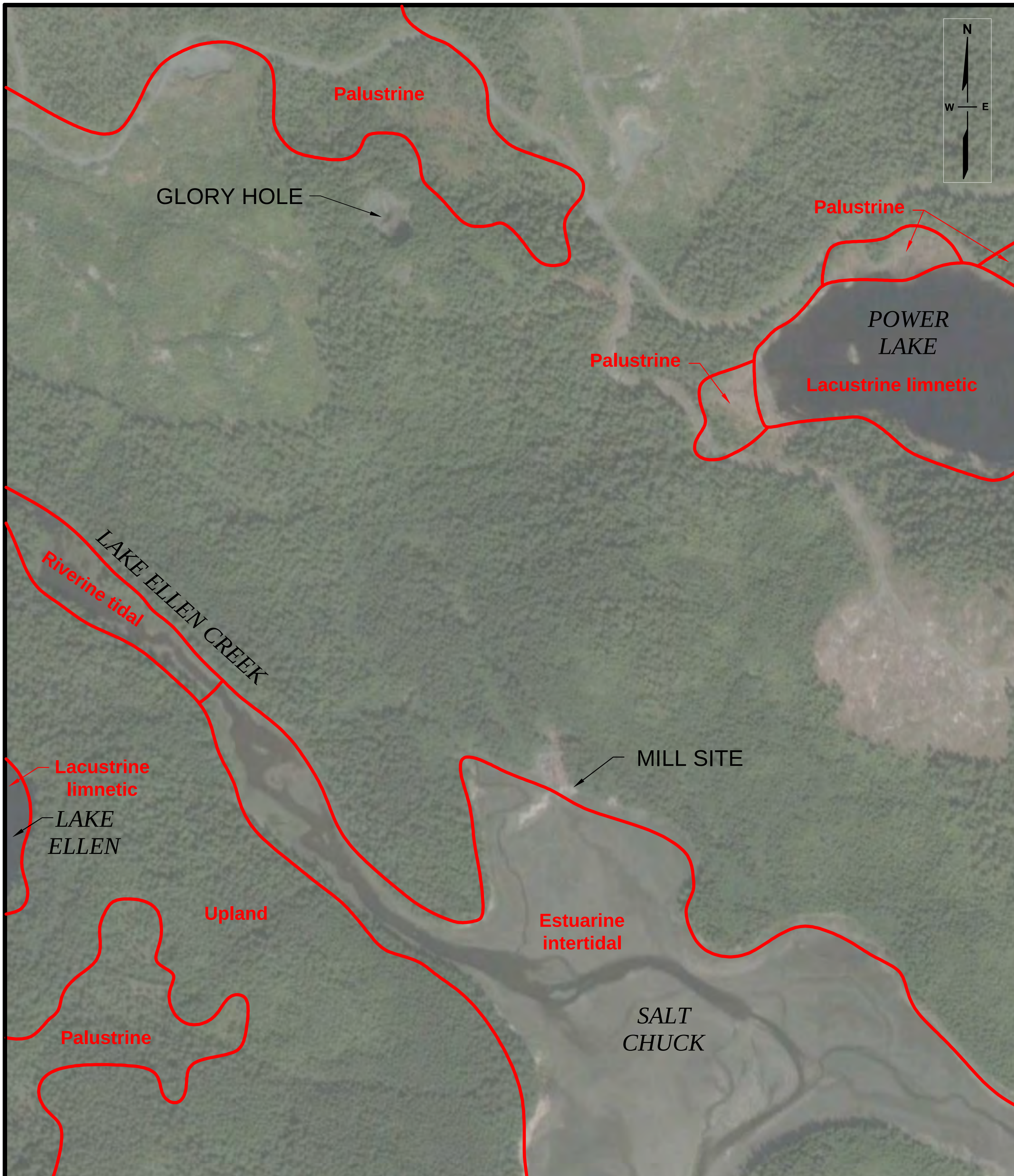


SOURCE:
GOOGLE EARTH (2009)

0 300 600 1200

APPROXIMATE SCALE IN FEET

USDA FOREST SERVICE - ALASKA REGION
FOCUSED UPLAND EE/CA

INVENTORIED WETLANDS

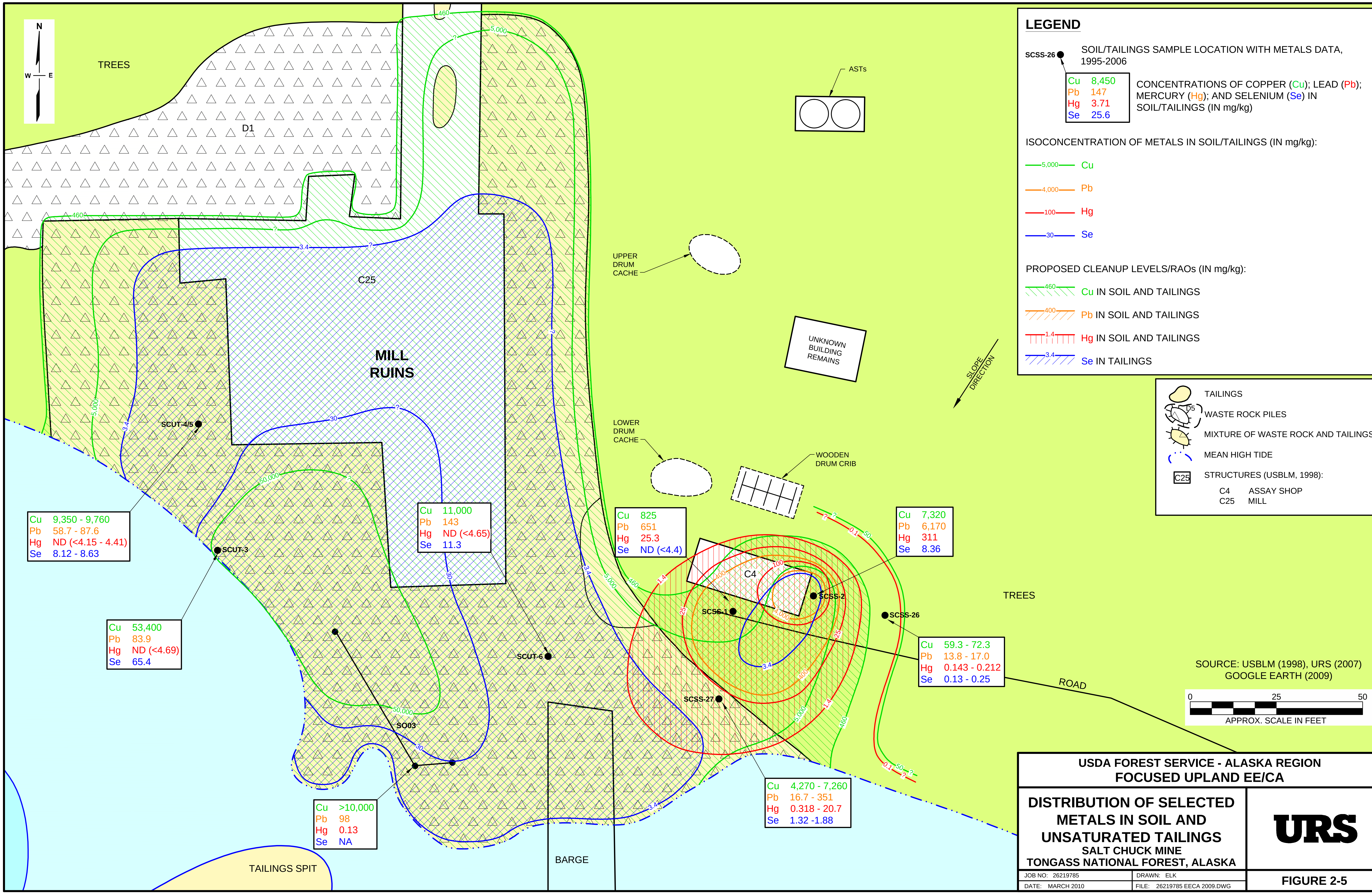
SALT CHUCK MINE
TONGASS NATIONAL FOREST, ALASKA

URS

JOB NO: 26219785	DRAWN: ELK
DATE: MARCH 2010	FILE: 26219785 EECA 2009.DWG

FIGURE 2-4

G:\PROJECTS\26219785 SALT CHUCK MINE\2009\26219785 EECA 2009.DWG ; Revised 3/3/2010 3:04:03 PM



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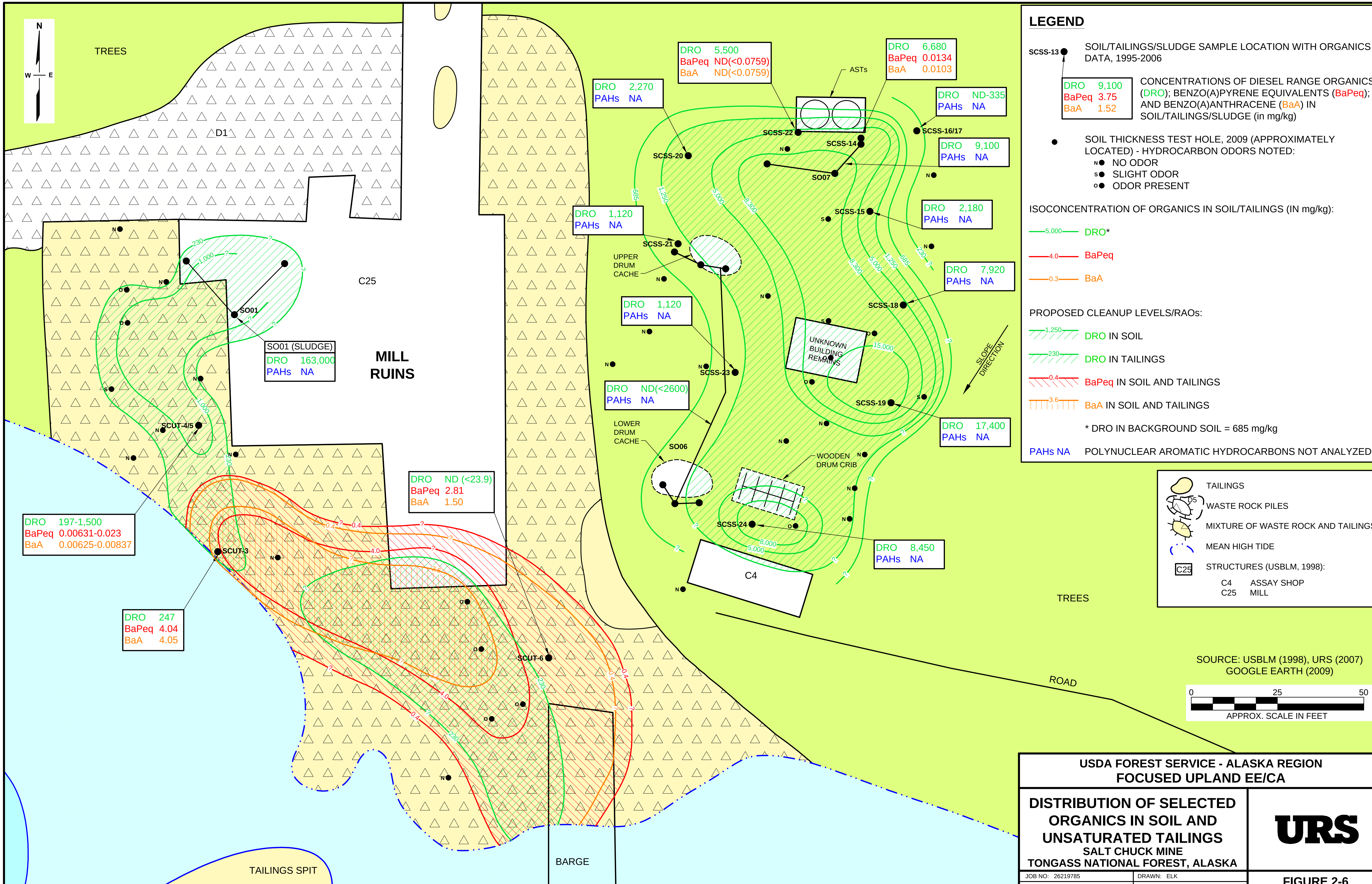

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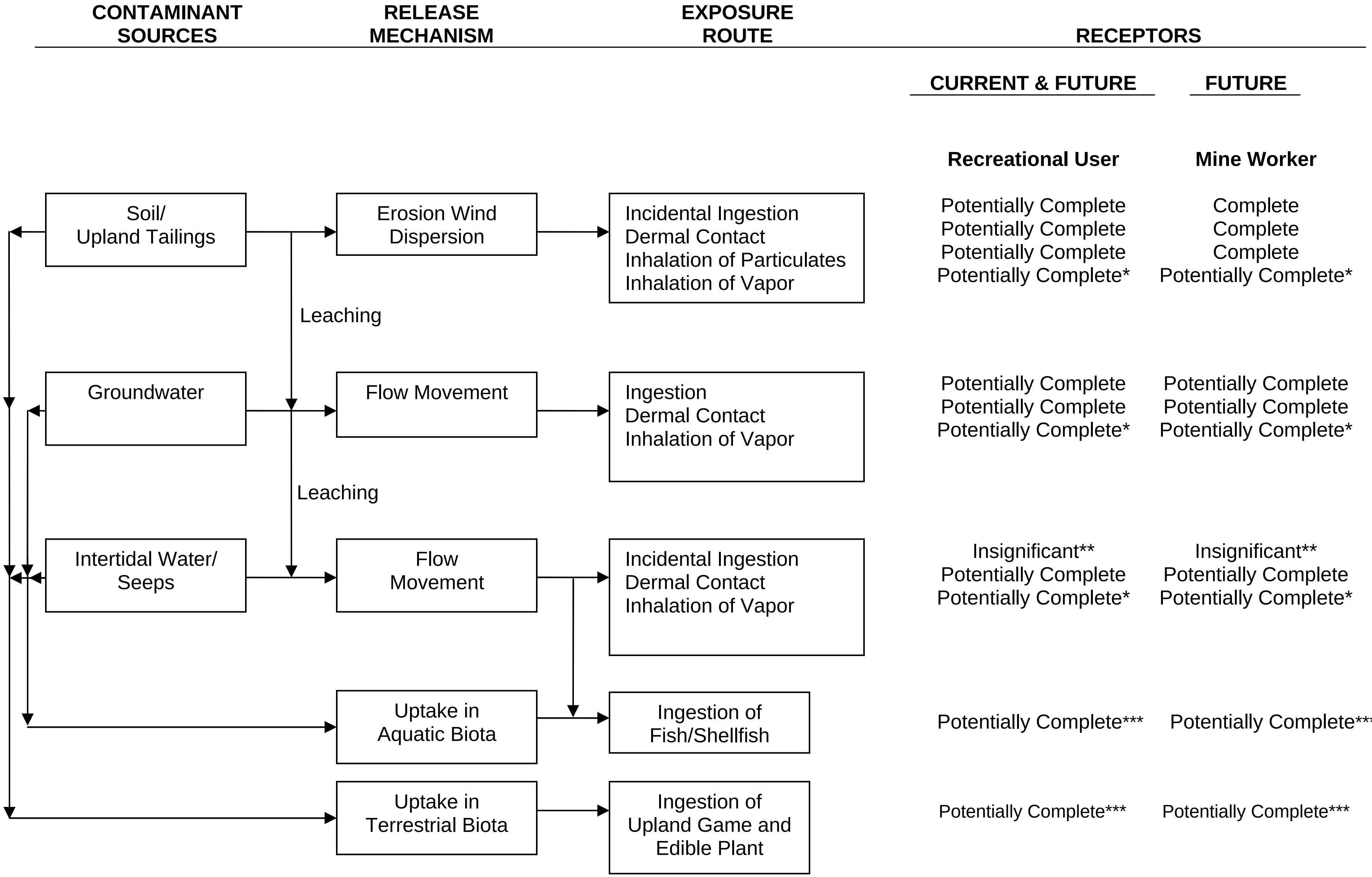


NOTE: This EE/CA addresses uplands soil and tailings only.
*Possibly complete for mercury, all other inorganics nonvolatile.
**Intertidal water too saline for ingestion as drinking water.
***To be addressed as part of site-wide risk assessment, including subsistence use as appropriate.

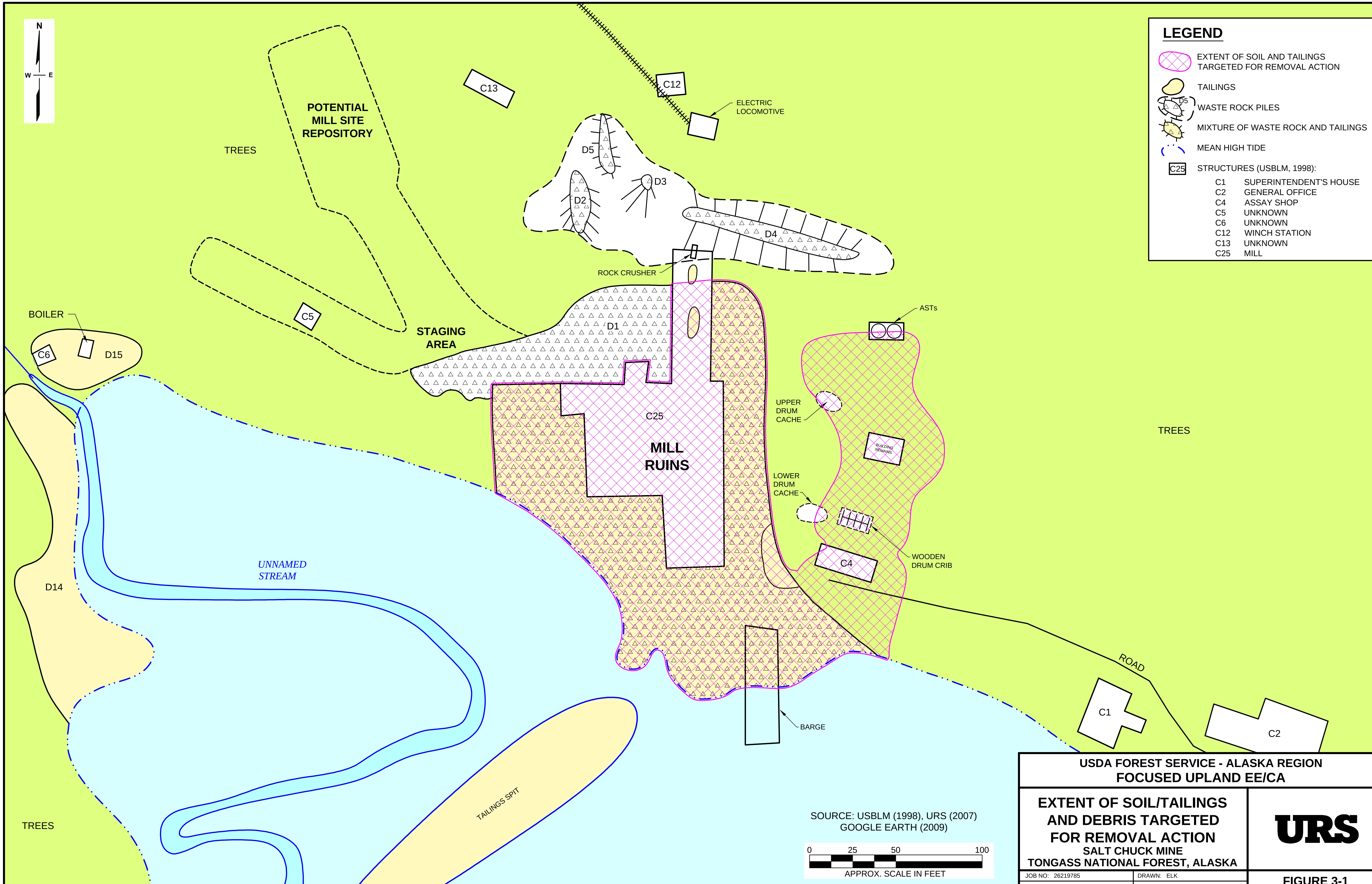
HUMAN HEALTH CONCEPTUAL SITE MODEL

February 2010
26219785

Focused Upland EE/CA Salt Chuck Mine
Tongass National Forest, Alaska

URS

Figure 2-7



USDA FOREST SERVICE - ALASKA REGION
FOCUSED UPLAND EE/CA

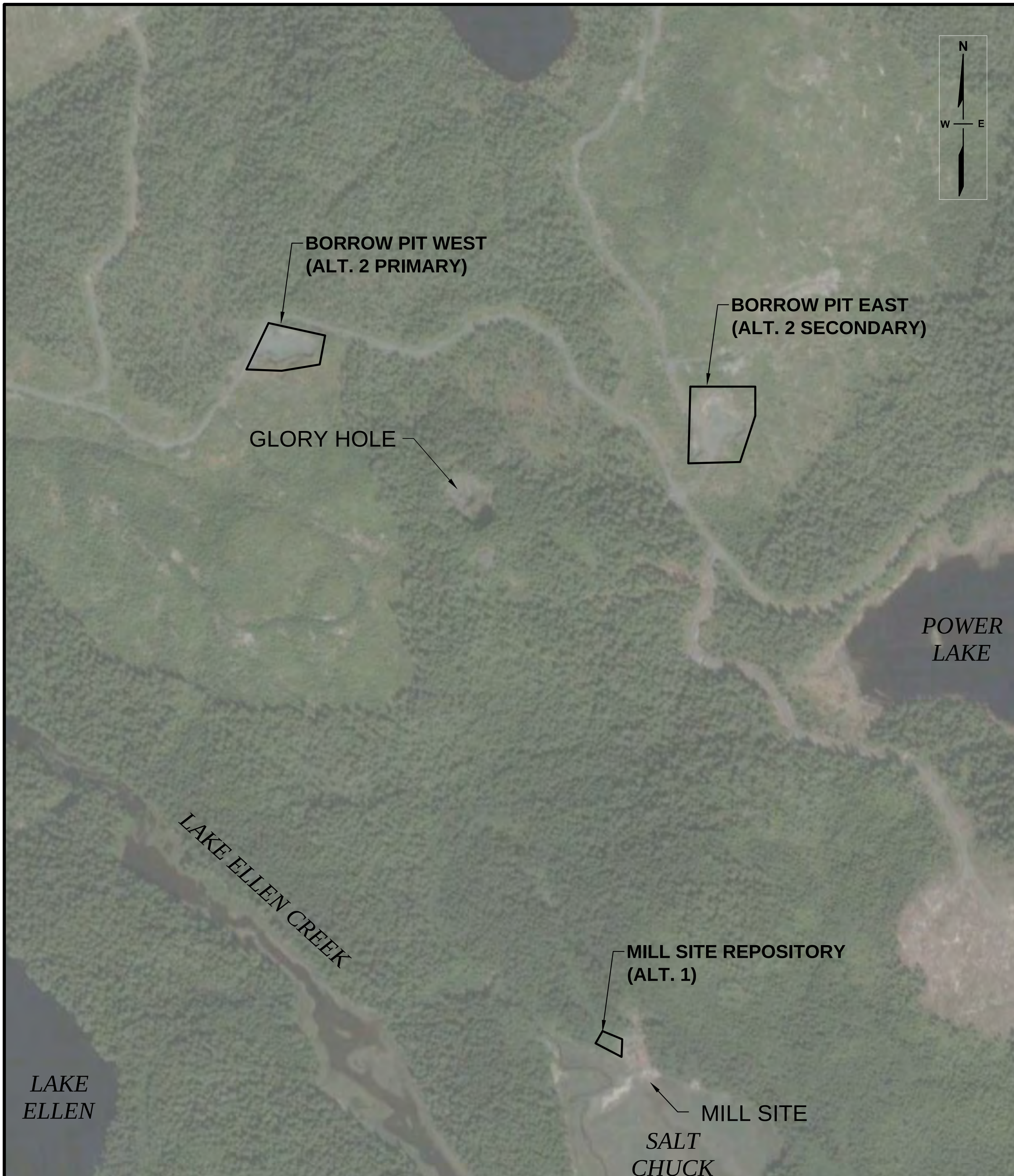
EXTENT OF SOIL/TAILINGS AND DEBRIS TARGETED FOR REMOVAL ACTION
SALT CHUCK MINE
TONGASS NATIONAL FOREST, ALASKA

URS

JOB NO: 26219785	DRAWN: ELK
DATE: MARCH 2010	FILE: 26219785 EECA 2009.DWG

FIGURE 3-1

G:\PROJECTS\26219785 SALT CHUCK MINE\2009\26219785 EECA 2009.DWG ; Revised 3/3/2010 3:04:03 PM



SOURCE:
GOOGLE EARTH (2009)

0 300 600 1200

APPROXIMATE SCALE IN FEET

USDA FOREST SERVICE - ALASKA REGION

FOCUSED UPLAND EE/CA

REPOSITORY SITES

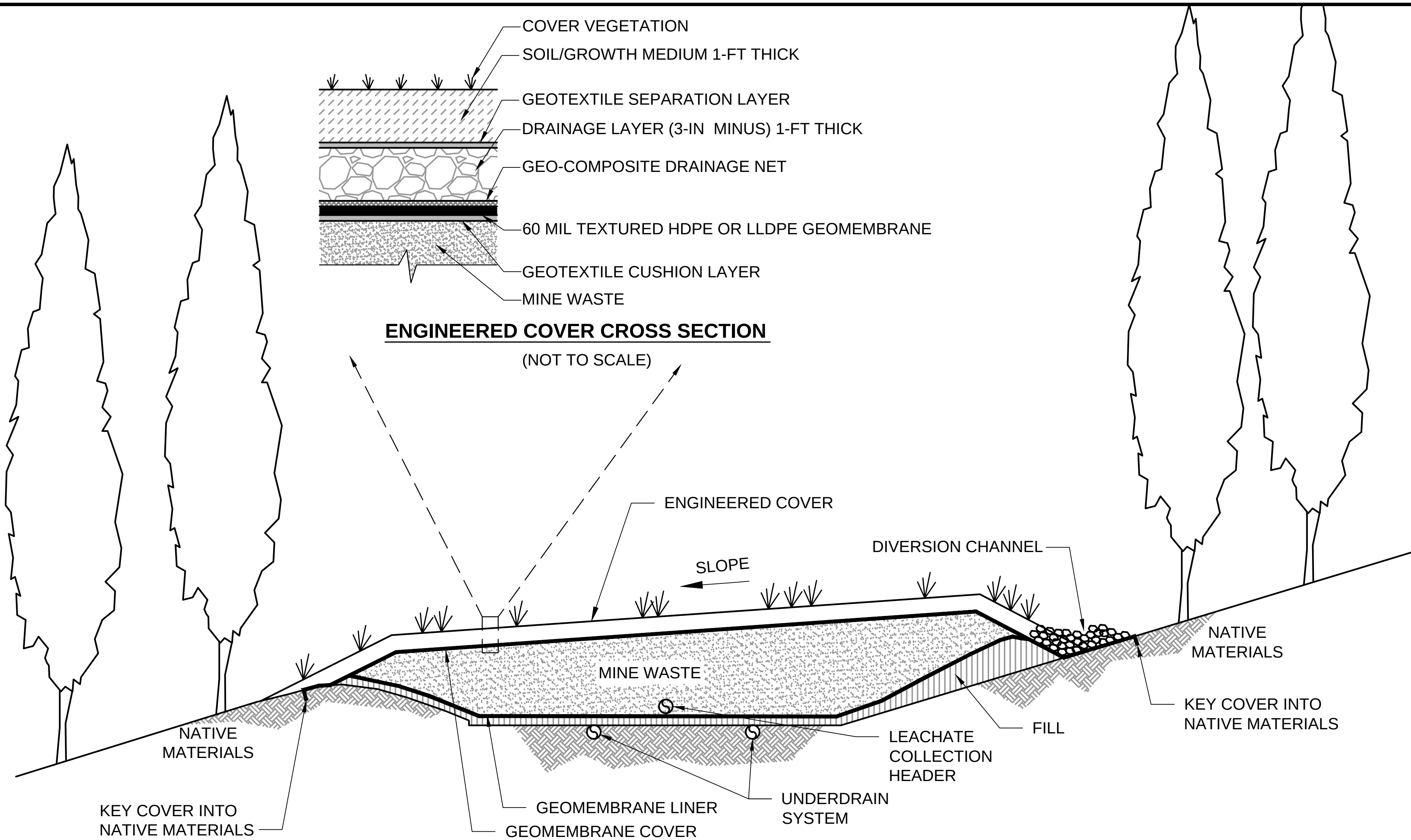
SALT CHUCK MINE
TONGASS NATIONAL FOREST, ALASKA

URS

JOB NO: 26219785	DRAWN: ELK
DATE: MARCH 2010	FILE: 26219785 EECA 2009.DWG

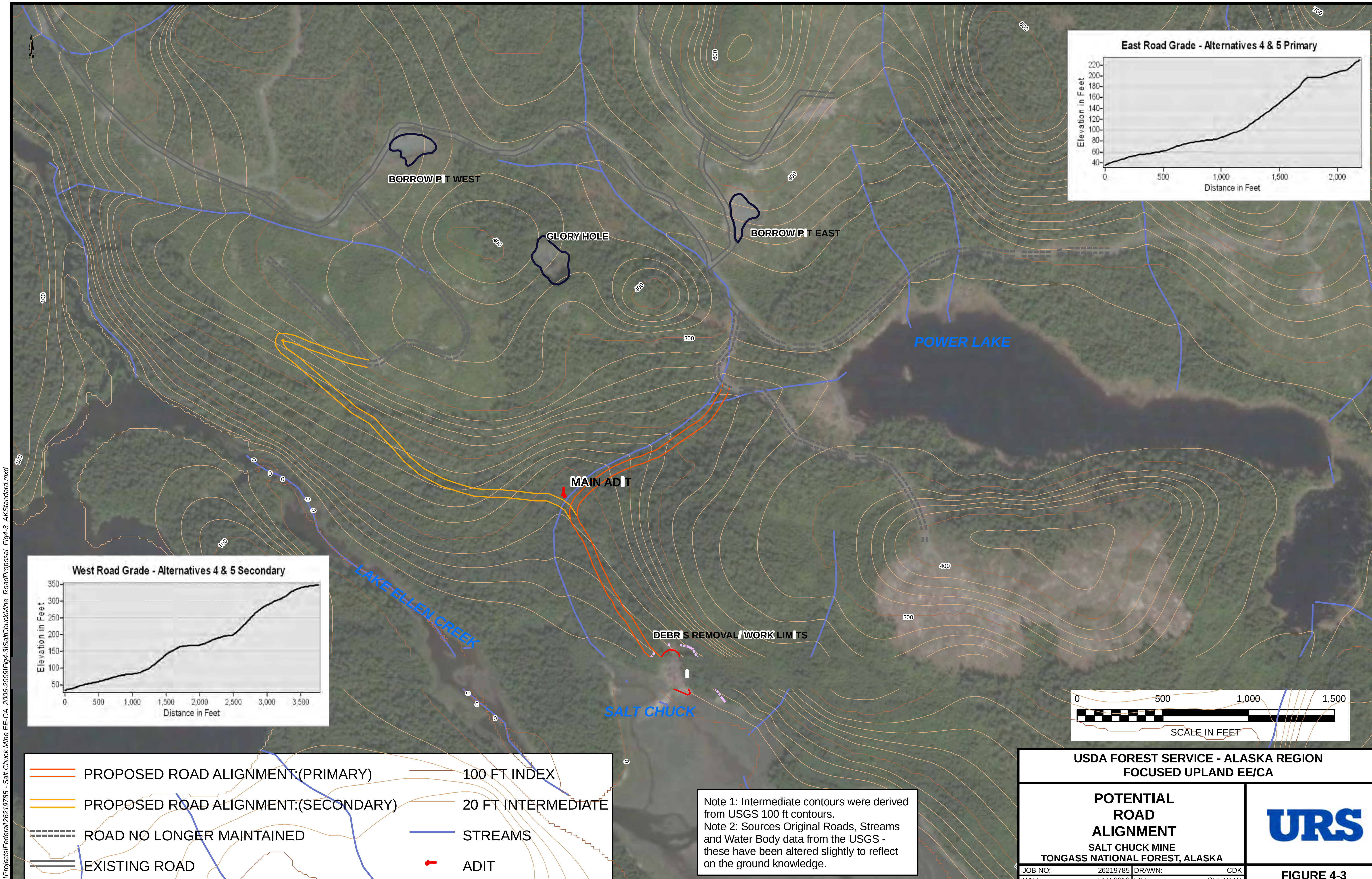
FIGURE 4-1

G:\PROJECTS\26219785 SALT CHUCK MINE\2009\26219785 EECA 2009.DWG ; Revised 3/3/2010 3:04:03 PM

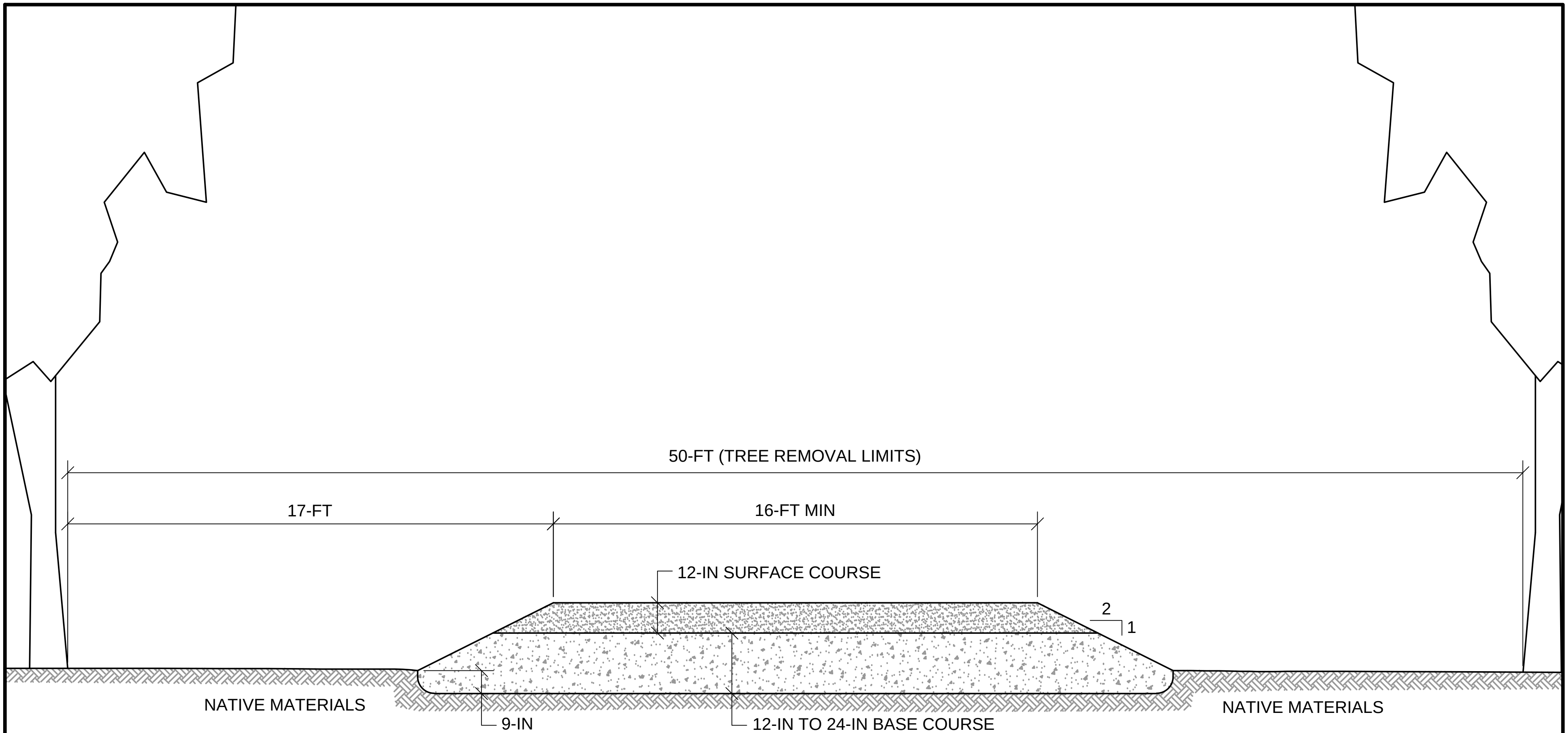


CONCEPTUAL MILL SITE REPOSITORY

USDA FOREST SERVICE - ALASKA REGION **FOCUSED UPLAND EE/CA**	
ENGINEERING CONCEPTS **REPOSITORY DESIGN** **SALT CHUCK MINE** **TONGASS NATIONAL FOREST, ALASKA**	URS
JOB NO: 26219785 DRAWN: ELK DATE: MARCH 2010 FILE: 26219785 EECA 2009.DWG	**FIGURE 4-2**



M:\Projects\Federal\26219785 - Salt Chuck Mine EE-CA_2006-2009\Fig4-3\SaltChuckMine_RoadProposal_Fig4-3_AKStandard.mxd



NOTE:
BASE COURSE MATERIAL SHALL BE FLOATED IN FOLLOWING CLEARING AND GRUBBING. THICKNESS WILL VARY BASED ON NATIVE MATERIALS ENCOUNTERED.

CONCEPTUAL ROAD CROSS SECTION

NOT TO SCALE

USDA FOREST SERVICE - ALASKA REGION FOCUSED UPLAND EE/CA	
ENGINEERING CONCEPTS ROAD DESIGN SALT CHUCK MINE TONGASS NATIONAL FOREST, ALASKA	URS
JOB NO: 26219785 DRAWN: ELK DATE: MARCH 2010 FILE: 26219785 EECA 2009.DWG	FIGURE 4-4

PHOTOGRAPHS

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Photograph 1. Mill site and associated waste rock and tailings.

Photograph 2. Electric locomotive.

Photograph 3. One of several drum caches.

Photograph 4. Former location of building C4.

Photograph 5. AST area near mill site.

Photograph 6. Unsaturated tailings beneath mill.

Photograph 7. Test holes advanced near barge, November 2009.

Photograph 8. Location of waste rock sample collected from D1 and rock mixed in with mine tailings.

Photograph 9. Location of mill site repository between Unnamed Stream and mill site.

Photograph 10. Borrow Pit West (Alternative 2 Primary) repository.

Photograph 11. Borrow Pit East (Alternative 2 Secondary) repository.

APPENDIX A

AUGUST 9, 2009 STRATEGY MEETING SUMMARY

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URS

Memorandum

Date: September 9, 2009

To: Michael Wilcox (USDA Forest Service), Neli Nelson (Village of Kasaan), Annemarie Palmieri (ADEC), Marty Brewer (ADEC), Ken Marcy (USEPA), Lori Verbrugge (DHSS), Jill Hedgecock (URS), Cary Brown (URS), Nancy Darigo (URS), Mark Vania (URS)

From: Mike Gray (URS)

Subject: **Strategy Meeting Summary and Conceptual Plan, Salt Chuck Mine**

Strategy Meeting Summary

A technical planning meeting for the Salt Chuck Mine (Site), Prince of Wales Island was held at the URS office in Anchorage, AK on August 13, 2009 to discuss future environmental assessment and planning activities in support of a potential removal action on USDA Forest Service (Forest Service) managed lands at and near the former mill site. The proposed removal action would be funded using federal stimulus funds under the American Recovery and Reinvestment Act (ARRA). Meeting attendees (in person and via telephone) included: Michael Wilcox (Forest Service), Neli Nelson (Village of Kasaan), Anne Marie Palmieri (ADEC), Marty Brewer (ADEC), Ken Marcy (USEPA), Jill Hedgecock (URS), Cary Brown (URS), Nancy Darigo (URS), Mark Vania (URS), and Mike Gray (URS). Lori Verbrugge (DHSS) was unable to attend.

The initial intent of the meeting was to discuss the scope of a planned focused EE/CA to be developed for Forest Service-managed upland areas of the Salt Chuck Mine site in order to maximize use of stimulus funds. A constraint was that a contracting package committing ARRA funds for activities at the Site would need to be advertised by mid December 2009, with fund obligation shortly thereafter. Upland zones (above the mean high tide line) are within Forest Service-managed lands, and intertidal zones are State of Alaska-managed. The Upland EE/CA, as preliminarily proposed, was to be developed from and built upon the existing Draft EE/CA document already prepared for the overall Salt Chuck Mine site (dated March 2007), as well as related technical comments generated through agency review of that document.

Through the process of discussions at the meeting, a preliminary consensus among participants suggested that stimulus funds might be better applied by clean up of POL-contaminated soil with a presumptive remedy, rather than through continuation of the EE/CA process. The primary basis for this view was consideration for the limited time to adequately complete an upland focused EE/CA; the expectation that the site as a whole will likely be listed under the USEPA NPL (Superfund); and through the subsequent CERCLA RI/FS process, a site-wide baseline risk assessment, comprehensive remedial action objectives, and remedial alternatives would be developed to address issues in both upland and intertidal zones, making additional EE/CA process activities in the upland zone at this time potentially duplicative.

The more limited approach discussed in the meeting would include removal of mine debris in and around the mill site for safety purposes, removal of POL-impacted soil at the AST area, and

URS Corporation
560 East 34th Avenue, Ste 100
Anchorage, AK 99503
Phone: 907.562.3366
Fax: 907.562.1297
www.urscorp.com

possibly some commingled POL/metals-impacted soil at the south end of the AST area near Building C4. The soil removal would be based primarily on exceedances of human-health-based cleanup levels. Meeting participants agreed in principle to the use of alternate cleanup levels for the AST area based on a Method 3 calculation, contingent on ADEC's review and approval of the calculation presented in the existing Draft EE/CA document. The Method 3-calculated migration to groundwater cleanup level for the AST area exceeds the maximum allowable 12,500 mg/kg under 18 AAC 75, so the applicable cleanup level for DRO in soil would revert to 8,250 mg/kg based on direct human exposure. ADEC remained concerned about potential migration of non-POL contaminants through groundwater to surface water, and it was agreed that cleanup levels for potential commingled metals-impacted soil would be based on the most conservative of Method 2 soil cleanup levels, including migration to groundwater levels.

Confirmatory sampling following the limited cleanup would include both soil and groundwater (if present). Meeting participants agreed in principle not to apply ecological risk-based cleanup levels to the limited action, but instead to revisit ecological risk in the AST/commingled area in the later site-wide risk assessment based on confirmatory sampling of media that remain onsite. To this end, it was agreed that screening levels in ADEC's *Ecoscoping Guidance* would be incorporated into DQOs for the confirmatory sampling program, so that data quality would be sufficient for later risk assessment use.

Addendum and Conceptual Plan

Following the 8/13/09 meeting, the Forest Service re-evaluated the limited approach in light of new internal direction regarding the obligation window of stimulus funds, and concluded that for the purpose of maximizing the effectiveness of cleanup activities under the stimulus-funded program, inclusion of some CERCLA hazardous substance impacts should be reconsidered. Thus, the conceptual path forward currently being proposed is to complete a focused EE/CA for selected upland areas to support a stimulus-funded interim removal action. The Focused Upland EE/CA would follow the human health-based approach agreed to in principle for the AST/commingled area, but would also include two additional upland areas that clearly exceed human health-based cleanup criteria (Mill Site Tailings and Building C4). Upland areas that are more clearly driven by ecological risk concerns (including Tailings Piles D14 and D15) would not be considered in the Focused Upland EE/CA, but would be addressed under the future site-wide program following NPL listing of the site. The Focused EE/CA would include a breakdown of removal action alternative costs by area of concern, so that the Forest Service could apply decision-making to selected areas based on the stimulus fund award cap and the possible future availability of additional funds.

Because the schedule of the stimulus-funded removal action would require obligation of funds by September 2010, the Focused Upland EE/CA would be completed using existing data, and would be followed shortly by a more detailed design and cost estimate of the selected alternative in order to meet schedule constraints. URS is preparing an EE/CA contract modification proposal for review by the Forest Service.

APPENDIX B

OCTOBER 2009 SITE VISIT FIELD NOTES

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SALT
CHUCK
MINE

"Rite in the Rain"
ALL-WEATHER
FIELD BOOK
No. 350 N

EE/CA

Site Visit

MEASUREMENT CONVERSIONS

INCH CM

IF YOU KNOW	MULTIPLY BY	TO FIND

"Rite in the Rain"®
ALL-WEATHER WRITING PAPER

Name Gary Brown

Address URS Corp Seattle
1501 4th Avenue Ste 1400
Seattle, WA 98101

Phone 206 438-2040
cell 206 419-3033

Project
Salt Chuck Mine
#26219785

"Rite in the Rain" - a unique all-weather writing surface created to shed water and to enhance the written image. Makes it possible to write sharp, legible field data in any kind of weather.

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TACOMA, WA 98421-3696 USA

CONTENTS

PAGE	REFERENCE	DATE

Cary Brown 10-27-09

- Travel day from Seattle to Thorne Bay
- Meet Mark Vaun & Michael Wilcox in Ketchikan (and Archeologist)
- Take ferry from Ketchikan to Hollis
- Tim from Welcome Inn drives project team from Hollis to Thorne Bay

Cary Brown
10-27-09

10-28-09

Cary Brown & Mark Vania

750 Meet Forest Service Mike Wilcox to Start Day

800 Pick up Archelogist Bret & K

820 Pick up Neilly & Stormy
~~835~~ Village of Kissan Repo

835 Stop on Forest Service Road agacent to Pit

840 mapped Pit

855 Rough Estimated area South of Pit for future long term borrow site
Its ~300 feet along the road & ~400ft toward the bay

915 Stop at 2nd Pit located further east just off main road

945 At End of road near River Lake

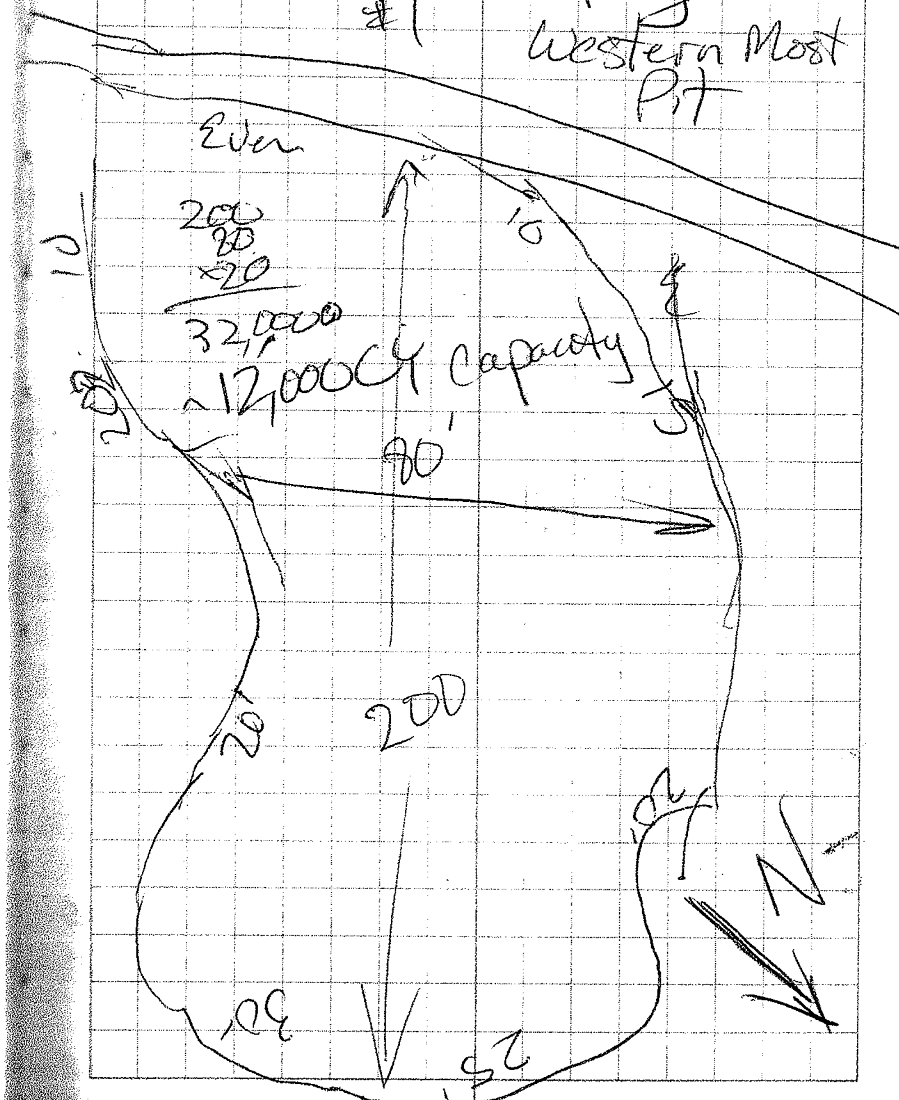
1000 Start hike after HES meeting from River Lake

10:15 At Mine Adit

10:30 At Locomotive filled w/ batteries

Cary Brown 10-28-09

Borrow Pit Mapping #1
Western Most Pit



Cary & Mark 10-28-09

1035 Group Mike & Bret agreed that they'd like to see batteries removed but nothing else necessary

1045 ~~At~~ AST area
Two ASTs located side by side
2 shovels Ø 8' Ø
~3 shovels tall 11' tall

★ Conversation about Scrap metal recycling feasibility

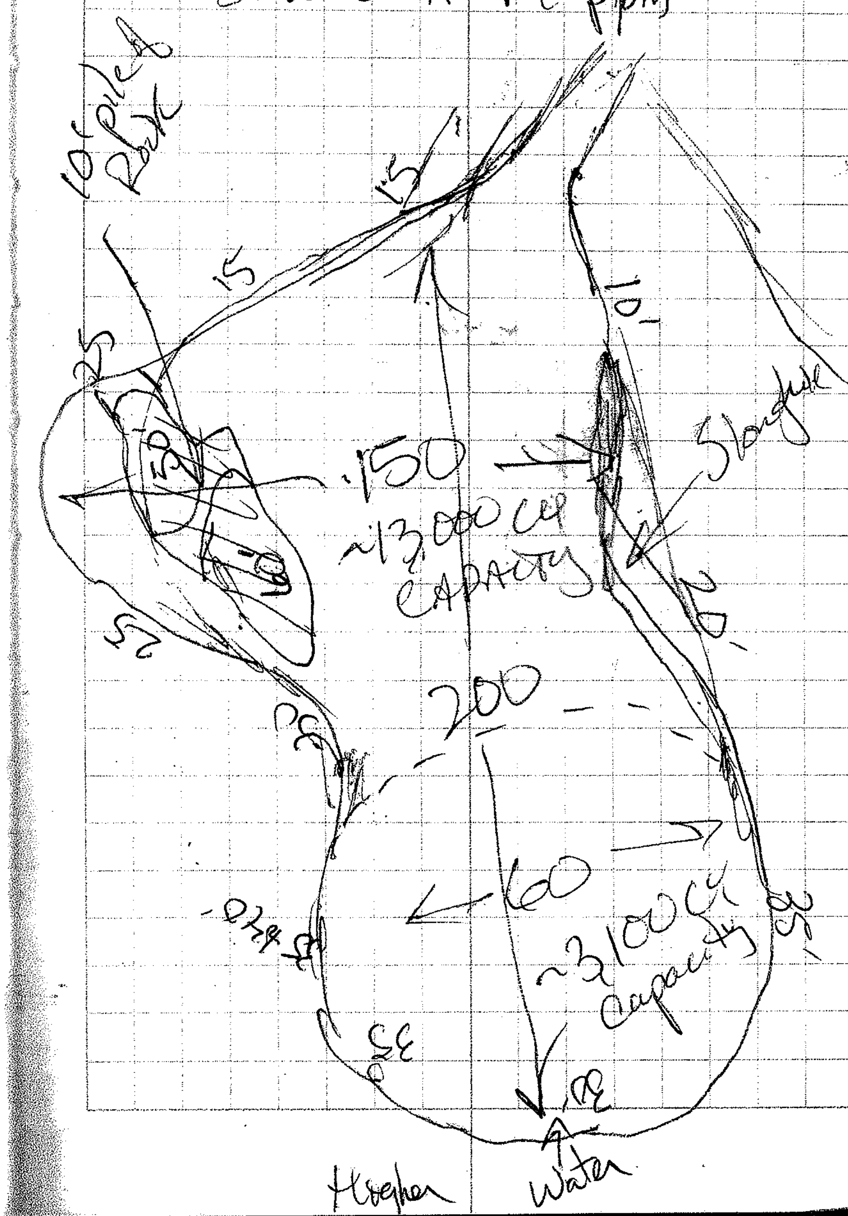
— Stormy said they store scrap at Coffman Cove

1120 Get lay of the land
— Explore site and document locations of items and tailings

1230 Discuss historical significance of Mill Debris and get general agreement on what would be scrap vs stay on site

Cary A Ber 10-28-09

Barrow Pit Mapping



Site
Action Items

- Measure Debris areas
- Measure Barge
- Estimate Height of Barge Draft
- ~~Estimate~~ Boundary of Work Areas
- Count Arms
- Count Trees
- Estimate Tide Change
- Confirm limits of POL area
- Burn Pit Area

Office
Action Items

- Wood Disposal options
- Metal Disposal Options
- Feasibility of conveyor belt
- feasibility of overhead tram
- tree removal cost
- Stump removal / ~~POL~~ POL Soil segregation
- Lead based paint considerations
- Creosote barge? considerations
- Have Closeup Aerial Photo of the Mill Site Taken
- Consider cost to deal with surface / perched water runoff
- Consider chipping wood debris
- How long to burn all wood debris

Tree / Stump Removal

- # of trees in POZ area
- Range of Ø
- Range of Height
- Mainly Doug Fir & Cedar. Actually the Trees are not Doug Fir more likely Spruce

Debris Removal Thoughts

- Leave concrete foundation equipment in place
- Don't Let debris removal significantly interfere with CERCLA process
- Place back ~~metal~~ metal in a safe manner
- wood attached to cool metal items can remain. No need to detach
- Placement not critical
- OK to keep some large timber
- Siding & misc pipe can go
- All Safety issues should be removed
- Don't forget buried Debris

Cary & Mark 10-28-09

1330 Lunch in the woods
Wind picking up & getting colder

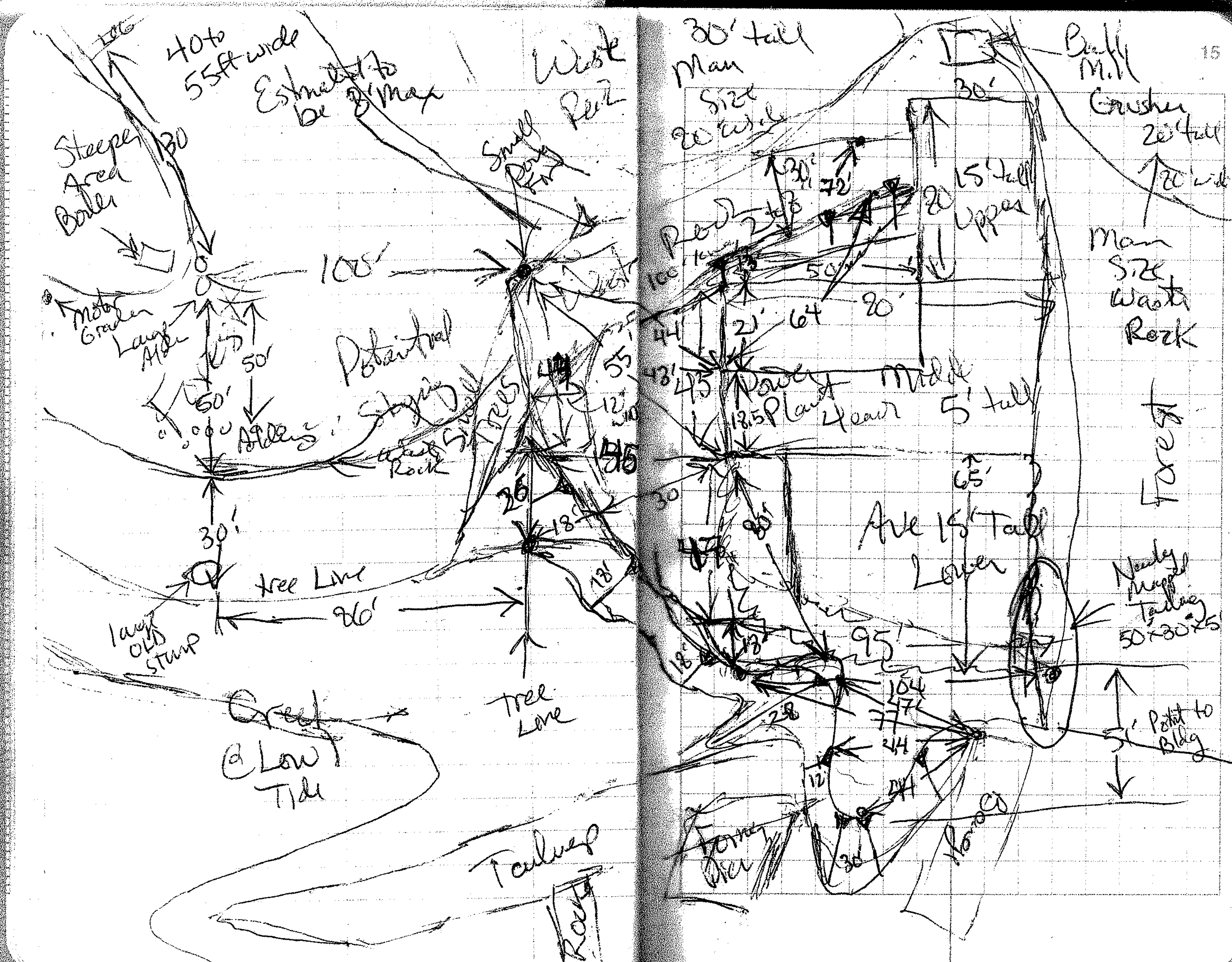
1400 CAR/Map out POL area
— Mark testing soil depths in POL area
— He's using hand auger & checking for odor
★ POL map appears off in scale
— Markup figure from old EE/CA with dimensions so we can correct later.

1450 Checking Barge Dimensions
TIDE 4:05pm 4.5 ft
9:58pm 12 ft
— Tide is way out then
Barge length 88'
Width 31'
Height 7.5' tall
— water side of Barge is open to the sea. Surface has holes & potential Hazard

Cary A Bern 10-28-09

Questions

— Can logged trees be stockpiled on site and left
— Can the stumps be burned?
— What are stump disposal options
— Can POL site be left as exposed bed rock. Yes
— If not is grass acceptable
— Discuss Thorne Bay Landfill w/ DAN Hauk
- Do we have to have Grass
- How do you prevent Alder or other trees from taking over


40 to 55ft wide
Estimated to be 8' max
Waste Rock
Steeper Area Border
Motor Grader
Large Alder
108'
50'
Potential Staging
Small Pond
30'
tree Line
86'
large OLD STUMP
Creek @ Low Tide
Tree Line
Tailings
Road
30' tall
Man Size
20' wide
Ball Mill
Crusher
20' tall
20' wide
Upper
15' tall
Man Size Waste Rock
Power Plant
Middle
5' tall
Forest
Ave 15' Tall
Lower
65'
95'
Newly Mapped Tailings 50x30x5'
5' Point to Bldg
Barge
Former River
15

Cary & Mark Brown Vania   Thursday 10-29-09

39°F   Overcast

755 Get picked up by the Forest Service Crew

805 Pick up Polaski @ Ranger Station

815 Meet Nelli Village of Kassan Rep

840 Start hike into the Mine via Salt Chuck Trail

920 Arrive at Mine site

930 Review area west of Mine for potential laydown

955 Take photo of bay near high tide

— Water up to the piles that run east/west

— Mark & Nelli checking Mine tailings pile by barge for thickness & extent

— Also checking for Petroleum odor

1010 Start to measure off laydown area w/ Michael

— Starting to RAIN

— In all we designated three sections for potential laydown

Cary Brown 10-29-09

Questions

- Where can burn pit be
- Can tailing spit be used to burn wood
- How far does burn pile need to be from trees
- Can a chipper be used for extremely large beams
- Can chipper handle some metal
- How much to have floating housing at the site
- Do we need to maintain a buffer for harvesting vegetation to the bay

Cary & Mark — 10-29-09
Showers 42°

— Identified another 100' by 60' area NW of Laydown area on previous page
— It's slightly larger in width but has a bit more slope

1100 Break for Lunch in the woods
1105 Took picture of Bay. The tide is near/at max now

Tide Chart Says
High was at 10:35 @ 13.8'
Low will be at 4:49 @ 3.8'

Kata Bay correction
High +0.03 +0.5
Low +0.04 −0.1

11:35 Lunch over
Michael checked top soil depth into M potential laydown area. 1" to 5" but overall it is ~2" thick

— Mark to dig by upper Mill
— Cary to check tree counts

Cary A Bur— 10-29-09

TREE COUNTS

★ Upper laydown/Storage
Quantity ~40
Type Red Alder
Ø Range 4 to 24"
Ave Ø 12"
Ave Height 50'
Area is thinned out

★ Middle Laydown Area
Quantity ~120
Type Red Alder & some small FIRS — Medium Dense
Ø Range 2 to 30"
Ave Ø 10"
Ave Height 50"

★ Lower Laydown Area
Quantity ~100
Type Red Alder & Small Fir
Ø Range 2 to 24"
Ave Ø 6"
Ave Height 40'
Dense

★ POL Area
Quantity ~200
Type Doug Fir & Cedar
Ø Range 4 to 30"
Ave Ø 9"
Dense
Ave Height 80ft

Cary & Mark 10-29-09
Showers 45°F

1215 Done w/ tree count info
Checking area west of
Motor Grader
Area Very open but
only 25 to 30' wide

* I think it's best to
stop at motor grader
so it doesn't have to be
moved

1235 Catalog Metal Debris
4 motors
Fairbanks Morse
~10 ft tall
~4 ft wide
length depends on # of
cylinders
3 motors are 2 cyl 8'
1 motor has 4 cyl 14"

— They are mounted on
Massive concrete foundation
that appear to be 5 to 8'
deep & likely into bedrock

— I believe material can be
removed from surroundings w/o
compromising them.

Cary A Bu 10-29-09

Questions

— Can we put wood debris
metal debris POL Contaminated
& Inorganic contamination
in a Monofill

— If we mix waste in
the repository how
do requirements change

— Wood disposal options
— Metal disposal options
— Tailings disposal options
— What qualifies for Vegetation
or top soil in SE Alaska

Cary & Mark 10-29-09

1245 Mark is still digging holes West of Mill building
- He's encountered some petroleum
☆ Wood debris varies greatly in size from 2x4's up to 18" square timbers
Nearly all has nails throughout and some has bolts or even metal tie rods
* Lower portion of upper area has 6'x8' concrete structure and tailings like material on the north side of it
- Timber in this area is 2x8 & larger 12x12"
** Best to estimate using original building dimension
- Mid level Wall Height is 16ft
- N/S Wall is 18.5Ft
- Roof is peaked

Cary ABurr 10-29-09

Cost Items

- Screener for Rock Material 2"&4" & larger
- Helicopter
- Top Soil
- Saw Dust

Cary & Mark 10-29-09
overcast ~45°F

1330 Map out tailings limits surrounding the MAL site
— Mark says tailings just north of barge limit shown on our maps
— It measures out to be 50ft north/south about 5ft tall relative to surroundings & width from 20 to 30ft

1500 Look at former structures East of the POL area
1st Cabin 210' East of tree line

1515 Leave site & take final tide photo
1600 Back to truck and Lake trail head
— Nelli from Village of Kasaan takes off

1620 At borrow pit #1 to take rock sample
1630 Hiked into Glory Pit
1700 Head back to town
1715 At Thorne Bay Landfill to check Top Soil

Cary A Burn 10-29-09

— Surface of Landfill doesn't really have vegetation. Surface consists of bare patches of top soil, small alders, small spruce & moss
— No signs of erosion
— It appears to me that O&M is actively removing trees.
— Top soil is very dark and organic rich, wood chips visible in places

1745 Done for day.

Cary A Burn
10-29-09

Cary Brown & Mark Vance 10-30-09

6:15 Tim drives project team from Thorne Bay to Hollis Ferry
9:00 On ferry to Ketchikan
11:00 Arrive Ketchikan
11:30 At Airport
13:30 Fly to Seattle
Others still waiting for flights
15:15 Arrive in Seattle
16:45 Done for Day

Cary L Brown
10-30-09

SaltChuck 2009 Site Visit

"Rite in the Rain"®

ALL-WEATHER

UNIVERSAL

No. 371

"Rite in the Rain"®
ALL-WEATHER WRITING PAPER

Name M. VAnia

Address URS

Phone (907) 361-9755

Project 2009 Salt Chuck site visit
Job# 26219785

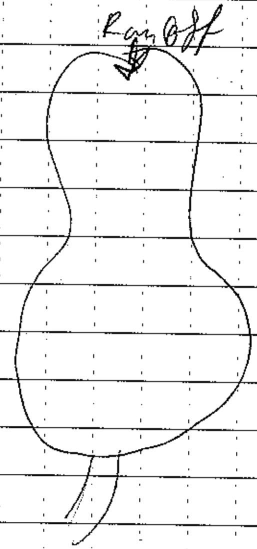
CONTENTS

PAGE	REFERENCE	DATE
	Cory Brown cell (206) 419-3038	
	Michael Wilcox - Office (907) 586-9379	
	Adventure AK (907) 828-3907 - Jason	
	Welcome Inn (907) 828-3950	
	Michael Wilcox cell - (~~907~~) 723-1860	
	Mike Gray cell 360-7781	345-5606

10/28/09

0830 arrive 1st Borrow pit for pref recon
High walls slopes [illegible]
Road Recent clearing ~~and~~ of trees around edges.

0915 Arrive 2nd Borrow Pit.
Larger than 1st Runoff Problem on west? side
180 - 150 - 60



10/28/09
0942 arrive down site Parking lot for water pipe

1026 Electrical Loco.
~~post~~ No Batteries outside of Loco
Confirm that we have sampled ~~atm~~ soil around Loco
- FS wants batteries to go away Acry agrees but it is up to SSTO

1100 Arrive millsite
[illegible] high in [illegible]

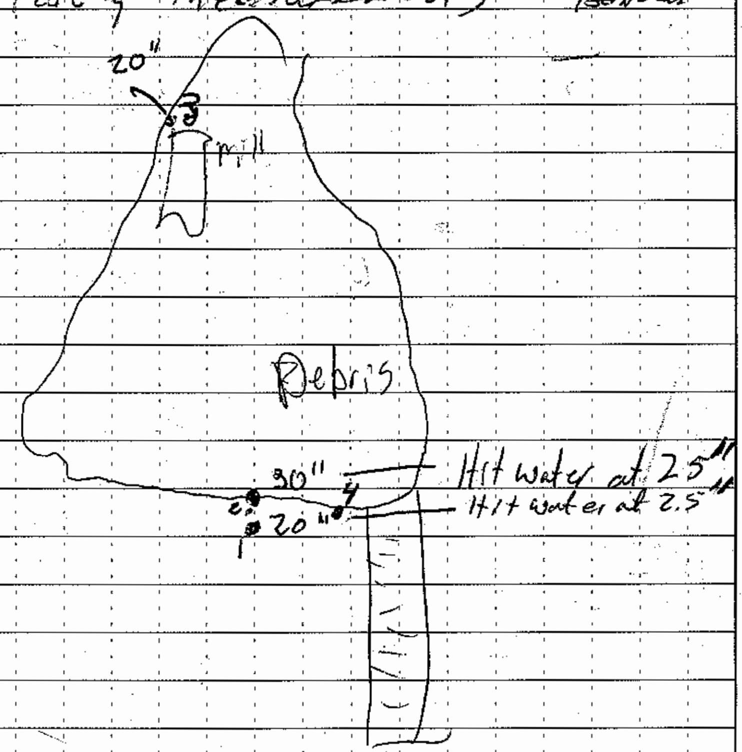
10/28/09

Mill site is built on waste Rock NOT tailings - tailings are intermixed. Moris

Bench that mill site on is 10' - 6' high. from Hightide Line

TP4 at edge of mill Debris
Hit H_2O at 25" ~
Water has heavy Hydrocarbon
odor + Sheen

10/28/09 Measurements to Refusal not Bottom
tailing measurements



10/28/09

at "Assay" shop Shop's
≈ 6' above High tide
Line

TP1 for soil Depth corner
of Assay shop. 36" trans From
Peat (Organics) to Soil - Brown
gravel - Refusal Organics are
wet at Just above Soil
Horizon.

TP2 at corner of Drum Crib
30" Black organics get
wet.

TP3 15' from Drum Crib.
30" to Refusal
No Hydo odor.

TP4 20" Refusal Black soil no
Odor. 15' from NE Corner
Drum Crib.

10/28/09

1400 TP5 - 12' North of Drum Crib
20" No Hydro odor. Black soil

TP6. 1/2 way between Drum Caches
20' to Refusal Black organics
No Hydro odor.

TP7 to west of TP6 - 25" Refusal (Rock or gravel)
Black soil ~~no~~ organics No Odor

TP8 10' South west of SW Corner
upper ~~of~~ Drum cache 25" ~~E?~~
Black soils 25" - Light Brown
soil with gravel. No hydro odor

No Hydro — TP9 5' south of SW corner of
AST pad 24" to refusal 6" of
Black organics 18" of Lt Br
Soil

~~TP~~
No Hydro odor — TP10 - 25' SE of ASTs.
Black soil to 20" Water at 20"
Lt Brown soil to gravel at 24"

10/28/09

TP11 East of upper Drum Cache - 30" 18" to Refusal
all Black soil water at 20"
No Hydro C odor

TP12 10' North of TP4
Bolders at 12" bgs 2t Brown Soil at 18"
no odor water in TP

1530 walk out gate

~~1600~~ Collie

10/28/09

meeting with MW

2048 - Build Debris Laydown clean yard on west end of mill

Reveg? - No Top soil - Look at Thorne Bay Landfill what material Did they use

Trees + Stumps michael will talk with Forester.

Debris - keep most here
- Anything not safety hazard - stage + place Back.
main goes metal with sharp edges
metal Siding - goes small non Haz Stays
cold metal attached to wood wood stays

16/29/09

0930 Arrive site
Overcast light Rain & Wind.

TP2 6' south of TP with petro odor
Hit Hydrocarbon at 12' bgs.

TP3 20' south of TP1 - 10/29/09
Hydro impacts encountered at
4' bgs ; 4ft of tails to
Refusal at 4' picking up grass
+ wood debris. bottom of tails?

TP4 20' North of Present High
tide - slight Hydro odor at
20" not very strong. 20" of
tailings, 5' west of Barge

TP5 30" Refusal all tailings
no water No odor.
30' SW of TP1

Scale: 1 square=______

16/29/09

1200 at millsite tailings
Depth TPs

TP1 at SW corner of mill
6-8" tailings over gravel w/Tailings

TP-2 8' West of mill 6" of
crushed gravel over tails
~~depth unknown~~ Tails to 48" No odor, no water.

TP3 - 20' West of mill 24" of
Tailings only at 24" hit Gravel

TP4 6" soil on top of Tailings/gravel
depth unknown

TP5 10' North of TP4
Black/Grey Hydro impacted tailings.
Black soil to 20" Green tailing
below But still Hydro odor
24" Refusal. no ground water
TP6 - Tailings to 30" bgs
then gravel. Little water. 20" bgs

(Holes Dry to 20" bgs)

Scale: 1 square=______

10/29/09

TP7 8' SW of TP 6
24" to Refusal Slight
Hydro odor. 24" of Tailings

TP8 8' North of ~~8~~ TP 5
Hydro carbon Impacts from
Surface to 20" bgs
hole filled with water
could NOT Dig Deeper.

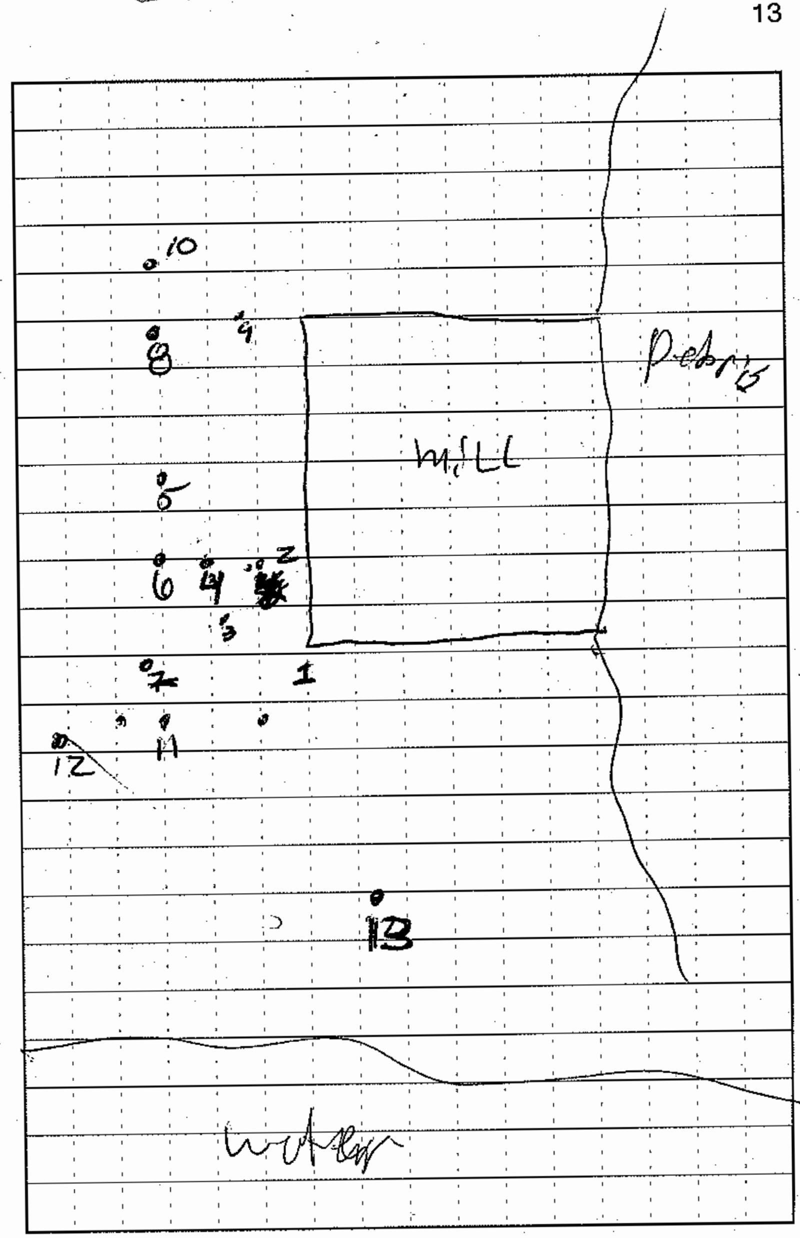
TP9 13" tails - no odor - Water

TP10 15" Tails + gravel no odor
- Water

TP11 20" all gravel - Refusal
15' South of TP 6 no
odor

TP12 8' west of TP 11 24"
all tailings - Refusal

Tailings are not Consistent spotty
across west side of mill.



10/29/09

TP13 8" of tailings after
Rock - Refusal

1400 at East Side of
mill - tailing Pile North of
Northend of Barge - Covered
with wood debris
has not Been mapped
30 X 15 mix of tails + Waste
Rock. at Least 36" Deep.

1414 in POL Area Looking for
Area of highest POL
Dug test pit in Bldg Foundation
That is not on current figures
TP12 20' south of center of Bldg.
No odor no water to 20"

TP13 - Center of Bldg. - Hot

TP14 - Hole to 36" - water And
Hydro odor,
TP15 - North side of Foundation
Slight odor at 30" bgs.

Scale: 1 square=______

10/29/09

TP16 25' South of ASTs
slight odor at 30" bgs.

TP17 SE Corner of Bldg.
Odor at 30"

TP18 20' East of SouthEast
corner of Foundation

TP19 40 west of Bldg. No odor
at 30". wet

1518 offsite to Borrow pits
+ Thorne Bay Landfill.

Scale: 1 square=______

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APPENDIX C

UPLAND LABORATORY ANALYTICAL DATA FOR 2002 INVESTIGATION

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URS

Memorandum

Date: January 5, 2009

To: Michael Gray, URS Anchorage

From: Geoffrey Garrison, PhD, URS Seattle

Subject: **Static Test Results**
Salt Chuck Mine
URS Project No. 26219785

INTRODUCTION

URS was retained by the US Forest Service to assess acid base accounting (ABA) analytical data for two samples from the former Salt Chuck Mine area on Prince of Wales Island, Alaska.

URS completed a site visit to the site on October 28 and 29, 2009. During the site visit URS inspected material in historic waste rock piles situated around the former mill building and collected two samples: MSWR-1 and MSWR-2.

GEOCHEMICAL ANALYSIS

Samples were submitted to ALS Chemex laboratories out of Reno, Nevada, for static geochemical ABA testing. Results included:

- fizz test
- paste pH
- total sulphur
- sulphur as sulfate
- sulphur as sulfide
- bulk acid neutralization potential (NP) by the modified Sobek method[1,2]
- acid potential (AP), net neutralization potential (Net-NP; Net-NP = NP-AP), and neutralization potential ratio (NPR; NPR = NP/AP).

GEOCHEMICAL RESULTS

Samples MSWR-1 and MSWR-2 had nearly equivalent NP values of 32 and 38 kilograms of calcite equivalent per tonne (kg $CaCO_3$/t), respectively (Table 1). Sample MSWR-1 had 0.55 % by weight (wt.%) sulfide sulfur, which is equivalent to an AP of 17.2 kg $CaCO_3$/t; the sample had a net NP of 14.8 kg $CaCO_3$/t and an NPR of 1.9. Sample MSWR-2 had 0.10 wt.%, which is equivalent to an AP of 3.1 kg $CaCO_3$/t; the sample had a net NP of 34.9 kg $CaCO_3$/t and an NPR of 12.2. Each sample had minor amounts of sulfate (0.02 wt.%) which suggests that either there has been negligible

[1] Skousen, J., Renton, J., Brown, H., Evans, P., Leavitt, B., Brady, K., Cohen, L. and Ziemkiewicz, P. (1997), Neutralization Potential of Overburden Samples containing Siderite, Journal of Environmental Quality, v26, n3, p673-681.

[2] Sobek, A.A., Schuller, W.A., Freeman, J.R. and Smith, R.M. (1978), Field and laboratory methods applicable to overburden and minesoils, EPA 600/2-78-054, 203pp.

sulphide oxidation within waste rock piles, or sulphide oxidation products are readily flushed away by precipitation or snowmelt infiltration.

CONCLUSIONS

- Sample MSWR-1 had a low NPR value of 1.9 and a low net-NP value of 14.8 kg $CaCO_3$/t. This sample is thus considered potentially acid generating (PAG).
- Sample MSWR-2 had a higher NPR value of 12.2 and a higher net-NP value of 34.9 kg $CaCO_3$/t. This sample is thus considered non acid generating (BAG).

Attachments:
Table 1 Acid Base Accounting Results
Laboratory Analytical Report

Table 1
Acid Base Accounting Results
Geochemical Assessment, Salt Chuck Mine

Sample #	Sample Type	paste pH	Total Sulphur (wt%)	Sulphate-Sulphur (wt%)	Sulphide-Sulphur (wt%)[1]	AP[2] (kg $CaCO_3$/t)	NP (kg $CaCO_3$/t)	Net-NP (kg $CaCO_3$/t)	NPR[3]
MSWR-1	waste rock, discrete	8.7	0.59	<0.02	0.55	17.2	32.0	14.8	1.9
MSWR-2	waste rock, discrete	8.8	0.10	<0.02	0.10	3.1	38.0	34.9	12.2
Analytical Detection Limits		0.1	0.01	0.01	0.01	0.3	1.0	0.1	0.01

Notes:
AP - Acid Potential; AP = (wt%-sulphide-sulphur)*31.25
Ca-NP - Carbonate NP based upon TIC; Ca-NP = wt%-TIC*83.3
kg CaCO3/t - kilograms of calcite equivalent per tonne of material
Net-NP - Neutralization Potential; Net-NP = NP - AP

[1] AP is calculated from the sulphur concentration as sulphide. Note, the analytical report lists Maximum Potential Acid (MPA) generating capacities calculated from the total sulfur contents.
[3] Highlighted samples are those considered potentially acid generating (PAG); that is, NPR < 4.0.