DEADWOOD MINE SITE
Boise National Forest, Idaho

FINAL
ENGINEERING EVALUATION / COST ANALYSIS REPORT

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1.0 INTRODUCTION

This report has been prepared for the U.S. Department of Agriculture, Forest Service (Forest Service), Intermountain Region and the Boise National Forest, under Forest Service Contract Number 53-84N8-1-011, for the completion of an Engineering Evaluation/Cost Analysis (EE/CA) for the Deadwood Mine. The EE/CA was prepared to support a Forest Service Non-Time Critical Removal Action. The EE/CA addresses technical alternatives for the cleanup of mining waste rock and tailings remaining at the Deadwood Mine site

On September 5-7, 2002, SAIC engineers conducted a site visit at the Deadwood Mine site. The purpose of the visit was to collect samples of the waste rock and mill tailings, perform field measurements of surface water, and measure the area and volume of waste rock and tailings piles. The resulting data and information and the analytical results from previous investigations were used to develop engineering alternatives for the cleanup of the Deadwood Mine site. Selected removal action alternatives were evaluated for their effectiveness and implementability. Cost estimates were prepared for the selected cleanup alternatives.

The EE/CA report is organized into eight sections. An overview of the information provided in each section is presented below:

Section 1.0 **INTRODUCTION.** Section 1.0 discusses the purpose and scope of the Deadwood Mine EE/CA and outlines the organization of the report.

Section 2.0 **SITE DESCRIPTION.** Section 2.0 summarizes information on the local geology and describes mining related disturbances and structures at the site.

Section 3.0 **SITE CHARACTERIZATION AND RISK SCREENING.** Section 3.0 provides a summary of site investigations and surveys conducted at the site, presents analytical results, and compares analytical data with BLM risk screening criteria for the Deadwood Mine site.

Section 4.0 **IDENTIFICATION AND SCREENING OF REMOVAL ACTION TECHNOLOGIES.** This section presents Forest Service removal action objectives for the site, identifies potential removal action technologies, and develops a list of removal action alternatives for further evaluation.

Section 5.0 **DESCRIPTION OF REMOVAL ACTION ALTERNATIVES.** This section provides an engineering description of selected preliminary removal action alternatives considered for cleanup of the Deadwood Mine site.

Section 6.0 **ALTERNATIVES EVALUATION.** This section evaluates the effectiveness, implementability, and cost of each preliminary removal action alternative using the CERCLA criteria for remedy selection. This section also identifies recommended removal action alternatives for the Deadwood Mine site.

Section 7.0 **RECOMMENDATIONS FOR FURTHER ACTIONS.** Section 7.0 identifies further actions that may be required to characterize the site or implement the recommended removal actions.

Section 8.0 **REFERENCES.** This section provides the references cited in the text.

Tables and figures follow Section 8.0. Selected Photographs of the Deadwood Mine site are provided in Appendix A. Potential Applicable or Relevant and Appropriate Requirements (ARARs) for the Deadwood Mine site are provided in Appendix B. Detailed cost estimates for each of the removal action alternatives are provided in Appendix C. A summary of the SAIC Data Validation Report is provided in Appendix D.

2.0 SITE DESCRIPTION

This section describes the location of the Deadwood Mine site, summarizes information on the local geology (Idaho Geological Survey, undated), and describes mining related disturbances and structures at the site. The description of the Deadwood Mine site is based on the Preliminary Assessment/Site Inspection (PA/SI) Report prepared by the Environmental Protection Agency (EPA) Region 10 Superfund Technical Assessment and Response Team (START, 2000) and from observations made by SAIC field personnel during their site visit, September 5-7, 2002. Selected photographs of the site are provided in Appendix A.

2.1 Site Location

The Deadwood Mine site is located in the Boise National Forest approximately 25 miles (45 miles by road) east of Cascade, Idaho (Figure 2-1). The mine is located in Sections 11 and 12, Township 13 North, Range 7 East of the Boise principal meridian. The area that is subject to this report is located in the southeast quarter of Section 11 (Figure 2-2). The mine is located in the Deadwood River valley, adjacent to the Deadwood River upstream of Deadwood Reservoir at an elevation of approximately 5,800 feet above sea level. The site includes both public and private lands. Forest Service Road 579 provides public access to the mine site.

2.2 Site Description

The Deadwood Mine is an inactive, underground, silver, lead, and zinc mine. The site, which encompasses approximately 100 acres of surface disturbance, is located at the base of a steep hillside adjacent to the Deadwood River. The site is not fenced.

The Deadwood River flows north to south. A wetland area is located on the west side of the Forest Service Road between the road and the river, and an unnamed creek flows from the east through the eastern waste rock pile and enters the Deadwood River to the southwest of the mine site (Figure 2-3).

Mining disturbances at the site include the mine adit, several mining related structures (including the former mill building), two waste rock piles, and a tailings pile (Figure 2-3). These disturbances are located east of the Deadwood River. The Deadwood adit is located on the hill slope approximately 100 feet above the valley floor. The adit has collapsed. A small amount of water flows from the adit and into the unnamed creek.

The mine site contains two waste rock piles. One is located to the southeast of the old mill building and the second is located to the northwest. The southeast pile is located on private property and cleanup of this pile is not included in this analysis. The northwest pile is located on Forest Service lands. It has a length of approximately 345 feet and extends from the mine portal elevation downward to about 120 feet below the portal elevation along the side of a hill. Based on megascopic mineral examination in the field, the material consists of mainly quartz monzonite rock with the largest average fragment size of about four inches in diameter. The material can be classed as poorly sorted with the diameters of the smallest fragments measured at less than one hundred microns. The material contains small concentrations of base metal minerals that appear to be contained in the finer fractions.

The waste rock pile is located on a steep hillside having average underlying surface slopes of 32 to 40 degrees based on measurement of the exposed hillside above the pile. The average slope beneath the waste rock pile is estimated to be 36 degrees. The face of the pile has an angle of repose, which varies from 36 to 39 degrees depending on the amount of armoring. This armoring is caused by the weathering of the indigenous minerals located within the pile. The angle of repose for the majority of the pile is about 39 degrees; the number used for the volume calculations. The amount of material contained in the northwest waste rock pile is calculated to be 21,000 cubic yards, plus or minus 20 percent.

Four intact or partially intact buildings remain at the Deadwood Mine site. Three buildings, including the mine office, the bunkhouse, and a small house or cabin are located on patented land. The fourth building, the remains of the former mill, is located on the National Forest. The locations of the buildings are shown on Figure 2-3.

The site contains an area where tailings have been placed as part of the milling operation. The tailings area is located to the west and north of the mine and the mill building in a relatively level area along the valley bottom on the east side of the Deadwood River. The estimated thicknesses of the tailings range from 0 to 12 feet. The estimated thickness is based on field mapping and projection of adjacent topography. It would be necessary to drill the area to develop more accurate volume estimates.

The tailings area consists of material associated with two impoundments. The tailings located at the base of the slope, west across the road, and toward the river consist of an earlier impoundment having an estimated average thickness of six feet. A second impoundment (the newer impoundment shown on Figure 2-3) was constructed on top of the first impoundment on the east side of the road. The newer impoundment has an estimated average thickness of six feet.

The physical composition of the material contained in the two impoundments appears to be similar, based on the collected data. The configuration of the top impoundment (the newer impoundment) is currently allowing the wind to move material from the outer dike areas, creating sand dunes. No vegetation is supported in the dune areas. Both the older and newer impoundments support limited amounts of vegetative cover that includes scattered lodge pole pine and very small amounts of grasses.

Forest Road 579 runs approximately through the center of the old tailings area for a distance of about 600 feet. The road is a two-lane gravel road having a total width of 20 to 25 feet. The road has been developed in tailings materials and becomes dusty during dry weather conditions.

The tailings located from the east edge of the road and westward, appear to be related in time to the older deposits located on the east side of the road. The thickness of this portion of the material is currently estimated to average three feet. An area of approximately 0.15 acres, located in the northern part of these tailings is nearly devoid of vegetation. The reason for the lack of vegetation is not currently known. The remainder of the tailings-covered area is heavily vegetated by lodge pole pine trees. The cover also includes grasses and wild strawberries. The trees have an estimated density of approximately one tree per square yard. The trees range from

saplings to trees having a maximum diameter of greater than 10 inches. The trees and vegetation appear to be healthy and in good condition. The volume of material in the old impoundment is estimated to be 54,000 cubic yards and the volume in the new impoundment is estimated to be 16,000 cubic yards. The estimated volumes are accurate to plus or minus 20 percent.

Based on the field inspection, it is probable that an area located between the west edge of the old tailings and the Deadwood River could also be underlain by tailings. This area has a thick cover of trees, willows and grasses. The amount of vegetation cover makes visual inspection of the surface difficult. The thickness of these suspected tailings, for costing purposes, is estimated to be two feet. If correct, the area could contain as much as 5,000 additional cubic yards of tailings. The vegetation in this area appears to be healthy.

2.3 Mining History

Mining activities began in the area in the early 1860's following discovery of placer gold along the lower portion of the Deadwood River. The first lode claims were staked in the area in 1876 (SAIC, 1999). The claims reportedly produced silver, lead, and zinc.

The Lost Pilgrim Mine was one of the first in the district that shipped ore. This mine was located on the northwest flank of Pilgrim Mountain above Lost Pilgrim Creek. Ore was shipped to Ketchum, Idaho by pack train for smelting. The Lost Pilgrim Mining Company received title to these claims in 1921.

The Independence claims were located by J. C. and J. S. Hall in 1903. These claims bordered the southwestern ends of the Lost Pilgrim Mining Company claims. The claims were transferred to the Hall Interstate Mining Company sometime before 1916.

Between 1924 and 1931, Bunker Hill & Sullivan Mining & Concentrating Company (Bunker Hill and Sullivan) obtained leases and options on both the Lost Pilgrim claims and the Hall claims. Bunker Hill & Sullivan built a camp at the mine including a boarding house, hydroelectric power plant, shops, a sawmill, and various ancillary buildings. The existing adit,

located on the east side of Lost Pilgrim Creek, was extended northeastward to access both of the leased properties. By 1928, a mineral processing mill was constructed and the property became one of the largest and most important mining operations in south-central Idaho (SAIC, 199X). The ore was crushed and processed using a newly-devised (at the time) flotation method. The method involved fine grinding the rock and then floating the silver and lead on the surface of the water where it could be skimmed off and retained. Following removal of the recoverable metal, the remaining ground rock (tailings) was sent to a settling pond where the water would be decanted and either be re-used or allowed to flow away. The mine was closed during 1931, and the leases and options were terminated the next year.

The mine was inactive until 1941 when Callahan Zinc-Lead Company again began development on the property. They called their activities the Deadwood Mine. Callahan operated the Deadwood Mine through World War II. The mine closed again in 1947, following the end of the war.

In 1952, through a series of transactions Webber Appel purchased the claims and worked the mine intermittently until 1963. The claims were then transferred to the Frontiersman Corporation, which might have performed some work on them until the end of the 1960s. Based on available information and the general appearance of the property, it is unlikely that any significant production occurred after 1947.

2.4 Site Geology

The Deadwood Mine is a silver-lead-zinc deposit in biotite grandodiorite of the Cretaceous Idaho batholith. The ore is a mixture of galena (lead sulfide), sphalerite (zinc sulfide), and tetrahedrite (a copper, iron, and antimony sulfide that often contains zinc, lead, mercury, cobalt, nickel or silver replacing the copper) in a gangue of siderite (iron carbonate), quartz, and altered wall rock. The steeply dipping vein strikes northeast, and the location of the ore bodies is controlled by fractures and shear zones. Quartzite and schist intrusions are found in or near the mine. Numerous Tertiary dikes (ranging from rhyolite to diabase) have been noted in the area, but the

relationship between the dikes and mineralization are unclear (Idaho Geological Survey Inventory Report, unknown date).

3.0 SITE CHARACTERIZATION AND RISK SCREENING

This section characterizes soil and surface water contamination at the Deadwood Mine site. The results of the previous PA/SI investigation conducted for the EPA (Region 10) are summarized. Detailed results are provided for samples collected by SAIC during the September 2002 EE/CA site visit. Risk screening is performed by comparing the analytical results to Bureau of Land Management (BLM) human health and ecological risk management criteria for metals at mine sites (Ford, 1996, and BLM, 1998).

3.1 Deadwood Mine Preliminary Assessment/Site Inspection

Ecology and Environment, Inc (E&E) as part of the START contract with EPA Region 10 investigated the Deadwood Mine site in 1999 and 2000. The objectives of this investigation (E&E, 2000) were to collect and analyze samples to characterize potential sources of hazardous substances, determine the off-site migration of contaminants, and document potential threat to public health and the environment. The EPA PA/SI included collection of subsurface soil, surface water, and sediment samples.

Fifteen subsurface soil samples, including 13 investigative and two background subsurface soil samples, were collected at the Deadwood Mine site. The soil samples were discrete located grab samples collected 12 to 18 inches below ground surface (bgs). The investigative samples were collected from potential on-site sources including the tailings pile, waste rock piles, and the former mill area.

Four subsurface soil samples were collected from the tailings pile located in the northwestern portion of the site. The subsurface soil was reported to appear to be silty, fine-grained sand. Antimony, arsenic, cadmium, copper, lead, manganese, mercury, selenium, silver, and zinc were detected in concentrations that the E&E (2000) report identified as significant. For the purposes of this investigation, significant/elevated concentrations were those concentrations that were at least three times the background concentrations when the background concentration equals or exceeds the laboratory detection limits.

Four subsurface soil samples were collected from the waste rock pile north of the former mill building. The samples were reported to consist of gravelly sand with loam. Antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc were detected in significant concentrations (E&E, 2000).

Three subsurface soil samples were collected in front of the former mill and two benches. The subsurface soil was reported to consist of gravelly sand with loam. Antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc were detected in significant concentrations.

Eleven surface water samples, including three background samples, were collected from the Deadwood River, the unnamed creek, the seep (believed to be the drainage from the adit), an upstream background location on the Deadwood River, and an up-gradient background location south of the site. Zinc was identified at an elevated concentration in one of the wetlands surface water samples. Arsenic and zinc were detected in elevated concentrations in the unnamed creek water sample. Arsenic, manganese, and zinc were detected in elevated concentrations in the seep water sample.

Eleven sediment samples, including three background samples, were collected from the Deadwood River, the unnamed creek, the seep, an upstream background location on the Deadwood River, and an up-gradient background location south of the site. These samples were collocated with their respective surface water samples. The sediment samples were collected at depths of 0 to six inches bgs. Arsenic, cadmium, copper, lead, and zinc were detected in elevated concentrations in one of the wetlands sediment samples. Arsenic was detected at an elevated concentration in one of the Deadwood River sediment samples. Antimony, arsenic, manganese, and zinc were detected at elevated concentrations in the seep sediment sample. Arsenic, cadmium, copper, lead, manganese, mercury, selenium, silver, and zinc were detected at elevated concentrations in the wetlands subsurface soil samples.

The results of the PA/SI concluded that the Deadwood Mine is a source of antimony, arsenic, cadmium, copper, lead, manganese, mercury, selenium, silver, and zinc contamination. All these analytes were detected at significant concentrations in on-site-source samples including the

tailings and waste rock piles and in the vicinity of the mill. Arsenic, cadmium, copper, lead, manganese, mercury, selenium, silver, and zinc were detected at elevated concentrations in the wetland subsurface samples. None of the analytes were detected at significant concentrations in the Deadwood River surface water samples. Arsenic and zinc were detected at elevated concentrations in the unnamed creek. Arsenic, manganese, and zinc were detected at elevated concentrations in the seep. The PA/SI report recommended further investigation and follow-up action.

3.2 SAIC Site Visit

On September 5-7, 2002, SAIC engineers conducted a site visit at the Deadwood Mine site. During the site visit, SAIC field personnel collected surface soil samples for metals analysis and conducted surface water field measurements. Following consultation with Forest Service personnel in the field, no surface water samples were collected for chemical analysis. Surface soil samples were analyzed for antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, mercury, manganese, molybdenum, nickel, selenium, silver, thallium, and zinc using EPA SW-846 analytical methods 0610B and 7471A. SAIC also performed independent data validation on the analytical results. A summary of the results of the data validation are provided in Appendix D.

The results of the field measurements taken during the SAIC site visit are presented in Table 3-1. Surface water at the Deadwood Mine site is generally neutral (pH between 6.0 and 8.0) and low in total dissolved solids, as indicated by the specific conductance measurements. The mine water discharge has a pH of 6.54 as it exits the portal and a higher specific conductance (171.2 micro Siemens [µS]) than the surface water in the Deadwood River. The mine water increases in pH and specific conductance (a measure of dissolved solids) as it crosses the mine waste pile.

SAIC personnel collected eight subsurface soil samples from the waste rock and tailings piles during the site visit. Sample number 090602-3 is a duplicate of sample number 090602-2. The results of the analyses of these samples are presented in Table 3-2. All of the metals analyzed were identified in the samples. Iron, zinc, lead, and manganese were identified in the highest

concentrations. Lead and zinc are toxic metals. Other toxic metals identified in the tailings and waste rock in moderate concentrations includes silver, arsenic, barium, cadmium, copper, nickel, and antimony. Beryllium, chromium, mercury, molybdenum, selenium, and thallium were identified in relatively low concentrations compared to the other metals identified.

3.3 Risk Screening

Metal concentrations in waste rock, tailings, and surface water samples were compared to BLM risk management criteria for metals at mining sites to evaluate the potential risk posed by these metals. Criteria have been developed for both human health and ecological concerns. The following guidelines (Ford, 1996) are recommended in applying the BLM criteria because of various toxicological and site-specific uncertainties:

- Less than or equal to the criteria: Low Risk;
- >1 to 10 times the criteria: Moderate Risk;
- >10 to 100 times the criteria: High Risk; and,
- >100 times the criteria: Extremely High Risk.

The analytical results for metals in surface water (Deadwood River, unnamed creek, seep, and wetlands) from the PA/SI Report were compared to the BLM risk management criteria for campers (Table 3-3). The results indicate that the water from the seep is unsuitable for use by campers because of arsenic concentrations. However, it is unlikely that campers would use the water from the seep.

The analytical results for metals in the waste rock and tailings piles collected by SAIC were compared to the BLM Human Risk Management Criteria for metals at mining sites (Table 3-4). The results of the comparison indicate the metals concentrations in the waste rock and tailings present a potential human health risk. All of the metals except nickel and selenium exceed BLM residential criteria. Arsenic and lead are the primary metals of concern. Arsenic concentrations would represent a high risk to residents, and a moderate risk to campers and workers. Lead

concentrations in the waste rock would represent a moderate risk to residents and All Terrain Vehicle (ATV) drivers. No one resides at the mine site, and it is unlikely that campers will use the mine site. However, recreation visitors including ATV drivers may visit the mine site.

Metal concentrations in waste rock and tailings at the Deadwood Mine site pose a risk to wildlife (Table 3-5). The lead, cadmium, and zinc concentrations in the waste rock and tailings exceed the BLM risk management criteria for most animal species for which the BLM criteria have been developed. Arsenic and copper exceed the risk management criteria for small birds. Surface water metals concentrations were compared to EPA Ambient Water Quality Criteria (Table 3-7). Lead concentrations in the Deadwood River exceed the EPA chronic criterion for aquatic life. However, these concentrations are less than the concentration in the sample collected upstream from the Deadwood Mine site (sample number BG04SW).

4.0 IDENTIFICATION AND SCREENING OF REMOVAL ACTION TECHNOLOGIES

This section describes the Removal Action Objectives (RAOs) and identifies removal action technologies selected for further consideration at the Deadwood Mine site. The RAOs address the environmental hazards and Forest Service concerns with the Deadwood Mine site. Removal action technologies available to meet the RAOs are identified and screened to select technologies for further consideration in the alternatives evaluation (Section 6.0).

4.1 Removal Action Objectives

The overall purpose for undertaking removal action at the Deadwood Mine site is to address human health and environmental concerns associated with the Deadwood Mine tailings and waste rock piles located on public land. At the direction of the Forest Service, this EE/CA does not address human health and environmental concerns associated with the Deadwood Mine adit or the waste rock pile located on private property.

Consultation with the Forest Service and review of available site characterization data indicate that the primary environmental and physical hazards and issues associated with the Deadwood Mine site include the following:

- There are approximately 21,000 cubic yards of waste rock in the northwest waste rock pile, which is located on a steep hillside. The waste rock in the pile is subject to erosion and surface water release. The risk screening indicates that lead concentrations could pose a risk to human health.
- Approximately 70,000 cubic yards of tailings remain at the site in the new and old piles, with another 5,000 cubic yards potentially present in the suspect area. The Forest Service road bisects the old tailings pile and appears to be constructed with tailings material. The tailings are subject to erosion and surface and groundwater release. The tailings contain metals that could pose an ecological risk to wildlife.

RAOs for the Deadwood Mine site are:

1. Reduce the potential exposure of human and wildlife receptors to toxic metals in the waste rock and tailings piles at the site;
2. Reduce/prevent the migration of metals by surface and groundwater from the waste rock and tailings piles; and
3. Stabilize/remove tailings used in the Forest Service road to reduce erosion and dispersion.

4.2 Identification of Removal Action Technologies

Removal action technologies that are likely to achieve Forest Service RAOs are identified and described in this section. These technologies are then screened against CERCLA criteria and a "short-list" of technologies is developed for further consideration.

Potential removal action technologies are identified that address the elevated levels of metals in the waste rock and tailings piles. The technologies have been identified based on previous experience with similar projects and a review available literature. This preliminary identification of technologies is not all-inclusive, but rather provides an overview of relevant technologies that could be implemented to protect human health and the environment. These technologies are classified into five basic categories:

- Institutional Controls – non-engineered instruments, such as administrative and/or legal controls, that minimize the potential for human exposure to contamination by limiting land or resource use;
- Access Controls – measures that prevent or minimize public exposure by limiting access or use of impacted areas;
- Engineering Controls – measures, such as caps and drainage controls, implemented to minimize contaminant mobility and exposure to the environment. (Engineering controls include excavation and on-site disposal.);
- Treatment – destruction or immobilization of contaminations by treatment of contaminated materials; and

- Excavation and Off-Site Disposal – excavate and dispose of contaminated material in off-site permitted disposal facility.

Each technology will be preliminarily screened in this section to determine if it should be retained for further evaluation. Retained technologies will be evaluated in the comparative analysis of alternatives.

4.2.1 Institutional Controls

Institutional controls are governmental controls, proprietary controls, enforcement and permits, and informational devices. Institutional controls include zoning restrictions, ordinances, building permits, easements, and covenants that restrict land use at a site. Institutional controls also include informational tools that provide information/notification that contamination may exist/remain at a site, such as deed notices or advisories.

4.2.2 Access Controls

Access controls involve the use of physical barriers to reduce the potential for exposure to hazardous substances that would otherwise need to be removed or treated to protect human health and the environment. Physical barriers such as fences are easy to construct and can, in some circumstances, be protective of human health and the environment. Access controls are usually not effective in removing the source or reducing the migration of contamination, but instead limit exposure to contaminated materials. Some potential access controls are described below.

Fencing

Fencing would consist of constructing a fence around the perimeter of the waste rock and tailings piles areas to restrict access to the waste rock and tailings piles. Access to the waste rock and tailings piles would be through a locked gate only.

Signs

This technology involves posting restricted access warning signs around the site and the perimeter of the waste rock and tailings piles.

4.2.3 Engineering Controls

Engineering controls involve using engineered structures to restrict the movement of waste rock and tailings and limit exposure to hazardous substances. This includes controlling percolation through the waste rock and tailings piles, run-on to the waste rock and tailings piles, and the migration of contaminated sediment or water. Some potential engineering controls are described below.

Covering the Waste Rock and Tailings in Place

Covering the waste rock and tailings in place could be utilized to minimize erosion from the existing waste rock and tailings piles. Covers also reduce potential human and environmental exposure to the toxic and hazardous materials. RCRA Subtitle C, RCRA Subtitle D, and reclamation covers were considered as potential covers for the waste rock piles.

RCRA Subtitle C Cover

A RCRA Subtitle C cover consists of a low hydraulic conductivity geomembrane/soil (24 in.) layer, a drainage (12 in.) layer, and a top vegetation/soil (24 in.) layer. The objective is to limit infiltration of water to the waste so as to minimize creation of leachate that could possibly escape to groundwater sources.

RCRA Subtitle D Cover

A RCRA Subtitle D cover generally consists of 18 inches of low hydraulic conductivity (10^{-5} cm/sec) geomembrane/soil layer and a top vegetation/soil layer (6 in.).

Reclamation Cover

A reclamation cover generally consists of a soil and/or rock layer designed to minimize physical contact with the waste rock or tailings piles, and provide a growth media for vegetation. A

reclamation cover may also reduce the leaching of toxic or hazardous substances from the waste rock and tailings piles.

A reclamation cover is sufficient to meet the RAO's for this site. The materials to construct the cover may be obtained from several sources.

In some cases the requirements for these cover materials can be met by using inert waste material from the mining process or other operations; more often, some of the materials have to be imported, borrowed on-site, or created.

Excavation and Consolidation in an On-Site Cell

Existing waste rock and tailings could be excavated and consolidated into a single engineered cell on the site. The cell would be designed to minimize infiltration of rainwater and snowmelt, reduce leachate generation, minimize contact with surface waters, and reduce migration of toxic metals. The cell would be located in an on-site area where it would be as "high and dry" as practical in terms of potential contact with groundwater and surface water.

Control Run-on and Run-off

Controlling run-on water involves reducing surface water contact with the waste rock and tailings (i.e., controlling run-on to the waste rock or tailings piles). Controls would be implemented to reduce run-on and prevent seasonal water drainage from contacting the waste rock piles and causing dispersion of the waste rock and tailings containing potentially toxic metals.

4.2.4 Waste Rock and Tailings Treatment

Treatment technologies potentially useful for treatment of waste rock and tailings produced by mining operations are numerous. Because it is not feasible to destroy metals, most treatment options immobilize or extract these constituents. Some potential treatment technologies for the waste rock and tailings piles are discussed below.

Soil Washing

Metals in the waste rock and tailings from the site may be separated from the material by soil washing. A portion of the metals adsorbed onto the waste material are separated and concentrated in an aqueous-based system. Chemical addition (e.g., chelation) is normally required to increase the desorption of metals from the soil. The process then requires precipitating chemicals to separate the dissolved metals from the wash water. This is strictly a soil volume reduction step, and large volumes of treatment residuals from the soil washing require treatment or disposal.

Solidification/Stabilization

Solidification/stabilization are chemical treatment processes that reduce the mobility of the metals in the waste rock and tailings. Contaminants are physically bound or enclosed within a stabilized mass, or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility. Very large amounts of stabilizing material (e.g., portland cement) and water are required. Substantial equipment would be placed on-site to store stabilizing materials, mix stabilizing material with soil and water in proper proportions, and control the process, which is similar to a concrete mixing plant. A reliable power supply and clean water supply is required. The stabilized mass would have a volume approximately 30 percent greater than the volume of the waste rock being treated. The material would either be treated in situ or disposed on-site in an engineered cell.

Chemical Reduction/Oxidation

The metals in the waste rock and tailings piles may be treated by chemical reduction/oxidation. Reduction/oxidation reactions chemically convert hazardous contaminants to nonhazardous or less toxic compounds that are more stable, less mobile, and/or inert. The purpose of this technology is to reduce the mobility of the contaminants in the waste rock and tailings. This process would involve the placement of substantial equipment on-site to store chemicals, mixing the chemicals with soil, separating metals from solution, and otherwise processing the soil and sediments. Reliable power and water supplies would be required. Significant quantities of treatment sludge would be produced that would probably require off-site disposal to a commercial facility.

4.2.5 Excavation and Off-Site Disposal

Excavation of the waste rock and tailings and off-site disposal in a permitted facility is an easily implemented technology that can be performed with standard equipment and construction methods. Excavation involves removing the waste rock and tailings from the site by means of conventional equipment. The material would be loaded into haul trucks and transported to an approved commercial disposal site. Disposal involves the permanent placement of the waste rock and tailings in a manner that reduces contaminant mobility and protects human health and the environment for the long term.

4.3 Preliminary Screening of Technologies

The objective of this section is to screen potential removal action technologies discussed in Section 4.1, and eliminate those technologies that do not meet preliminary screening criteria. These criteria will be used to evaluate the potential removal action technologies in order to develop a short list of technologies that will meet the ROAs. These screening criteria are based on site or regulatory conditions that preclude a certain technology from being implemented at the site. The preliminary screening criteria are:

- Technical feasibility;
- Administrative feasibility;
- Maintenance requirements; and
- Availability of services and materials.

These criteria are further defined in the following sections. Removal action technologies that do not meet these preliminary screening criteria will be removed from further evaluation. The list of identified remediation technologies and preliminary screening criteria is provided in Table 4.1.

4.3.1 Technical Feasibility and Implementability

Due to some characteristics of the site, including the remoteness of the area and the lack of utilities (electrical power and water), some of the technologies may not be feasible for the site. Any removal action technology that requires improved roads, water supply, electrical power, has not been proven, etc., will not be technically feasible nor can be reasonably implemented. The following technologies were not retained because they did not meet the technical feasibility criteria.

Solidification/Stabilization

Solidification of the contaminated material would require transportation of the solidification matrix to the site. The required solidification matrix is approximately one-third of the contaminated material to be solidified. This process increases the total volume of waste to be disposed in an on-site cell. Significant water and power supply are required. Overall, the technology would be difficult to implement at a remote site and is not technically feasible.

Soil Washing

Washing soil to remove contaminants requires large quantities of water, and produces large volumes of contaminated sludge and water requiring treatment. This technology would not be technically feasible at this location.

Chemical Oxidation/Reduction

Chemical oxidation/reduction requires the placement of substantial equipment on-site to store chemicals, mix chemicals with soil, separate metals from solution, and otherwise process the soil. Processing the soil is likely to take much more time than the four-month weather window. The sludge produced would probably need expensive off-site disposal. The technology would be difficult to implement at this site and would not be technically feasible.

4.3.2 Administrative Feasibility

Any removal action technologies that do not coincide with Forest Service goals and objectives will not be administratively feasible and will be removed from further consideration during the preliminary screening.

The use of property controls, land use restrictions, fencing and signs to limit access to public lands is contrary to Forest Service policy. In addition, institutional controls would not reduce the migration of toxic metals from the site.

4.3.3 Maintenance Requirements

Due to the remote location of the site and funding issues, it would be very difficult to provide regular significant maintenance for any removal action technology implemented at the site. Therefore, technologies that are considered should have low to moderate maintenance requirements. Any removal actions that require regular frequent maintenance and operational oversight will be removed from consideration during the preliminary screening. No technologies were removed that were not previously removed because they did not meet the maintenance requirements screening criteria.

4.3.4 Availability of Services and Materials

Many technologies that may be reasonably implemented at other sites would be difficult at the Deadwood Mine site due to the lack of local services and materials. For example, it may not be feasible to construct a clay cover if there is not a source of clay within a reasonable distance from the site. The preferred removal action technologies will most likely be simple in nature and can be accomplished with local equipment and expertise. Any technology requiring services and/or materials that are not reasonably attainable in the local area will be screened out and will not be further evaluated.

4.3.5 Supportive of Future Removal Actions

Any action chosen will be considered on the basis of implementation with ease to future removal actions. The Forest Service does not foresee any future actions beyond the removal actions described in this EE/CA.

4.4 Summary of Selected Removal Action Technologies

The potential removal action technologies identified in Table 4.1 were screened utilizing the above criteria, and the technologies selected for further evaluation are presented in Table 4.2. Detailed descriptions of preliminary removal actions including these alternatives are provided in Section 5 of this report.

5.0 DESCRIPTION OF REMOVAL ACTION ALTERNATIVES

This section describes the preliminary removal action alternatives for the Deadwood Mine site. Alternative 1 is to perform No Further Action. This alternative could be applied to either the waste rock pile or the tailings piles, or both the waste rock and tailings piles. Alternatives 2 through 4 address the waste rock pile only, and Alternatives 5 through 8 address only the tailings piles. These alternatives address the waste rock and tailings piles separately and offer a graded approach to cleaning up the waste rock and tailings piles. The selected removal action could implement one of the alternatives that address the waste rock and one of the alternatives that address the tailings piles. Alternatives 9 and 10 address both the waste rock pile and tailings piles. Figures 2-4 and 2-5 show the locations addressed by each Alternative and locations of trees in the mine area.

5.1 Alternative 1 – No Further Action

This alternative is to perform No Further Action at the Deadwood Mine site. The tailings and waste rock piles would remain in their current condition.

5.2 Description of Removal Action Alternatives - Waste Rock Pile

5.2.1 Alternative 2 - Cover Waste Rock Pile in Place

This alternative would leave the waste rock in place and construct a cover over the waste rock pile. It assumes that a borrow area can be developed nearby on Forest Service land possibly on the alluvial fan located on the unnamed creek above its confluence with the Deadwood River. The borrow material would be excavated, transported to the top of the waste rock pile and dumped over the edge. The slope of the cover would be reduced to an average of 30 degrees (1: 1.75 slope vertical to horizontal) to allow stabilization and development of vegetation. The slope would include terraces and be covered with brushy debris to assist in the initiation of vegetation (grass and tree species).

The work would require obtaining permission to construct an access road on private land. The access road would be constructed from the former mill area eastward across private land to the southeast waste rock pile and west across the cliff face to the northwest waste rock pile. The cliff above the old mill would require blasting to allow the travel of trucks to import the cover. The equipment required to perform the work would include a small dozer (Caterpillar Mfg. D-4 or equivalent), a medium sized dozer (Caterpillar Mfg. D-6 or equivalent), a four-cubic yard wheel loader (Caterpillar Mfg. 950 or equivalent), and two end dump trucks. The amount of material required to cover the pile as described is 54,000 cubic yards.

5.2.2 Alternative 3 - Remove the Waste Rock Pile and Place in an On-Site Repository

This alternative would consist of constructing an on-site disposal cell directly below the waste rock pile. The waste rock would then be moved downhill into the cell and covered using the material that had been previously removed from the cell.

The work would require the use a medium-sized crawler-mounted excavator, a small crawler-type dozer, and a large crawler dozer. The large dozer (Caterpillar Mfg. D-6 or equivalent) would doze a depression into the level area directly below the waste rock pile. The removed material would be placed east of the excavation so that it could be easily replaced. The small dozer (Caterpillar Mfg. D-4 or equivalent) and an excavator (Caterpillar Mfg. 225 or equivalent) would construct a road up the face of the waste rock pile from northwest to southeast. Upon reaching the top, the pile would be dozed evenly downward. Concurrently, the underlying hillside would be re-graded, terraced, and planted with grasses and trees to minimize erosion. When the entire waste rock pile was placed into the cell, the material that had been previously removed from the footprint of the cell would be place over the top, and the cell site contoured and re-vegetated. Since the slope of the underlying hillside is nearly angle of repose, its re-vegetation will most likely be difficult.

5.2.3 Alternative 4 - Remove Waste Rock Pile to a Licensed Off-Site Landfill

In this alternative, the waste rock pile would be excavated and transported to the nearest licensed landfill, assuming that the material meets the landfill standards. For costing purposes, the nearest landfill will be assumed to be located at Cascade, Idaho. The location of the disposal site cannot be determined without additional characterization of the materials.

The waste rock pile would be moved downhill for loading using a small dozer (Caterpillar Mfg. D-4 or equivalent) and a medium sized excavator (Caterpillar Mfg. 225 or equivalent) after a road was cut across the pile to allow the equipment to access the top. Upon reaching the top, the waste rock pile would be dozed evenly downward. The terracing, preparation, and seeding of the underlying slope would be performed concurrently with the movement of the material downward by the dozer.

The waste rock would be loaded into tractor-trailers at the bottom of the slope using a four-yard loader (Caterpillar Mfg. 950 or equivalent). The material would then be transported to the designated landfill for disposal. Due to the steep nature of the underlying slope, it will be difficult to establish vegetation on the hillside after the waste rock is removed.

5.3 Description of Removal Action Alternatives - Tailings

5.3.1 Alternative 5 - Import Road Surfacing to Cover Tailings in Road and Stabilize Tailings to East of Road

This alternative would leave the tailings in place below the road and raise the road where it crosses them. Surface slopes would be reduced on the wind blown areas located on the younger tailings east of the road, and soil cover would be placed over them.

Based on field data, the length of the road crossing over the tailings is about 600 feet, with an average width of about 22 feet. The tailings below the road would be graded to level and covered with two feet of clean imported gravels. The top of the gravel would then be covered

with six inches of suitable road base and graded to produce the final travel surface. This work would be done using dump trucks and a grader.

The "new" tailings area located east of the road contains steep slopes along their west and north boundaries. These steep-sloping areas are subject to erosion by wind action, and the sand fractions in the tailings from wind erosion are re-deposited as dunes nearby. The tailings slopes are as high as 1 to 2.5 (vertical to horizontal). These slopes would be reduced to no greater than 1 to 4 and covered by locally obtained soils. This work would be performed using a small crawler dozer (Caterpillar Mfg. D-4 or equivalent), a loader, and dump trucks.

The closest potential location to obtain fill and cover materials is in the alluvial area located at the base of the unnamed creek at the mine site immediately below the old mill. If sufficient equipment was available, this material could be screened to produce surface material for the road. The cost estimation assumes that all of the material can be made on-site. Based on available information, the closest working pit containing material suitable would be near Landmark, Idaho. The use of this material would result in an increase in the costs of transportation over those shown.

5.3.2 Alternative 6 - Excavate Tailings from Road Area, Replace with Road Surfacing, and Stabilize Sand Dunes to the East of Road

This alternative would include removal of an estimated three feet of tailings along approximately 600 feet of Forest Road 579, replacement of that material with clean locally-derived fill, and topped with six inches of road base. The work would require dump trucks, a grader, a dozer, and a loader. The material would be transported and placed onto the eastern portion of the existing tailings pile near the base of the slope. It would be covered with one to two feet of locally mined soils.

The tailings labeled "New" located east of the road contain steep slopes along their west and north boundaries. These steep-sloping areas are subject to erosion by wind action, and the sand fractions in the tailings from wind erosion are then re-deposited as dunes nearby. The tailings

slopes are as high as 1 to 2.5 (vertical to horizontal). These slopes would be reduced to no greater than 1 to 4 and covered by locally obtained soil. This work would be done using a small crawler dozer (Caterpillar Mfg. D-4 or equivalent), a loader, and dump trucks.

The closest potential location to obtain fill and cover materials is in the alluvial area located at the base of the unnamed creek at the Deadwood Mine site, immediately below the old mill. If sufficient equipment was available, this material could be screened to produce surface material for the road. The costing for this Alternative will assume that all material can be made on-site. Based on available information, the closest working pit containing material suitable for use would be near Landmark, Idaho. The use of this material would result in an increase in the costs of transportation over those shown.

5.3.3 Alternative 7 - Remove all Tailings, Transport to an On-Site Repository, and Cover with Clean Native Soils

This Alternative removes all tailings from the west half of the portion east of the road and all of the tailings below and west of Forest Road 579. The material would be placed along the base of the slope on top of the eastern portion of the existing tailings located east of the road. The tailings would be graded to a 1 to 3 (vertical to horizontal) slope, covered with two feet of locally mined soils, brush and wood debris, and seeded with native grasses. The road would require the import of three feet of fill and six inches of road surfacing materials to bring it up to its original level. The area adjacent to the road would require barriers to restrict traffic access.

The closest potential location to obtain fill and cover materials is in the alluvial area located at the base of the unnamed creek at the Deadwood Mine site, immediately below the old mill. If sufficient equipment was available, this material could be screened to produce surface material for the road. The estimated cost for this alternative assumes that all material can be made on-site. Based on available information, the closest working pit containing material suitable for use would be near Landmark, Idaho. The use of this material would result in an increase in the costs of transportation over those shown.

5.3.4 Alternative 8 - Excavate and Transport all Tailings to an Off-Site Licensed Landfill

This Alternative would require the tailings to be excavated and transported to the nearest licensed landfill, assuming that the material meets the landfill standards. For costing purposes, the nearest landfill will be assumed to be located at Cascade, Idaho. The location of off-site disposal cannot be determined without additional characterization of the materials.

The tailings would be dozed to designated loading areas and loaded onto tractor-trailer trucks using a four cubic yard loader (Caterpillar Mfg. 950 or equivalent). The material would then be transported to the determined landfill for disposal. The tailings area would be graded, prepared for a seedbed, covered with brushy debris, and seeded with native grasses. The area would require barriers to restrict traffic access.

5.4 Description of Removal Action Alternatives - Waste Rock and Tailings Piles

5.4.1 Alternative 9 - Remove Waste Rock Pile and use for Cover for Tailings Located East of Forest Road 579

If metals concentrations in the waste rock pile are determined to pose no significant risk if allowed to remain on the surface, waste rock would be used as cover for the tailings. As in Alternative 3, an on-site disposal cell would be excavated near the base of the waste rock pile. The tailings from the east side of Forest Road 579 would be excavated and transported to the on-site cell area. The waste rock pile would then be dozed down over the tailings as a cover.

Moving the tailings would be accomplished following removal of a limited number of trees that are currently located within the tailings area. The tailings would be transported from their present location to the on-site disposal cell by dozers and scrapers. Once the tailings were placed in the cell, a small dozer (Caterpillar Mfg. D-4 or equivalent) and an excavator (Caterpillar Mfg. 225 or equivalent) would construct a road up the face of the pile from the north. After reaching the top, the pile would be dozed evenly downward. Concurrently, the underlying hillside would

be re-graded, terraced, and planted with native grasses and trees to minimize erosion. The placement of the volume of tailings at the base of the slope would act as a fill for the original steep slope. By filling the base of the slope with tailings and covering them with waste rock, the slope of the hillside could be reduced. This would make re-vegetation of the original hillside less difficult and reduce potential erosion.

All of the areas that had been disturbed during implementation of this Alternative would then be re-graded, the surface ripped and covered with woody debris as prescribed by Forest Service standards, and planted in suitable native grasses and trees.

5.4.2 Alternative 10 - Remove the Waste Rock Pile and use for Cover for all Tailings

If metals concentrations in the waste rock pile are determined not to pose a risk if allowed to remain on the surface, they could be used as cover for all of the tailings. As in Alternative 3, an on-site cell would be excavated near the base of the waste rock pile. All tailings associated with the Deadwood Mine site would be excavated and transported to the on-site cell. The waste rock pile would then be dozed down over the tailings as a cover.

The movement of tailings would be done using dozers and scrapers following removal of trees that are located within the tailings area. Since the area contains a significant number of trees and brush, the cost for this work has been broken out as a separate item in the costing table. At the time of the SAIC site visit, the majority of the tailings area was dry. For the purposes of this evaluation, all of the tailings are assumed to be outside of wetlands area. However, a study must be made prior to excavation to determine whether parts of the area would accumulate enough water to be characterized as wetlands. The portion of the pile located south of Forest Road 579 could also have a boggy bottom after the trees and tailing were removed. If so, additional costs would need to be determined to allow for operation in these conditions.

Once the tailings were placed in the on-site cell, a small dozer (Caterpillar Mfg. D-4 or equivalent) and an excavator (Caterpillar Mfg. 225 or equivalent) would construct a road up the

face of the pile from the northwest to the southeast. After reaching the top, the pile would be dozed evenly downward. Concurrently, the underlying hillside would be re-graded, terraced, and planted with native grasses and trees to minimize erosion. The placement of the tailings at the base of the slope would act as a fill against the original steep slope. By filling the base of the slope with tailings and covering the tailings with waste rock, the slope of the hillside could be reduced. This would make re-vegetation of the original hillside less difficult and reduce potential erosion.

The area where remediation had occurred would then be re-graded, ripped, covered with woody debris as prescribed by Forest Service standards, and planted in native grasses and trees. Forest Road 579 would be re-filled to its original level with clean road base and re-graded.

6.0 ALTERNATIVES EVALUATION

This section evaluates the potential removal action alternatives for the Deadwood Mine site with respect to the CERCLA evaluation criteria. These criteria include effectiveness, implementability, State and community acceptance, and cost.

6.1 Effectiveness

The effectiveness of an alternative refers to its ability to meet the objectives within the scope of the removal action. There are several components of effectiveness as listed below.

Overall Protection of Public Health and Environment

Each alternative is evaluated as to how well it protects public health and the environment from potential impacts from hazards at the site (i.e., toxic materials and physical hazards). This includes nearby residents, visitors and recreational users, and remediation workers during the implementation of the removal action.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Each alternative will be evaluated with respect to compliance with identified federal, state, and local ARARs.

Long-Term Effectiveness

The long-term effectiveness of the removal action alternatives is considered. The long-term effectiveness considers the risk from potentially hazardous materials and physical hazards that would remain at the site after the removal alternative is implemented. Long-term effectiveness may also be affected by operation and maintenance (O&M) requirements.

Reduction of Toxicity, Mobility, or Volume through Treatment

The EPA has a policy of preference for technologies that will permanently and significantly reduce toxicity, mobility, or volume of hazardous substances. Each alternative will be evaluated

to determine if the technology reduces the toxicity, mobility, or volume of the hazardous substances.

Short-Term Effectiveness

Short-term effectiveness addresses the effects of the alternative during implementation, before the removal objectives have been met. This may include such things as fugitive dust, hazardous waste transportation, etc., that could affect the public, workers, and the environment during the implementation of the removal action.

6.1.1 Overall Protection of Human Health and the Environment

Alternative 1 would not mitigate or reduce the human health and ecological risks from direct exposure to hazardous substances in the waste rock and tailings at the site. Release of hazardous substances by surface water, groundwater and air pathways would continue. Traffic on the Forest Service road would continue to disperse tailings containing hazardous substances.

Alternatives 2 and 3 would reduce the human health and environmental risks associated with direct contact with hazardous substances in the waste rock pile. Release of hazardous substances to surface water would be reduced or eliminated. Release of hazardous substances to groundwater would continue; however, groundwater may not be a significant migration pathway.

Alternative 4 would eliminate human health and environmental risks associated with the waste rock pile. The waste rock pile would be removed from the site.

Alternatives 5 and 6 would eliminate the human health and ecological risks associated with direct contact to hazardous substances in the tailings in Forest Service Road 579 and in the portion of the tailings pile located to the east of the road. Release of hazardous substances to surface water and air transport would be reduced or eliminated in these portions of the tailings pile, but would continue in the portion of the tailings piles west of the road. Release of hazardous substances to groundwater would continue; however, groundwater may not be a significant pathway.

Alternative 7 would eliminate the human health and ecological risks associated with direct contact to hazardous substances in the tailings pile. Release of hazardous substances to surface water and air transport would be reduced or eliminated. Release of hazardous substances to groundwater would continue; however, groundwater may not be a significant pathway.

Alternative 8 would eliminate the human health and ecological risks associated with the tailings piles. All of the tailings material would be removed from the site.

Alternative 9 would eliminate the human health and ecological risks associated with direct contact to hazardous substances in the waste rock pile, the tailings in Forest Service Road 579, and the portion of the tailings pile located to the east of the road. Release of hazardous substances to surface water and air transport would be reduced or eliminated in these areas, but would continue in the portion of the tailings piles west of the road. Release of hazardous substances to groundwater would continue; however, groundwater may not be a significant release pathway.

Alternative 10 would eliminate the human health and ecological risks associated with direct contact to hazardous substances in the waste rock pile and the tailings piles. Release of hazardous substances to surface water and air transport would be reduced or eliminated. Release of hazardous substances to groundwater would continue; however, groundwater may not be a significant release pathway.

6.1.2 Compliance with ARARS

ARARS have not yet been identified for the Deadwood Mine site removal action. Potential contaminant-specific, location-specific, and action-specific ARARS are identified in Appendix B. (These include potential ARARs identified by the State of Idaho.) The Forest Service will address the determination of applicable ARARs after they receive and review the proposed remedial action alternatives. During implementation of the selected removal action, Best Management Practices (BMPs) would be utilized to ensure compliance with applicable or

relevant and appropriate federal and state standards for runoff and sediment control and fugitive air emissions.

No chemical-specific ARARs are applicable to the Deadwood Mine site cleanup. No significant surface water or groundwater contamination has been identified at the site. The State of Idaho has not developed chemical-specific cleanup standards for soil.

Several location-specific ARARs (Appendix B) may be applicable to the Deadwood Mine site including ARARs for the protection of historic structures, wetlands, floodplains, and threatened and endangered species. The abandoned mine land inventory report indicates that the Deadwood Mine site contains mining related structures, mining equipment and debris. Because of the poor condition of the structures, it is unlikely that any of the structures are eligible for nomination to the register of historic places and would require preservation. However, the Forest Service should evaluate whether documentation of historic structures, collection of artifacts, or mitigation is appropriate for the implementation of any removal action that would affect the mill area.

No ARARs are applicable to Alternative 1.

Several alternatives (Alternatives 2, 3, 4, 5, 6, 7, 8, 9 and 10) would involve construction activities and disturbance of waste rock and tailings piles. Action-specific ARARS would apply to all of these alternatives. Dust suppression and erosion mitigation methods would be implemented to reduce air emissions and control run-off at the site. Engineering criteria for solid waste landfills in accordance with State of Idaho's standards and rules may be considered in the detailed design of the on-site repository. Stormwater BMPs would be applicable to construction activities.

Alternatives 4 and 8 would dispose of the waste rock or tailings in a permitted off-site facility. The Forest Service would be required to demonstrate compliance with the off-site facility acceptance criteria before the waste could be disposed offsite.

Alternatives 8 and 10 would require excavation of tailings material adjacent to a wetlands area. Before implementation of these alternatives, the wetlands should be evaluated and mitigations developed if the wetlands are adversely affected.

6.1.3 Long-Term Effectiveness

Alternative 1 would not be effective in the long-term as the hazards represented by the Deadwood Mine site would not be mitigated or removed. This alternative would require monitoring and surveillance to verify that conditions at the site have not changed, and future site remediation may be necessary.

Alternatives 2, 3, 5, 6, 7, 9, and 10 would be effective long-term provided they are periodically inspected and maintained.

Alternatives 4 and 8 would be very effective and permanent. The waste rock or tailings would be permanently removed from the site.

6.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

None of the preliminary alternatives provide a reduction in toxicity, mobility, or volume through treatment. No treatment measures are included in these alternatives.

6.1.5 Short-Term Effectiveness

Alternative 1 would be effective from a short-term perspective. No Further Action does not result in additional human health and environmental concerns during implementation.

Alternatives 2, 3, 4, 5, 6, 7, 8, 9, and 10 involve construction and disturbance of waste rock at the site. Engineering controls would be implemented to mitigate fugitive dust, control runoff and erosion, and minimize hazardous substance release during implementation of the removal action alternatives.

A site-specific health and safety plan (HASP) would be prepared before implementation of Alternatives 2, 3, 4, 5, 6, 7, 8, 9 and 10, and would include health and safety controls to reduce or mitigate potential hazards of the selected removal actions.

Implementation of Alternatives 8 and 10 may affect the adjacent wetlands area if all of the tailings material is excavated. Modification of the removal action to leave some of the tailing in place or other mitigation measures may be required.

6.2 Implementability Evaluation of Alternatives

This section evaluates the alternatives with respect to the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation.

Technical Feasibility

Technical feasibility refers to the ability to construct, operate, maintain, replace, and monitor an alternative's technical components. Potential constraints associated with characteristics of the Deadwood Mine site are also addressed. Due to the remote nature of the site, some components of technical feasibility are of special importance and are addressed separately, including maintenance and monitoring requirements, construction feasibility, and availability of services and materials. Each alternative will be evaluated to determine if it can technically meet the removal action objectives provided in Section 4.0, regardless of other factors such as regulatory restrictions, etc.

Maintenance and Monitoring Requirements

Each of the removal action alternatives should require minimal maintenance and monitoring at the least. The site's remote location and difficult access during winter and inclement weather conditions would make frequent and regular maintenance impractical. The feasibility of the removal action may be significantly affected by maintenance requirements.

Construction Feasibility

Construction feasibility evaluates whether it is reasonably possible to construct the alternative at the site. This includes site access issues, space available, utilities, and other factors that may affect construction feasibility.

Availability of Services and Materials

The availability of off-site treatment, storage, disposal capacity, equipment, personnel, services, materials, and any other resources necessary to implement an alternative will be evaluated. Because of the remoteness of the site, the sensitivity of this evaluation criterion will be high.

Administrative Feasibility

Administrative feasibility includes required permits, regulatory acceptance of the alternative, and an evaluation of community acceptance (discussed separately). Each alternative will be evaluated to determine if the alternative requires permits, adheres to non-environmental regulations, and addresses concerns of other regulatory agencies. This may include NPDES discharge permits, easements, etc. The acceptance of federal, state, and local regulatory agencies would be evaluated to determine if an alternative would be accepted by the responsible regulatory agencies.

Community/State Acceptance

Although the site is remote, community and state acceptance of proposed alternatives would be evaluated.

6.2.1 Technical Feasibility

Alternative 1 is technically feasible. There are no technical issues associated with performing No Further Action.

Alternatives 2, 3, 4, 5, 6, 7, 8, 9, and 10 are technically feasible. These alternatives could be executed using readily available equipment and machinery. Alternative 2, although technically feasible, would be difficult to implement due to the steep hillside on which the waste rock is

presently located and access to the top of the pile. Inspection and maintenance requirements could be implemented during the summer and fall months.

6.2.2 Maintenance and Monitoring Requirements

Alternative 1 would require periodic monitoring to verify that conditions have not changed.

Alternatives 2, 3, 5, 6, 7, 9, and 10 would require periodic inspection of the cover, and maintenance and repair of the cover and re-vegetated areas, as necessary. Seasonal monitoring would be considered acceptable and feasible.

Alternative 4 would not require periodic inspection and maintenance. The waste rock would be permanently removed from the site.

Alternative 8 would not require periodic inspection and maintenance. The tailings would be permanently removed from the site.

6.2.3 Construction Feasibility

All the alternatives could be constructed at the site. Implementation of Alternatives 2, 3, 4, 5, 6, 7, 8, 9, and 10 would require bringing construction equipment, materials and supplies to the site. Alternative 2 would require construction of a temporary haul road between the two waste rock pile areas at the Deadwood Mine site.

6.2.4 Availability of Goods and Services

The required goods and services are reasonably available for all of the alternatives. Contractors, labor, equipment, and materials would probably come from Boise, which is located about 100 miles from the site.

For Alternatives 2, 3, 5, 6, and 7, a local borrow area for soil cover material would be required. It is assumed that this material can be obtained from a suitable source within one mile of the Deadwood Mine site. An area within the alluvial fan located above the unnamed creek's intersection with the Deadwood River has been identified as a possible borrow source area.

Alternatives 9 and 10 would use low-mineralized waste rock to cover the tailings material. However, it is uncertain that sufficient low-mineralized waste rock can be obtained from the waste rock pile to construct the required cover. Additional evaluation of the waste rock pile would be required before implementing either of these alternatives.

6.2.5 Administrative Feasibility

Alternative 1 is administratively feasible because it would maintain the current status of the site.

Alternatives 3, 4, 5, 6, 7, 8, 9 and 10 appear to be administratively feasible because they are proven methods, do not impact surrounding lands, and are compatible with Forest Service policy.

Under Alternative 2, access to the top of the waste rock pile would require permission from the private landowner and construction of access road across the privately owned land.

6.2.6 State/Community Acceptance

It is anticipated that Alternatives 2, 3, 5, 6, 7, 9, and 10 would be acceptable to the local community. None of these alternatives involve hauling waste rock or tailings from the site for off-site disposal. Use of the general area for recreational purposes would not be seriously impacted during implementation of any of the alternatives.

Alternatives 4 and 8 would require hauling the waste rock or tailings on Forest Service Road 579. The local community may object to the truck traffic.

Alternative 1 may not be acceptable to the State because it does nothing to remediate the site. Alternatives 2, 3, 4, 5, 6, 7, 8, 9 and 10 are likely to be acceptable to the State because they involve standard technologies, and implementation would reduce public health and environmental concerns at the site.

6.3 Cost Evaluation

This section identifies the CERCLA cost criteria and evaluates each alternative with respect to the criteria. The cost estimates provided in this report are preliminary, and are provided primarily for the purpose of comparison of the removal action alternatives with each other. The final actual costs of a remedial alternative will depend upon the labor and material costs, site conditions, productivity, and competitive market conditions at the time of implementation, as well as final project scope, final project schedule, final engineering design, and other factors.

Estimates regarding volumes of the waste rock piles were made from visual observation and field measurements made during a site visit.

Estimated costs of the alternatives include indirect capitol costs, direct capitol costs, and annual costs. Estimated costs were prepared utilizing estimated volumes, vendor quotes, available literature, Means Cost Data guides, and other sources as deemed appropriate. Twenty percent of the total estimated construction costs have been added for overhead and engineering. A more detailed cost analysis may be required for funding purposes. In addition, Forest Service costs for project management, oversight, and contracting have not been included in the estimate.

Indirect Capital Costs

These costs include indirect expenses that are necessary to complete the alternative. Most of these costs are incurred prior to the actual implementation of the alternative. These costs include engineering, permits, and oversight costs.

Direct Capital Costs

These costs include costs to directly implement the alternative such as construction costs, materials, services, and disposal costs.

Annual Costs

After the alternative is implemented, it may be necessary to perform periodic inspection, O&M, and repairs. These costs are estimated on an annual basis in 2002 dollars.

Present Worth Cost

Present worth costs represent the amount of money in current dollars (mid-2002) needed to cover all of the expenditures associated with a removal alternative. They enable the comparison of costs on an equal basis for expenditures that occur over different time periods. A discount (interest) rate of five percent has been used to calculate present worth costs. This is approximately the present cost of money to the U.S. Government. The estimated length of annual O&M costs is into the foreseeable future because the contaminants of concern, e.g. metals, do not degrade over time. As an example calculation, if the capital cost of an alternative is $200,000 and the annual O&M cost is $9,000, both in 2002 dollars, then the present worth cost is $200,000 plus $9,000 times 20 ($200,000 + ($9,000 x 20)), which equals $380,000. You would pay $200,000 immediately for construction, and invest an additional $180,000 at five percent interest to obtain the annual O&M costs of $9,000 in perpetuity.

Detailed cost estimates for the Removal Action Alternatives are provided in Appendix C. Table 6-1 summarizes the estimated costs for the alternatives.

6.4 Comparative Analysis of Alternatives

The removal alternatives for the Deadwood Mine site are compared with respect to the CERCLA criteria of effectiveness, implementability, and cost in this section. The comparison is summarized in Table 6.2 and discussed in the following sections.

Alternative 1, No Further Action, would be easy to implement and at low cost, but is not effective in addressing the environmental problems associated with the Deadwood Mine waste rock pile or tailings piles. This alternative would not meet RAOs for the Deadwood Mine site.

Alternative 2, Cover Waste Rock Pile in Place, would be moderately to highly effective in addressing the human and environmental risk associated with the waste rock pile. This alternative has some administrative and technical feasibility issues that would have to be resolved prior to implementation and would be comparatively expensive to perform.

Alternative 3, Remove the Waste Rock and Place in an On-Site Repository, would be highly effective in addressing the human and environmental risk associated with the waste rock pile. This alternative would be comparatively inexpensive to implement.

Alternative 4, Remove Waste Rock Pile to a Licensed Off-Site Landfill, would be highly effective in reducing the human and environmental risks associated with the waste rock. This alternative would be comparatively expensive to implement.

Alternative 5, Import Road Surfacing to Cover Tailings in Road and Stabilize Sand Dunes to East of Road, would be effective in reducing the dispersion of tailings in the road and east of the road. This alternative does not address the entire tailings piles area. The alternative would be comparatively inexpensive to implement.

Alternative 6, Excavate Tailings from Road Area, Replace with Road Surfacing, and Stabilize Sand Dunes to the East of Road, would be effective in reducing human health and ecological risk associated with the tailings in the road and east of the road. This alternative does not address the entire tailings piles area. This alternative would be comparatively inexpensive to implement, although more expensive than Alternative 5.

Alternative 7, Remove all Tailings, Transport to an On-Site Repository, and Cover, would be highly effective in reducing human health and ecological risks associated with the tailings. This alternative would be moderately to highly expensive to implement.

Alternative 8, Excavate and Transport all Tailings to an Off-Site Landfill, would be highly effective in eliminating the human health and ecological risks associated with the tailings. This alternative would be comparatively very expensive to implement.

Alternative 9, Remove Waste Rock Pile and Use for Cover for Tailings located east of Forest Service Road, would be highly effective in reducing the human health and ecological risks associated with the waste rock pile and the tailings piles to the east of the road. This alternative would be moderately to highly expensive to implement.

Alternative 10, Remove Waste Rock Pile and Use for Cover for Tailings, would be highly effective in reducing the human health and ecological risks associated with the waste rock pile and the tailings piles. This alternative would be moderately to highly expensive to implement.

All the alternatives would be implemented in accordance with the applicable regulatory requirements, good engineering practices, and BMPs. Engineering controls and appropriate health and safety practices would minimize the potential short-term impacts to human health and the environment resulting from the implementation of the selected alternative.

6.5 Recommended Removal Action Alternatives

The recommended removal action for the Deadwood Mine site is Alternative 5, Import Road Surfacing to Cover Tailings in Road and Stabilize Sand Dunes located east of Forest Service Road 579. This alternative would address the tailings area (Figure 6-1) that has the highest risk to be disturbed and dispersed.

This alternative does not address the waste rock pile on Forest Service Land or portions of the tailings piles that have stabilized. The waste pile is on the side of a steep hill and would be difficult to revegetate if removed. Much of the tailings piles have naturally revegetated and is unlikely to be dispersed in its present condition. Although the waste rock and tailings contain metals that exceed the BLM risk screening guidelines for wildlife, the overall area that is

disturbed and contains elevated concentrations of potentially toxic metals is small. The benefit gained from performing additional removal actions beyond what is recommended is not worth the cost to perform the work. These areas can be remediated at a future time if it is determined to be appropriate.

7.0 RECOMMENDATIONS FOR FURTHER ACTION

This section briefly discusses recommendations for additional actions and activities that should be conducted prior to implementing the proposed removal action alternatives for the Deadwood Mine site.

For Alternatives 2, 3, 5, 6, 7, 9, and 10, a local source of soil material is required for construction of the soil reclamation cover. Potential suitable locations have been identified from topographic and National Forest maps and during the SAIC site visit. However, field confirmation and/or geotechnical analysis may be required to confirm suitability of the local soil material.

Alternatives 9 and 10 would use waste rock containing low metals concentrations to cover the portions or all of the tailing piles. Additional chemical analysis and evaluation of the waste rock pile would be required to determine whether the waste rock pile contains a sufficient volume of waste rock with suitable metals concentrations to construct the required cover.

If off-site disposal of waste rock or tailings is selected as the proposed alternative, a solid-waste facility willing to accept the waste rock or tailings must be identified. Additional characterization of the waste rock or tailings would likely be required to demonstrate compliance with the disposal facility's waste acceptance criteria.

The cost and schedule for the implementation of any of the alternatives may be affected by land ownership or the presence of jurisdictional wetlands and T&E species in the vicinity of the Deadwood Mine site. If wetlands were destroyed during the implementation of an alternative, wetlands mitigation would be required. If T&E species are present and may be disturbed during the implementation of an alternative, preparation of a biological assessment and consultation with the U.S. Fish and Wildlife Service may be required. T&E species mitigation may be required.

The Idaho Geologic Survey Inventory Report (IGS, 1994) for the Deadwood Mine indicates (Page 2Ci-7) "There are lots of historic buildings and features of general cultural/historical

significance." The Forest Service should consult with the Forest Historian and appropriate state personnel to determine if modification of the selected removal action alternative is required to preserve historic resources at the site.

8.0 REFERENCES

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SAIC, 1999, Report Prepared for U.S. Forest Service, Potentially Responsible Party Search for the Deadwood Mine Site, Boise National Forest, Valley County, Idaho. October 1999.

U.S. Bureau of Land Management, 1998, Interim Revision of Wildlife Risk Management Criteria, Technical Note 390, 3p.

Tables

Table 3-1. Surface Water Field Measurements

Location	pH	Temperature (°C)	Conductance (µS)
Mine water at portal	6.54	6.8	171.2
Mine water on waste rock pile	6.46	8.7	262.9
Mine water above confluence with unnamed stream	7.45	7.3	120.7
Unnamed stream above adit discharge	7.56	7.2	23.2
Combined flow below adit/unnamed stream confluence	7.91	7.1	40.1
Unnamed stream above confluence with Deadwood River	7.05	7.7	41.1
Deadwood River below confluence with unnamed stream	7.29	8.0	34.0
Deadwood River above Deadwood Mine site	7.08	8.1	55.9

Table 3-2. Tailings and Waste Rock Analytical Results for Metals (SAIC Site Visit)

Sample	Location	Ag	As	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mn	Mo	Ni	Pb	Sb	Se	Th	Zn
090602-1	Waste rock	26.3	143	12.2	0.2	75.2	2.4	317	27700	6.9	1100	2.3	10	1840	27.4	1 U	1 U	7980
090602-2	Waste rock	78.5	213	52.5	0.28	65.5	4	335	22800	3.2	865	2.6	11	3080	74	1 U	1 U	7830
090602-3	Waste rock	30.3	151	43	0.28	32.2	3.6	200	16800	4.7	863	2.2	8.4	4480	43.3	2.2	1 U	3860
090602-5	Waste rock	15.8	155	90.4	0.3	28.5	6.3	190	18100	4.1	542	2	14.6	1480	22.6	1 U	1 U	3990
090602-6	Tailings	8.6	92.2	6.8	0.2 U	23	2.4	227	57900	1.6	2810	0.92	5.7	436	16.7	1 U	1 U	2310
090602-7	Tailings	6.4	77.8	3.4	0.2 U	28.7	0.6 U	98.2	48100	2.1	2290	0.8 U	1.6	512	15.8	1 U	1 U	2530
090602-8	Tailings	12.8	54.7	24.3	0.2 U	12.1	1.1	112	56100	0.73	2700	0.8 U	3.4	355	17.3	1 U	1 U	1240
090602-9	Tailings	8.2	67.2	17.5	0.2 U	32.5	4.3	185	51400	1.8	2420	0.8 U	7.5	524	14.8	1 U	1 U	2710

All values in mg/kg **ND= Not Detected** **U= Numerical Value is sample quantification limit**

Sample locations are shown on Figure 2-3

Table 3-3. Comparison of Metal Concentrations in Surface Water to BLM Human Risk Management Criteria (START data)

Sample Location	Sb	As	Cd	Cu	Pb	Mn	Ni	Se	Ag	Tl	Zn
DR01SW Deadwood River					2.6	2.2					14.8
DR02SW Deadwood River					4.8	2.2					27.7
DR03SW Deadwood River					7.2	2.3					22.8
DR04SW Deadwood River					2.8	1.9					12.2
UC01SW Unnamed creek		2.2			4.3	10.2	3.1				40.7
UC02SW Unnamed creek		22.4			2.6	112	3.1				455
SP01SW Mine drainage		176			3.8	617	5.7				2380
WL03SW Wetlands		2.3	2.3	3.6	7.8	35.8	3.1	1.3			31.8
BLM Risk Management Criteria											
Camper	124	93	155	11490	50	1548	93	6194	1548	1548	92909

Metals concentrations reported in ug/L.

Concentrations indicate in bold exceed BLM Risk Management Criteria.

Table 3-4. Comparison of Metal Concentrations in Surface Soil to BLM Human Risk Management Criteria (SAIC data)

Sample Location	Sb	As	Cd	Cu	Pb	Mn	Ni	Se	Ag	Zn
090602-1 Waste rock	27.4	143	75.2	317	1840	1100	10	1	26.3	7980
090602-2 Waste rock	74	213	65.5	335	3080	865	11	1	78.5	7830
090602-3 Waste rock	43.3	151	32.2	200	4480	863	8.4	2.2	30.3	3860
090602-5 Waste rock	22.6	155	28.5	190	1480	542	14.6	1	15.8	3990
090602-6 Tailings	16.7	92.2	23	227	436	2810	5.7	1	8.6	2310
090602-7 Tailings	15.8	77.8	28.7	98.2	512	2290	1.6	1	6.4	2530
090602-8 Tailings	17.3	54.7	12.1	112	355	2700	3.4	1	12.8	1240
090602-9 Tailings	14.8	67.2	32.5	185	524	2420	7.5	1	8.2	2710
BLM Risk Management Criteria										
Resident	3	1	3	250	400	960	135	35	35	2000
Camper	50	20	70	5000	1000	19000	2700	700	700	40000
ATV Driver	750	300	950	70000	1000	250000	38000	9600	9600	550000
Worker	100	12	100	7400	2000	28000	4000	1000	1000	60000
Surveyor	600	100	800	59000	2000	220000	32000	8000	8000	480000

All values in mg/kg **ND= Not Detected B= Estimated result, less than reporting limit**

Table 3-5. Comparison of Metal Concentrations in Surface Soil to BLM Human Risk Management Criteria (START data)

Sample Location	Sb	As	Cd	Cu	Pb	Mn	Ni	Se	Ag	Zn
TP01SB	64	73	7.1	303	697	6920	12.3	3.6	25.8	1520
TP02SB	26.8	187	37.1	256	820	2640	7.6	2.8	8.1	2180
TP03SB	25	127	38.9	186	676	3160	9.5	2.5	11.2	3230
TP04SB	31.3	211	39.2	143	1020	3410	6	2.6	14.1	3310
WP01SB	46.9	137	36.5	236	1810	745	9.4	2.2	55	4540
WP02SB	44	239	42.2	278	1430	1000	30.4	2.8	31.4	5920
WP03SB	31.7	144	34.3	206	1190	532	11.3	2	22.2	4170
WP04SB	21.8	145	28.4	153	931	694	14.2	2.1	13	3000
ML01SB	55.1	114	50.3	492	997	813	3.2	1.5	22.5	3140
ML02SB	122	100	90.1	409	16800	155	2.5	11	76.3	9510
ML03SB	45	76.4	46.8	988	1200	246	5	1.8	30.6	11200
BLM Risk Management Criteria										
Resident	3	1	3	250	400	960	135	35	35	2000
Camper	50	20	70	5000	1000	19000	2700	700	700	40000
ATV Driver	750	300	950	70000	1000	250000	38000	9600	9600	550000
Worker	100	12	100	7400	2000	28000	4000	1000	1000	60000
Surveyor	600	100	800	59000	2000	220000	32000	8000	8000	480000

All values in mg/kg **ND= Not Detected B= Estimated result, less than reporting limit**

Table 3-6. Comparison of Metal Concentrations in Surface Soil to BLM Risk Management Criteria for Wildlife and Livestock (SAIC data)

Sample Location/Criteria	As	Cd	Cu	Pb	Zn
090602-1	**143**	**75.2**	**317**	**1840**	**7980**
090602-2	**213**	**65.5**	**335**	**3080**	**7830**
090602-3	**151**	**32.2**	**200**	**4480**	**3860**
090602-5	**155**	**28.5**	**190**	**1480**	**3990**
090602-6	**92.2**	**23**	**227**	**436**	**2310**
090602-7	**77.8**	**28.7**	**98.2**	**512**	**2530**
090602-8	**54.7**	**12.1**	**112**	**355**	**1240**
090602-9	**67.2**	**32.5**	**185**	**524**	**2710**
BLM Risk Management Criteria					
Deer Mouse	230	7	640	142	419
Cottontail Rabbit	438	6	358	172	373
Bighorn Sheep	387	9	64	152	369
White-Tailed Deer	319	3	128	124	267
Mule Deer	200	3	102	106	222
Elk	328	3	131	127	275
Cattle	419	15	413	244	1082
Sheep	352	12	86	203	545
Mallard	116	1	141	59	4
Canada Goose	61	2	161	34	271
Trumpeter Swan	76	2	201	43	340
Robin	4	0.3	7	6	43

Table 3-7. Comparison of Metal Concentrations in Surface Water to Selected EPA Ambient Water Quality (START data)

Sample Location	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Se	Ag	Tl	Zn
DR01SW	NS	13.4	NS	NS	NS	42.7	2.6	2.2	NS	NS	NS	NS	14.8
DR02SW	NS	15.7	NS	NS	NS	44.6	4.8	2.2	NS	NS	NS	NS	27.7
DR03SW	NS	15.2	NS	NS	NS	74.7	7.2	2.3	NS	NS	NS	NS	22.8
DR04SW	NS	15.6	NS	NS	NS	44.8	2.8	1.9	NS	NS	NS	NS	12.2
UC01SW	2.2	12.2	NS	NS	NS	82.6	4.3	10.2	3.1	NS	NS	NS	40.7
UC02SW	22.4	5.7	NS	NS	NS	449	2.6	112	3.1	NS	NS	NS	455
SP01SW	176	16	NS	NS	NS	3310	3.8	617	5.7	NS	NS	NS	2380
WL03SW	2.3	17.2	2.3	1.9	3.6	569	7.8	35.8	3.1	1.3	NS	NS	31.8
BLM Risk Management Criteria													
Freshwater Aquatic Life Acute Exposure	360	NA	3.7*	550*	17	NA	65*	NA	1400*	20	3.4*	NA	110*
Freshwater Aquatic Life Chronic Exposure	190	NA	1.0*	180*	11	NA	2.5*	NA	160	5	NA	NA	100*

Metals concentrations reported in ug/L. Based on hardness of 100mg/L **NS= Not Sampled**

Table 4-1. Removal Action Technology Preliminary Screening Matrix

Technology	Technical Feasibility and Implementability	Administrative Feasibility	Maintenance Requirements	Availability of Services and Materials
Institutional/Access Controls				
Property Controls/Land Use Restrictions	Medium	Low	N/A	N/A
Fencing	High	Low	Moderate	High
Signs	High	Low	Moderate/High	High
Engineering Controls				
Capping Waste Rock/Tailings in Place	High	High	Low	Moderate
Consolidation, Disposal in an Onsite Cell	High	High	Low	Moderate
Control Run-on & Run-off	High	High	Moderate	Moderate
Waste Rock/ Tailings Treatment				
Solidification/Stabilization	Low	Low	Low	Moderate
Soil Washing	Low	Low	Low	Moderate
Chemical Reduction/ Oxidation	Low	Moderate	Low	Moderate
Excavation and Disposal				
Excavation, Off-Site Disposal	High	High	Low	Moderate

Table 4-2. Retained Removal Action Technologies

Area of Concern	Removal Action Technology
Waste Rock/Tailings	Excavate, Relocate and Cover Waste Rock/Tailings On-site
	Excavate, Transport, and Dispose Waste Rock in Permitted Facility
	Cover Waste Rock Pile in Place

Table 6-1. Costs of Removal Action Alternatives

ALTERNATIVE	Indirect Capital Cost	Direct Capital Cost	Total Capital Cost*	Annual O&M Cost**	Present Worth Cost***
1 – No Further Action	$0	$0	$0	$0	$0
2- Cover Waste Rock Pile In-Place	$86,000	$216,000	$302,000	$3.000	$362,000
3- Remove Waste Rock Pile and place in an On-Site Repository	$5,700	$14,300	$20,000	$3000	$80,000
4- Remove the Waste Rock Pile to a Licensed Landfill	$263,000	$657,000	$920,000	$0	$920,000
5- Import Road Surfacing to Cover tailings in Road and Stabilize Tailings to East of Road	$9,300	$23,400	$33,000	$3,000	$93,000
6- Excavate Tailings from Road Area Replace with Road Surfacing, and Stabilize Tailings to the East of Road	$16,800	$42,000	$59,000	$3.000	$119,000
7- Remove all Tailings to an On-Site Repository	$42,800	$107,000	$150,000	$3,000	$210,000
8- Excavate and Transport all Tailings to a Licensed Landfill	$830,000	$2,372,000	$3,202,000	$0	$3,202,000
9- Remove Waste Rock Pile and Use for Cover for Tailings located East of Road	$53,000	$132,000	$185,000	$3,000	$245,000
10- Remove Waste Rock Pile and Use for Cover for Tailings	$74,000	$185,000	$260,000	$3,000	$320,000

* Includes 5% to 20% contingency
** Included 20% to 30% contingency
*** Present worth cost based on 5% discount (interest) rate and an O&M period into the foreseeable future
Total Cost $\pm$ 50%

Table 6-2. Summary of Comparative Evaluation of Preliminary Removal Action Alternatives – Waste Rock

Criteria	Alternative 1 No Further Action	Alternative 2 Cover Waste Rock Pile In Place	Alternative 3 Remove the Waste Rock Pile and Place in an On-Site Repository	Alternative 4 Remove the Waste Rock Pile to a Licensed Off-Site Landfill
Effectiveness	**Low**	**Moderate/High**	**Moderate/High**	**High**
Protection of Public Health and Environment	No reduction in physical hazards or human health and ecological risk.	High reduction in human health or ecological risk.	High reduction in human health or ecological risk.	Highest reduction in human health or ecological risk.
Compliance with ARARs	Not Applicable	Location-specific and action specific ARARs would apply. Compliance with Historic Preservation Act may require alternative access road design.	Location-specific and action specific ARARs would apply.	Location-specific and action specific ARARs would apply. Compliance with disposal facility waste acceptance criteria required
Long Term Effectiveness and Permanence	No long-term protection provided. Deadwood Mine site would remain in its current conditions.	Effectiveness depends on design and maintenance.	Effectiveness depends on design and maintenance.	Very effective and permanent. Waste rock would be removed from site.
Reduction of Toxicity, Mobility, or Volume Through Treatment	No reduction in toxicity, mobility, or volume through treatment.	No reduction in toxicity, mobility, or volume through treatment.	No reduction in toxicity, mobility, or volume through treatment.	No reduction in toxicity, mobility, or volume through treatment.
Short Term Effectiveness	No change in physical hazards or human health and ecological risk.	Engineering controls would be implemented.	Engineering controls would be implemented.	Engineering controls would be implemented.
Implementability	**Moderate**	**Low/Moderate**	**Moderate/High**	**Moderate/High**
Technical Feasibility	Technically feasible.	Technically feasible. Additional design necessary.	Technically feasible. Additional design necessary.	Technically feasible
Maintenance and Monitoring Requirements	Periodic monitoring may be required.	Periodic inspection, monitoring, maintenance, and repair on as needed basis	Periodic inspection, maintenance, and repair on as needed basis.	None required.
Construction Feasibility	Not applicable.	Construction would be difficult	Construction is feasible.	Construction is feasible.
Availability of Services and Materials	None required.	All materials and services available locally.	All materials and services available locally.	All materials and services available locally.
Administrative Feasibility	Administratively feasible.	Would require access to private land and access road construction.	Administratively feasible.	Administratively feasible.
State/Community Acceptance	May not be acceptable to state because no removal action implemented.	No acceptance problems anticipated.	No acceptance problems anticipated.	No acceptance problems anticipated.
Cost	**$0**	**$362,000**	**$80,000**	**$920,000**

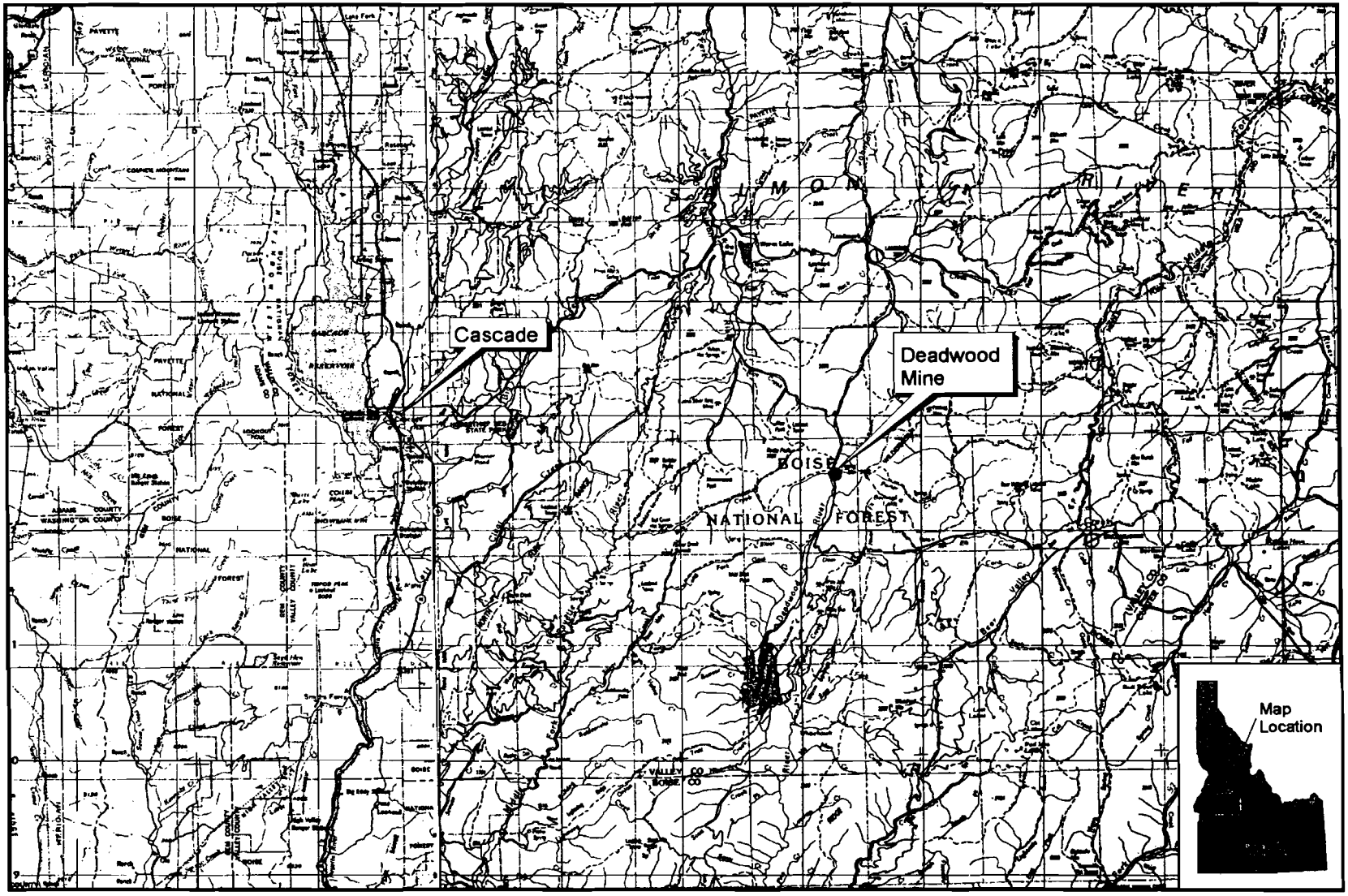
Table 6-3. Summary of Comparative Evaluation of Preliminary Removal Action Alternatives – Tailings

Criteria	Alternative 5 Import Road Surfacing to Cover Tailings in Road and Stabilize Tailings to East of Road	Alternative 6 Excavate Tailings from Road Area, Replace with Road Surfacing, and Stabilize Tailings to the East of Road	Alternative 7 Remove all Tailings and Transport to an On-Site Repository	Alternative 8 Remove all Tailings and Transport to an Off-Site Repository	Alternative 9 Remove Waste Rock Pile and use for Cover for Tailings to East of Road	Alternative 10 Remove Waste Rock Pile and Use for Cover for All Tailings
Effectiveness	**Moderate/High**	**Moderate/High**	**High**	**High**	**Moderate/High**	**High**
Protection of Public Health and Environment	Moderate reduction in human health or ecological risk.	Moderate reduction in human health or ecological risk.	High reduction in human health or ecological risk.	Highest reduction in human health or ecological risk.	Moderate reduction in human health or ecological risk.	High reduction in human health or ecological risk.
Compliance with ARARs	Location-specific and action specific ARARs would apply.	Location-specific and action specific ARARs would apply.	Location-specific and action specific ARARs would apply.	Location-specific and action specific ARARs would apply. Compliance with disposal facility waste acceptance criteria required	Location-specific and action specific ARARs would apply.	Location-specific and action specific ARARs would apply. Compliance with disposal facility waste acceptance criteria required.
Long Term Effectiveness and Permanence	Effectiveness depends on design and maintenance.	Effectiveness depends on design and maintenance.	Effectiveness depends on design and maintenance.	Very effective and permanent. Tailings would be removed from site.	Effectiveness depends on design and maintenance.	Effectiveness depends on design and maintenance.
Reduction of Toxicity, Mobility, or Volume Through Treatment	No reduction in toxicity, mobility, or volume through treatment.	No reduction in toxicity, mobility, or volume through treatment.	No reduction in toxicity, mobility, or volume through treatment.	No reduction in toxicity, mobility, or volume through treatment	No reduction in toxicity, mobility, or volume through treatment.	No reduction in toxicity, mobility, or volume through treatment.
Short Term Effectiveness	Engineering controls would be implemented.	Engineering controls would be implemented.	Engineering controls would be implemented.	Engineering controls would be implemented. Wetlands mitigation may be required.	Engineering controls would be implemented.	Engineering controls would be implemented. Wetlands mitigation may be required.
Implementability	**High**	**Moderate/High**	**Moderate/High**	**Moderate/High**	**Moderate/High**	**Moderate/High**
Technical Feasibility	Technically feasible. Additional design necessary.	Technically feasible. Additional design necessary.	Technically feasible. Additional design necessary.	Technically feasible.	Technically feasible. Additional design necessary.	Technically feasible. Additional design necessary.

Table 6-3. Summary of Comparative Evaluation of Preliminary Removal Action Alternatives – Tailings

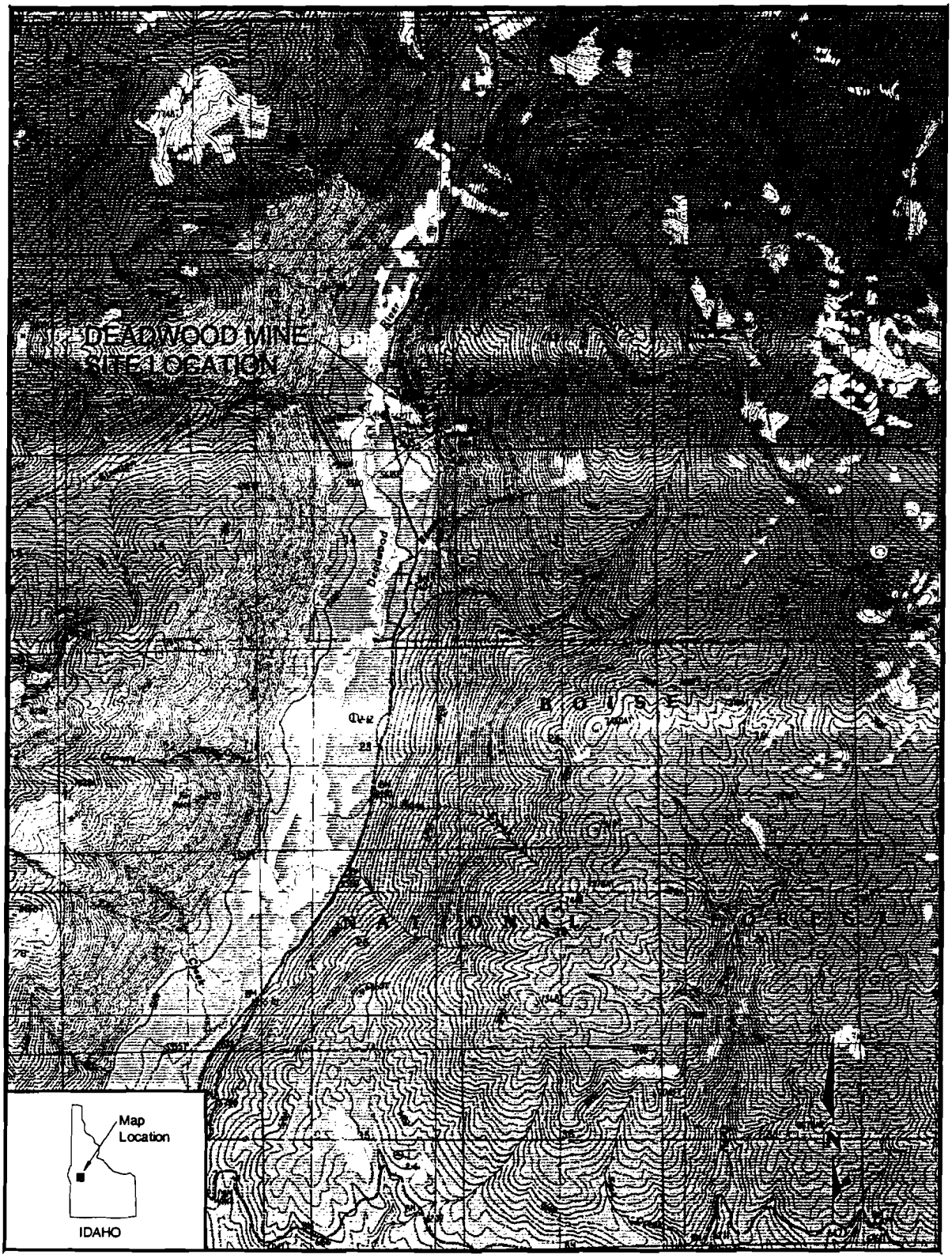
Criteria	Alternative 5 Import Road Surfacing to Cover Tailings in Road and Stabilize Tailings to East of Road	Alternative 6 Excavate Tailings from Road Area, Replace with Road Surfacing, and Stabilize Tailings to the East of Road	Alternative 7 Remove all Tailings and Transport to an On-Site Repository	Alternative 8 Remove all Tailings and Transport to an Off-Site Repository	Alternative 9 Remove Waste Rock Pile and use for Cover for Tailings to East of Road	Alternative 10 Remove Waste Rock Pile and Use for Cover for All Tailings
Maintenance and Monitoring Requirements	Periodic inspection, monitoring, maintenance, and repair on as needed basis.	Periodic inspection, monitoring, maintenance, and repair on as needed basis.	Periodic inspection, monitoring, maintenance, and repair on as needed basis.	None required.	Periodic inspection, maintenance, and repair on as needed basis.	Periodic inspection, monitoring, maintenance, and repair on as needed basis.
Construction Feasibility	Construction is feasible.	Construction is feasible.	Construction is feasible.	Construction is feasible.	Construction is feasible.	Construction is feasible.
Availability of Services and Materials	All materials and services available locally.	All materials and services available locally.	All materials and services available locally.	All materials and services available locally.	Availability of sufficient low mineralized waste rock uncertain.	Availability of sufficient low mineralized waste rock uncertain.
Administrative Feasibility	Administratively feasible.	Administratively feasible.	Administratively feasible.	Administratively feasible.	Administratively feasible.	Administratively feasible.
State/Community Acceptance	No acceptance problems anticipated.	No acceptance problems anticipated.	No acceptance problems anticipated.	No acceptance problems anticipated.	No acceptance problems anticipated.	No acceptance problems anticipated.
Cost	**$93,000**	**$119,000**	**$210,000**	**$3,202,000**	**$245,000**	**$320,000**

Figures



Base Map Source: 1:250,000 Scale USGS Topographic Maps
Chalis, ID 1989 and Baker, OR & ID 1974

Figure 2-1
Deadwood Mine Location



Base Map Source: 1:24,000 Scale USGS Topographic Map
Bernard Mountain, Valley County, ID 1985

Figure 2-2
Deadwood Mine Site Location Map

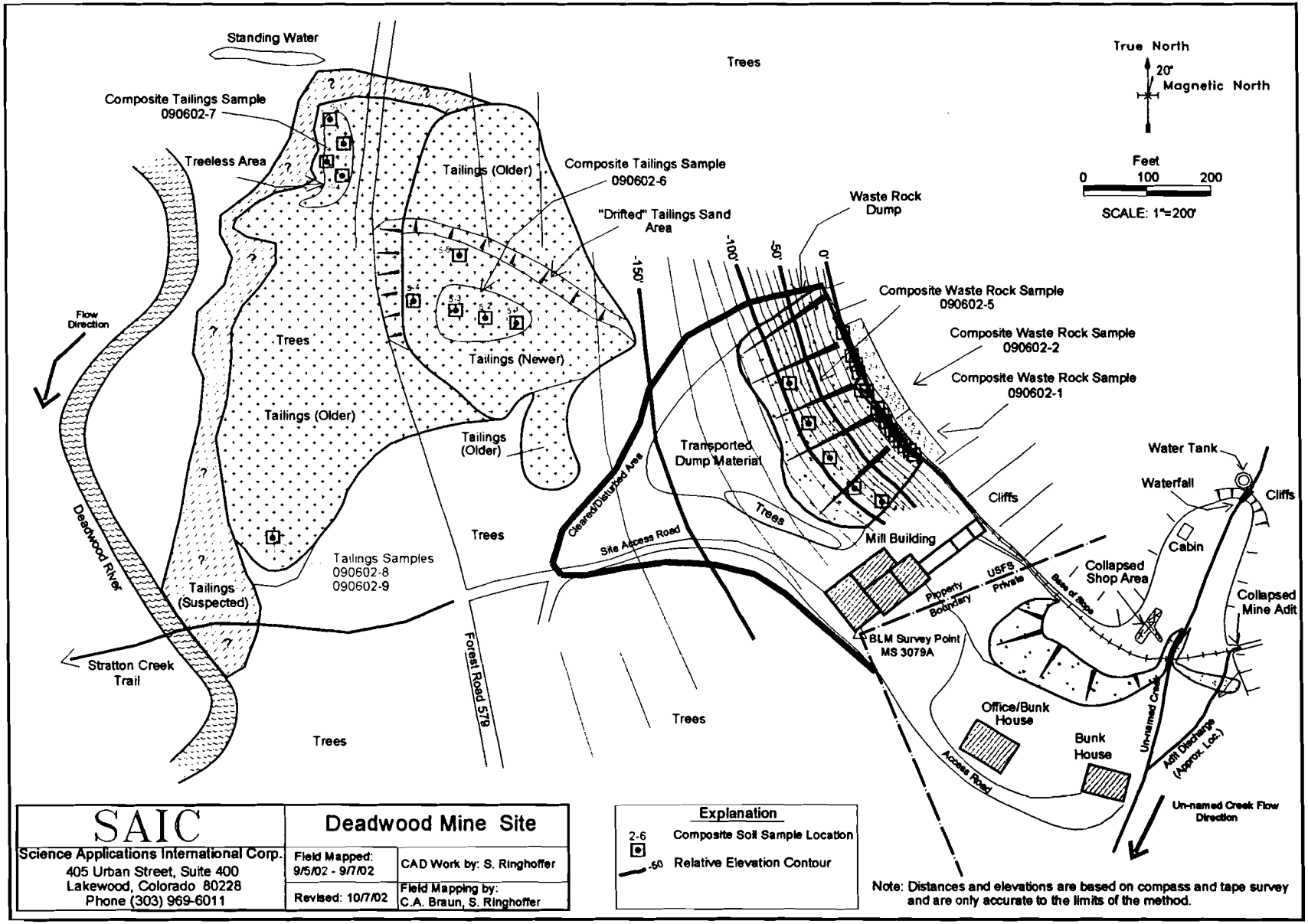


Figure 2-3 Site Map

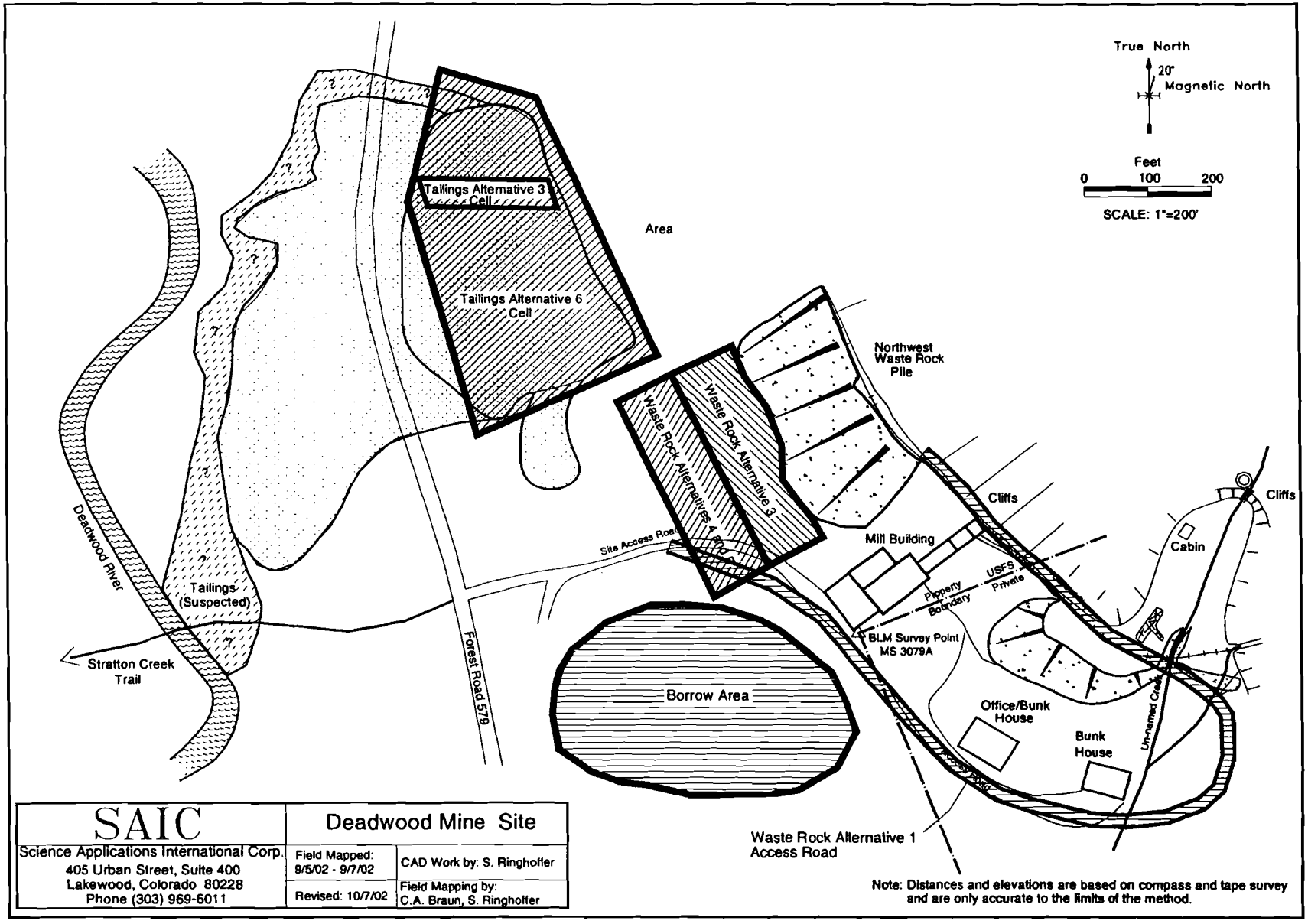


Figure 2-4 Showing Locations for Alternatives

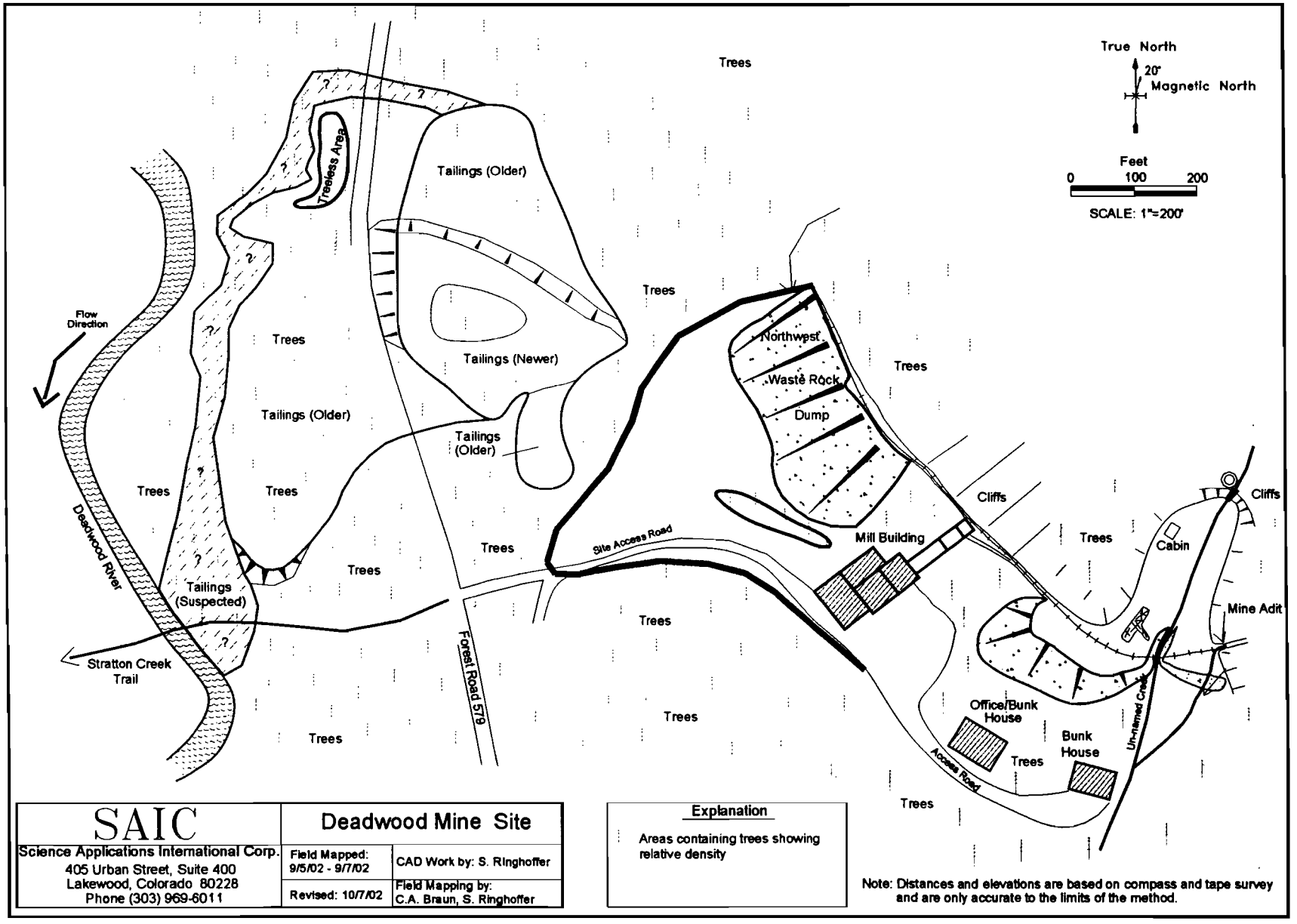


Figure 2-5 Showing Location of Areas of Trees

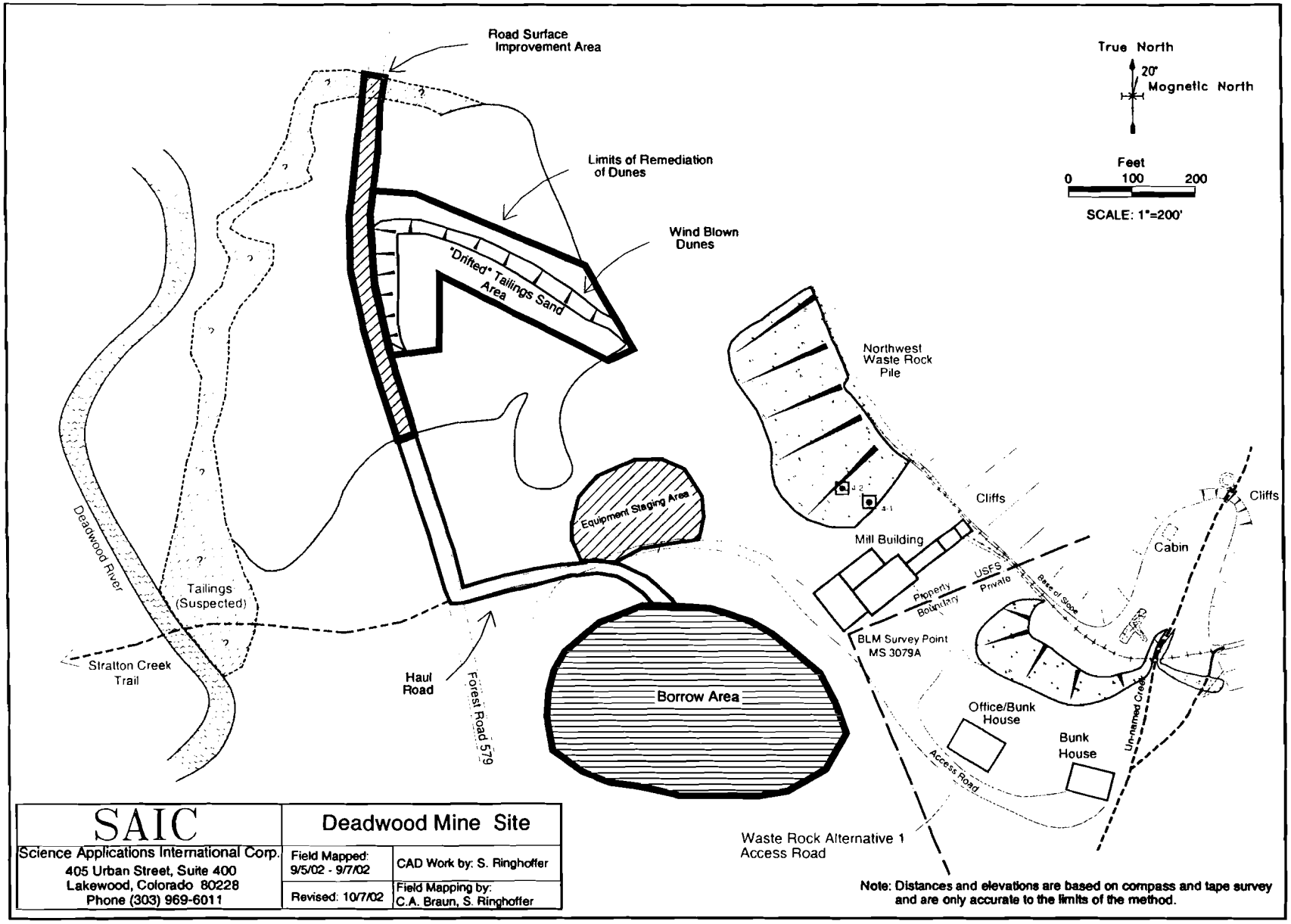
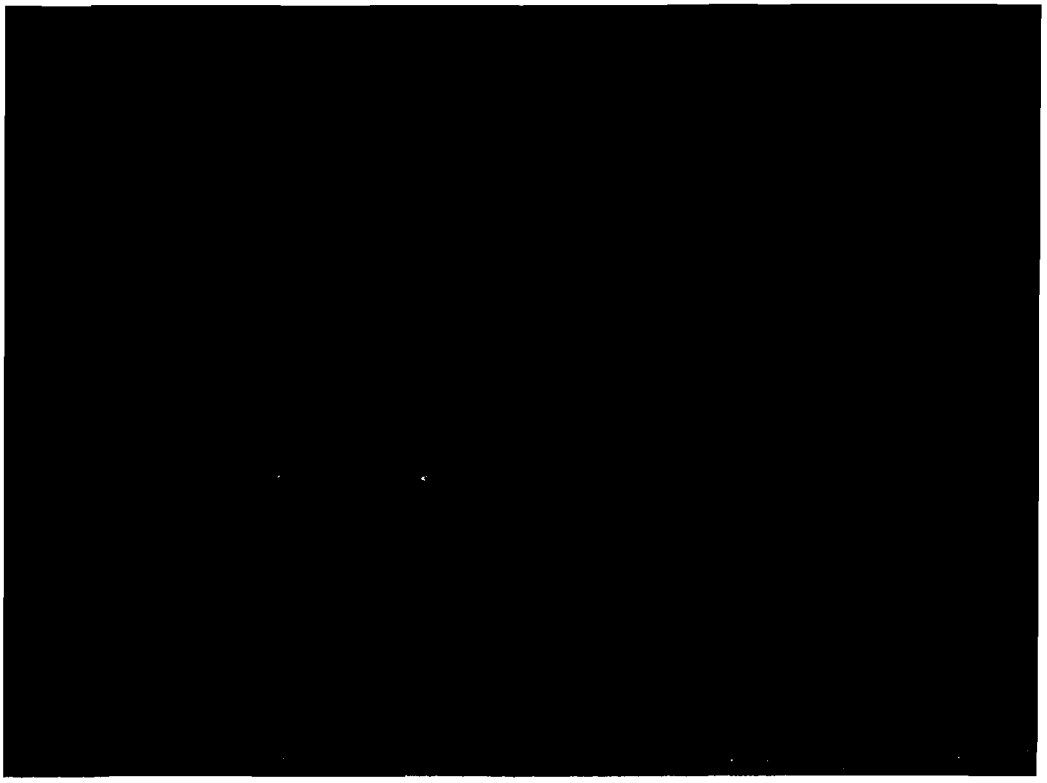


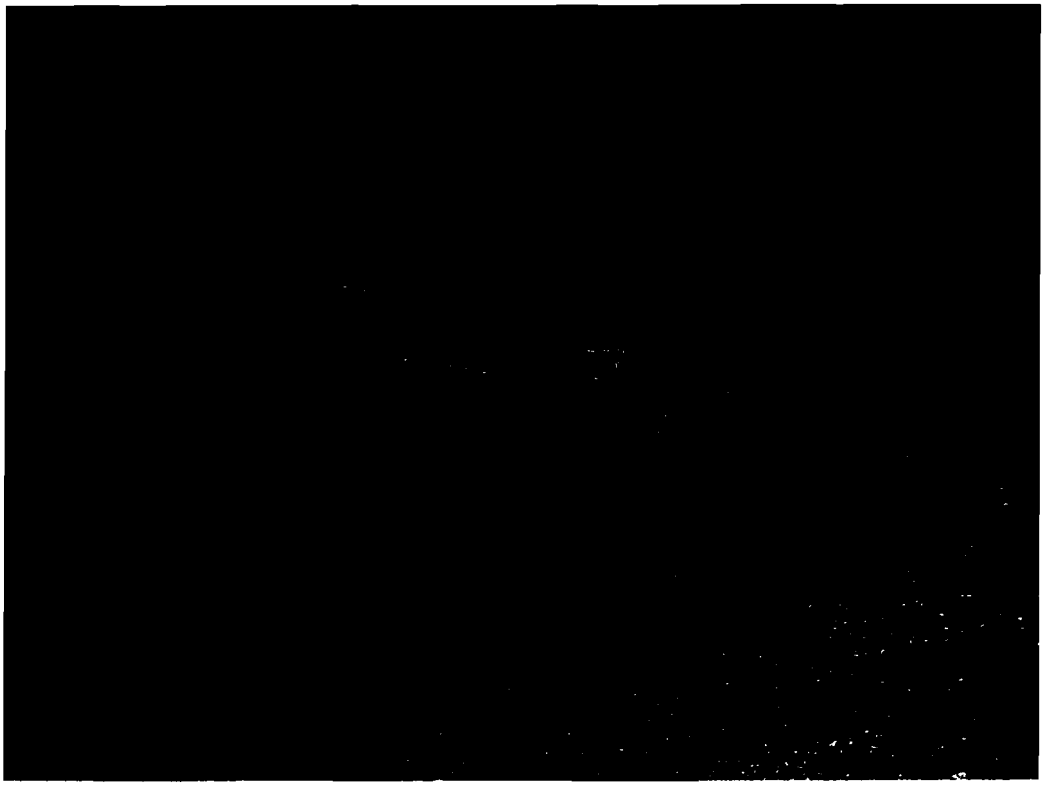
Figure 6-1 Recommended Alternative

Appendix A

Selected Photographs of the Deadwood Mine Site



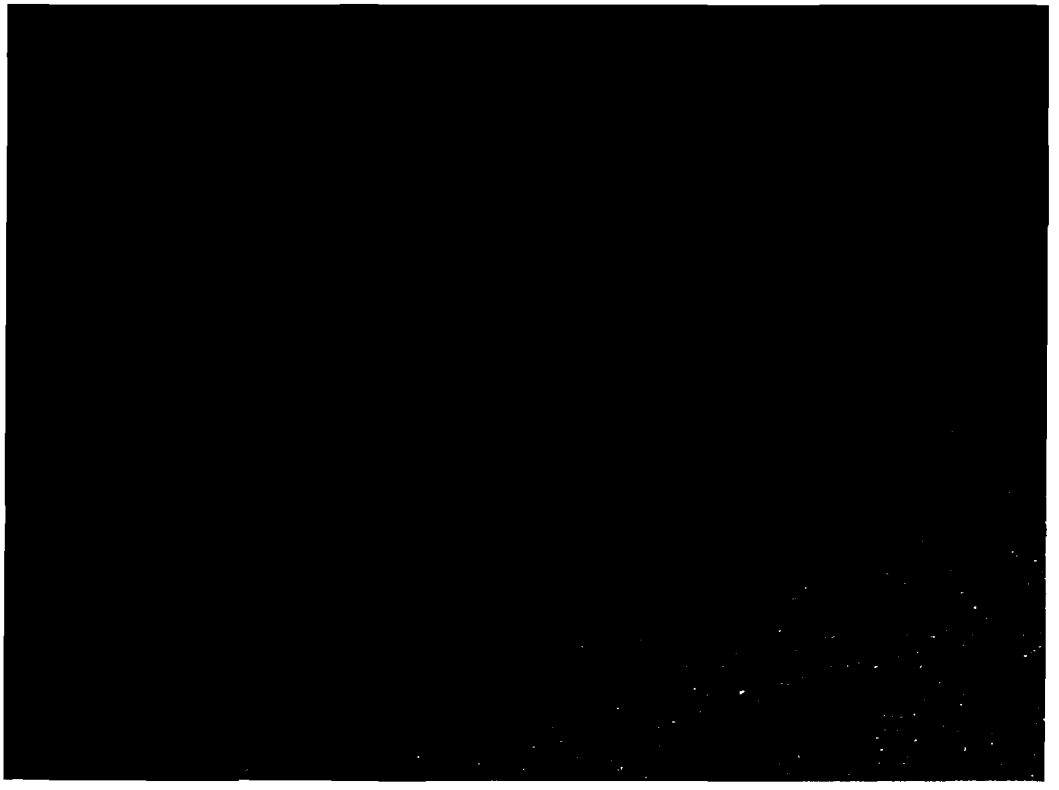
Looking southwest from top of waste rock pile



Looking northwest from top of waste rock pile



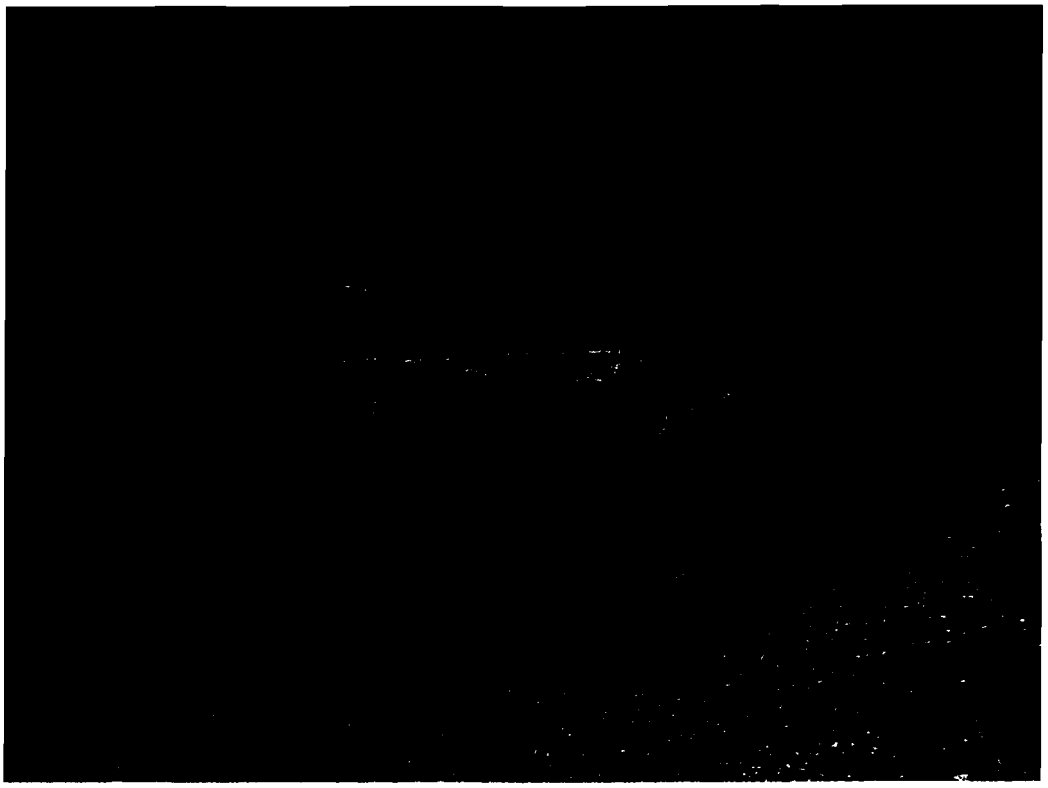
Mill building and site access road



Looking northwest from top of waste rock pile



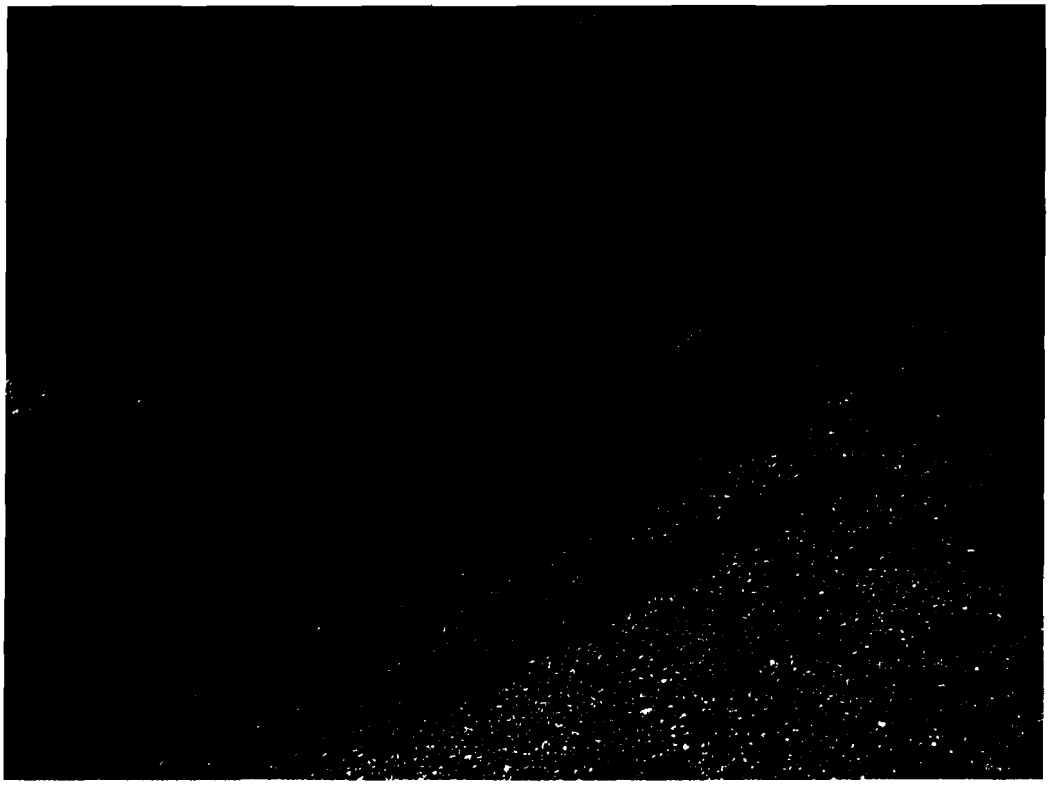
Looking southwest from top of waste rock pile



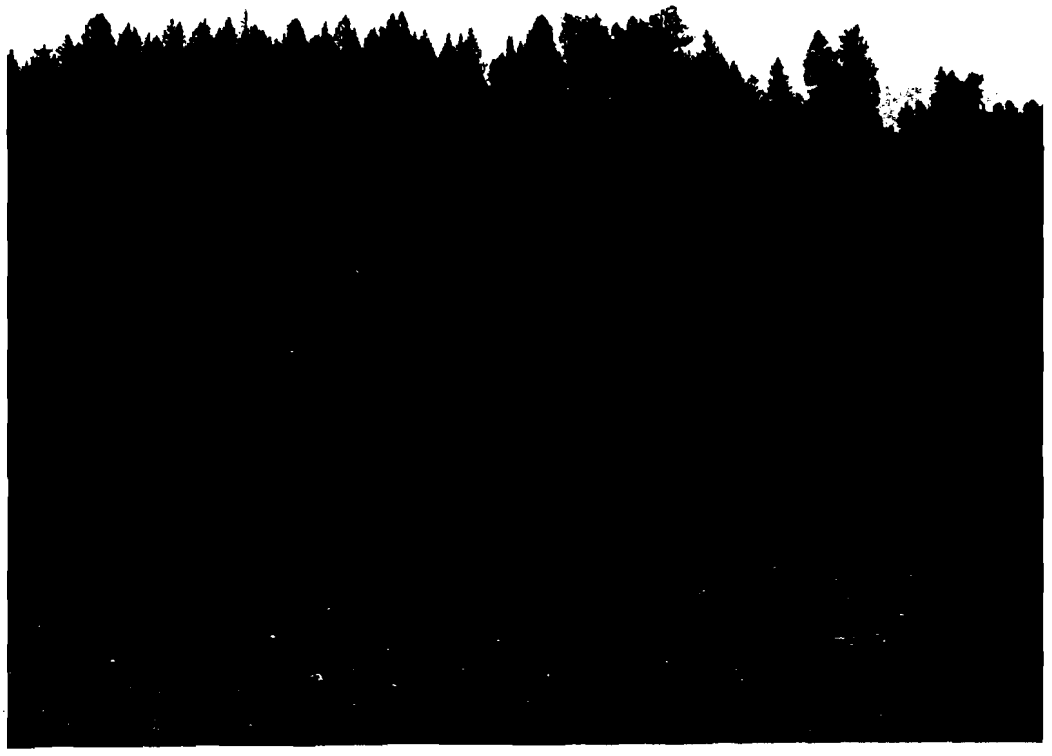
Looking northwest from top of waste rock pile



Looking east at mill building



Looking northeast along top of waste rock pile



Looking east at waste rock pile



Looking north at tailing pile



Looking south at treeless area of tailings pile



Cliffs between waste rock piles

Appendix B

Applicable, Relevant, and Appropriate Requirements (ARARs)

APPLICABLE, RELEVANT, AND APPROPRIATE REQUIREMENTS

The following section is a summary of ARARs for a non-time critical removal action under CERCLA.

ARARs

Section 121(d)(2) of CERCLA of 1980, 42 USC 9621(d)(2), requires that cleanup actions conducted under CERCLA achieve a level or standard of control which at least attains "any standard, requirement, criteria, or limitation under any Federal environmental law...or any (more stringent) promulgated standard, requirement, criteria or limitation under a State environment or facility siting law...(which) is legally applicable to the hazardous substance concerned or is relevant and appropriate under the circumstances of the release of such hazardous substance or pollutant, or contaminant..." The standards, requirements, criteria, or limitations identified pursuant to this section are commonly referred to as "applicable or relevant and appropriate requirements (ARARs)."

ARARs may be either "applicable" or "relevant and appropriate" to removal activities at a site, but not both. Applicable requirements are those standards, requirements, criteria, or limitations promulgated under federal or state environment or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, removal action, location, or other circumstance found at a CERCLA site. A removal action must satisfy all the jurisdictional prerequisites of a requirement for it to be applicable to the specific removal action at a CERCLA site.

ARARs are divided into contaminant-specific, location-specific, and action-specific requirements. Contaminant-specific requirements govern the release of materials possessing certain chemical or physical characteristics or containing specific chemical compounds into the environment. Contaminant-specific ARARs generally set human or environment risk-based criteria and protocol which, when applied to site-specific conditions, result in the establishment of numerical action values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment.

Location-specific ARARs relate to the geographic or physical position of the site rather than to the nature of the contaminants. These ARARs place restrictions on the concentration of hazardous substances or the conduct of cleanup activities due to their location in the environment.

Action-specific ARARs are usually technology- or activity-based requirements or are limitations on actions taken with respect to hazardous substances. A particular removal activity will trigger an action-specific ARAR. Unlike chemical- and location-specific ARARs, action-specific ARARs do not, in themselves, determine the removal alternative. Rather, action-specific ARARs indicate how the selected remedy must be achieved.

As provided by Section 121 of CERCLA, 42 USC 9621, only those State standards that are more stringent than any federal standard and that have been identified by the State in a timely manner are appropriately included as ARARs. Some State standards that are potentially duplicative of federal standards may be identified to ensure their timely identification and consideration in the event that they are not identified or retained in the federal ARARs.

Two general types of cleanup actions are recognized under CERCLA: removal and remedial actions. A removal action is an action to abate, prevent, minimize, stabilize, mitigate or eliminate a release or threat of release. This action is often temporarily taken to alleviate the most acute threats or to prevent further spread of contamination until more comprehensive action can be taken. A remedial action is a thorough investigation, evaluation of alternative, and determination and implementation of a comprehensive and fully protective remedy for a site. The policy of the Department of Agriculture is to implement removal actions whenever appropriate. The Deadwood Mine site cleanup action is classified as a "removal action." ARARs will be evaluated only to help ensure a complete and satisfactory result.

ARARs Applicable to the Deadwood Mine Site CleanUp

At the time of the development of this EE/CA, the Forest Service and the State of Idaho have not developed site-specific ARARs for the Deadwood Mine site. It will be the responsibility of the Forest Service to ensure that ARARs are developed and adhered to during implementation of the selected removal action. However, a list of potential ARARs has been developed from EE/CA guidance and previous EE/CAs developed for similar sites.

These potential ARARs are identified in Tables B-1, B-2, and B-3, and provide a basis from which the Deadwood Mine site ARARs can be developed. Once the ARARs are established, the requirements will be taken into consideration when implementing a removal action for the cleanup of the site. Each alternative should be evaluated to which of the identified federal, state, and local ARARs apply to the removal action and whether the ARARs can be met.

In addition to the ARARs identified, appropriate BMPs for erosion control and stabilization will be required during excavation and construction activities to prevent sediment run-off, slope instability, turbidity and other erosion occurrences.

Table B-1: Potential Chemical-Specific ARARs

Media	Citation	Applicability
Surface Water	Clean Water Act, Section 303, Water Quality Standards; National Toxics Rule (40 CFR 131.16)	Federal and state requirements related to surface water quality in the Deadwood River. However, no point source discharges are associated with the proposed cleanup alternatives.
	Idaho Water Quality Standards and Wastewater Treatment Requirements (IDAPA 58.01.02)	
Ground Water	Safe Drinking Water Act (40 CFR Parts 141 and 143)	Federal and state requirements related to the quality of ground water in the area of the Deadwood Mine site.
	Idaho Ground Water Rule (IDAPA 58.01.11)	
Air	Clean Air Act – National Ambient Air Quality Standards (40 CFR Part 50)	Federal and state requirements related to air quality in the area of the Deadwood Mine site.
	Rules for the Control of Air Pollution in Idaho (IDAPA 58.01.01)	

Table B-2: Potential Location-Specific ARARs

Requirement	Citation	Applicability
Wetlands Protection	Executive Order 11990 – Applies to Federal Actions affecting wetlands. Actions must be implemented to minimize the destruction, loss, or degradation of wetlands. Compensatory mitigation for unavoidable impacts to wetlands may be required.	Federal requirements applying to the protection of wetlands in the vicinity of the Deadwood Mine site.
Floodplain Protection	Executive Order 11988 – Applies to Federal Actions affecting floodplains. Actions must be implemented to minimize potential harm to or within the floodplain, and to restore or preserve floodplain values.	Federal requirements applying to implementation of removal actions potentially affecting floodplains. Because the Deadwood Mine is located adjacent to the Deadwood River, the floodplain may be affected by the removal actions currently being considered for implementation.
Historic Preservation	The National Historic Preservation Act of 1966 as amended. Public Law 89665; 80 Stat. 915; 16 U.S.C. 470) - Applies to the preservation of the prehistoric and historic resources of our country.	Federal Act protecting historic buildings and other structures of historic significance. These requirements may apply to the structures remaining at the Deadwood Mine site.
Protection of Threatened and Endangered Species	Endangered Species Act of 1972, as amended. Applies to the protection of state and federal designated species of plants and animals.	Federal and state requirements applying to the protection of Endangered, Threatened, and State designated plant and animal species.

Table B-3. Potential Action-Specific ARARs

Requirement	Citation	Applicability
Hazardous and Solid Waste	RCRA Subtitle C – Hazardous Waste Characteristics, Contained-in Policy, Corrective Action Management Units, Corrective Action Temporary Units, and Land Disposal Restrictions (40 CFR Part 261 and 268). These sections, however, will not apply due to the Bevill exemption for mining waste.	Federal and State requirements related to the management of hazardous and solid waste. Mining waste is specifically exempted from RCRA hazardous waste requirements and may be disposed as a solid waste. However, facility specific acceptance criteria would still apply mining waste disposed in a permitted, off-site facility.
	RCRA Subtitle D – Non-hazardous Solid Waste (40 CFR Parts 257 and 258). Applies to the management of non-hazardous solid waste.	
	Idaho Solid Waste Management Rules and Standards (IDAPA 58.01.06)	
	Idaho Hazardous Waste Rules and Standards (IDAPA 58.01.05)	
Surface Water	Clean Water Act EPA Administered Permit Programs: The National Pollutant Discharge Elimination System (40 CFR 122); *add citations for State act and NPDES Requirements*. NPDES permit required for point source discharges to waters of the United States.	NPDES permit required for point source discharges of pollutants to the waters of the United States. None of the proposed removal actions being considered include point source discharges.
	Industrial facilities (as defined in 40 CFR 112.26) are required to obtain a NPDES Stormwater Discharge Permit.	Stormwater permits required for construction sites 5 acres or larger. This requirements will soon apply to all construction sites 1 acre or larger.

	Federal Guidelines under the Clean Water Act for Specification of Disposal Sites for Dredged or Fill Material (40 CFR 230).	The purpose of these Guidelines is to restore and maintain the chemical, physical, and biological integrity of waters of the United States through the control of discharges of dredged or fill material. None of the proposed removal actions being considered include dredge and fill of drainages or streams.
Air	Clean Air Act – National Ambient Air Quality Standards (40 CFR Part 50)	Federal and state requirements related to air quality. Fugitive dust emissions may result form any alternative involving excavation and construction activities.
	Colorado Air Pollution Prevention and Control Act, Colorado Air Quality Control Commission, 25-7-101 through 212.	

Appendix C

Detailed Cost Estimates

Alternative 2

Cover Waste Rock Pile in Place

Deadwood Mine, Idaho

Assumptions

Use 2 trucks, one loader, one D-4 dozer, one D-6 dozer, and blasting equipment
Cover material can be obtained from alluvial fan located below old mill
No cost allowed for permitting or regulatory issues
Total amount of material required to produce 30 degree slope equals 54,000 cubic yards
A road would need to be installed across the cliff above mill. 225 feet would require blasting
Face of waste rock pile and borrow area will be seeded, woody debris spread, and seeded with grasses and trees
No cost allowed for procurement of right of way across private property

Capital Cost Calculations

		Item	Units	Quantity	Unit Cost (1)	Subtotal Cost	Total
Direct Costs		*Mob/Demob* ($500 per piece of equipment)	NA	4	$500.00	$2,000	
	Construct road road to top of waste rock pile	Blast 225 feet of road across cliff	N/A	1	$8,500.00	$8,500	
		Caterpillar 318 BL	hours	40	$76.00	$3,040	
		Caterpillar Mfg. D-6 Dozer	hours	40	$93.00	$3,720	
	Remove cover material, transport, and place	Caterpillar Mfg. D-4 Dozer	hours	200	$59.00	$11,800	
		Caterpillar Mfg. D-6 Dozer	hours	200	$93.00	$18,600	
		Caterpillar Mfg. 950 Loader	hours	650	$120.50	$78,325	
		Two axle dump trucks (2)	hours	1286	$65.00	$83,590	
	Finish, spread woody debris, and seed waste rock pile and borrow area		acre	3	$2,000.00	$6,000	
					BARE CAPITOL COSTS		$215,575
Indirect Costs		Engineering and Project Manager oversight (20% of direct costs)	LS			$43,115	
		CONTINGENCY (20%)				$43,115	
					TOTAL CAPITOL COST		**$302,000.00**
							Rounded to nearest $1,000
Annual O&M Costs		Inspection	days	2	$500.00	$1,000.00	
		Repairs/Materials	LS	1	$2,000.00	$2,000.00	
					Annual O&M Costs		$3,000.00
					PRESENT WORTH COST		**$362,000.00**

Alternative 3

Remove the Waste Rock Pile and Place in an On-site Repository

Deadwood Mine, Idaho

Assumptions

Use one D-4 dozer, one D-6 dozer, and 318 excavator
Disposal cell will be excavated to hold approximately 50 % of waste rock. Remainder will be placed above original ground surface
Cell will be covered with material excavated from cell
No cost allowed for permitting or regulatory issues
Face of waste rock pile and borrow area will be seeded, woody debris spread, and seeded with grasses and trees
Move waste rock pile into cell located at base of hill directly below current location

Capital Cost Calculations

		Item	Units	Quantity	Unit Cost (1)	Subtotal Cost	Total
Direct Costs		*Mob/Demob* ($500 per piece of equipment)	NA	3	$500.00	$1,500	
	Excavate cell at base of waste rock pile	Caterpillar Mfg. D-6 Dozer	hours	20	$93.00	$1,860	
	Construct road and move waste to cell	Caterpillar 318 BL	hours	40	$76.00	$3,040	
		Caterpillar Mfg. D-4 Dozer	hours	40	$59.00	$2,360	
	Place cover on cell using excavated material	Caterpillar Mfg. D-6 Dozer	hours	10	$93.00	$930	
		Caterpillar Mfg. D-4 Dozer	hours	10	$59.00	$590	
	Finish, spread woody debris, and seed		acre	2	$2,000.00	$4,000	
					Bare Capitol Costs		$14,280
Indirect Costs		Engineering and Project Manager oversight (20% of direct costs)	NA	1		$2,856	
		CONTINGENCY (20%)				$2,856	
					TOTAL CAPITOL COST		
							$20,000.00
							Rounded to nearest $1,000
Annual O&M Costs		Inspection	days	2	$500.00	$1,000.00	
		Repairs/Materials	LS	1	$2,000.00	$2,000.00	
					Annual O&M Costs		$3,000.00
					PRESENT WORTH COST		**$80,000.00**

Waste Rock Pile Alternative 4

Remove the Waste Rock Pile to a Licensed Off-Site Landfill

Deadwood Mine, Idaho

Assumptions

Use one D-4 dozer, one 950 loader, and one 318 excavator
Material meets acceptance standard for landfill at Cascade, Idaho
Volume of material equals 21,000 cubic yards
Tractor-trailer trucks will be used to haul from site to landfill
Original surface below waste rock pile will be seeded, woody debris spread, and seeded with grasses and trees
Assume dump fees to be 12 dollars per cubic yard
No cost allowed for permitting or regulatory issues

Capital Cost Calculations

		Item	Units	Quantity	Unit Cost (1)	Subtotal Cost	Total
Direct Costs		*Mob/Demob* ($500 per piece of equipment)	NA	3	$500.00	$1,500	
	Construct road and move waste to loading point	Caterpillar 318 BL	hours	80	$76.00	$6,080	
		Caterpillar Mfg. D-4 Dozer	hours	100	$59.00	$5,900	
	Haul from site to Cascade	15 yard tractor trailer trucks	hours	4200	$82.00	$344,400	
		Caterpillar Mfg 950 Loader	hours	450	$96.00	$43,200	
		Dump fees	yards	21,000	$12.00	$252,000	
	Finish, spread woody debris, and seed		acre	2	$2,000.00	$4,000	
					BARE CAPITOL COSTS		$657,080
Indirect Costs		Engineering and Project Manager oversight (20% of direct costs)	NA	1		$131,416	
		CONTINGENCY (20%)				$131,416	
					TOTAL CAPITOL COST		**$920,000.00**
							Rounded to nearest $1,000
Annual O&M Costs							
					Annual O&M Costs		$0.00
					PRESENT WORTH COST		**$920,000.00**

Alternative 5

Import Road Surfacing to Cover Tailings in Road and Stabilize Sand Dunes to East of Road

Deadwood Mine, Idaho

Assumptions

Use one D-4 dozer, one D-6 dozer, one 950 loader, and one 135H grader
Assume no hazard determined for tailings
Assume 1,100 cubic yards of fill needed for road
Assume 280 cubic yards of surface needed for road
1,100 yard throughput through screenplant will produce at least 280 yards of road surface
Assume 200 yards of run of pit will cover dune areas
Assume two 7 yard trucks to haul
Woody debris spread, and seeded with grasses and trees at borrow area
No cost allowed for permitting or regulatory issues

Timber removal costs are estimated excluding costs for regulatory requirements and conditons

Capital Cost Calculations

		Item	Units	Quantity	Unit Cost (1)	Subtotal Cost	Total
Direct Costs		*Mob/Demob* ($500 per piece of equipment)	NA	4	$500.00	$2,000	
	Excavate borrow area	Remove trees in .25 acres	acres	0.25	$750.00	$188	
		Caterpillar Mfg. D-6 Dozer	hours	30	$93.00	$2,790	
	Build up road	Haul fill in 7 yard trucks	hours	40	$82.00	$3,280	
		Haul road surface in 7 yard trucks	hours	10	$82.00	$820	
		Caterpillar Mfg 950 Loader	hours	30	$96.00	$2,880	
		Screen plant for road surfacing	yards	1100	$2.50	$2,750	
		Caterpillar Mfg. 135H grader	hours	25	$82.00	$2,050	
	Repair sand dunes on younger tailings pile	Caterpillar Mfg. D-4 Dozer	hours	8	$59.00	$472	
		7 yard trucks	hours	10	$82.00	$820	
		Caterpillar Mfg 950 Loader	hours	35	$96.00	$3,360	
	Finish, spread woody debris, and seed		acre	1	$2,000.00	$2,000	
						BARE CAPITOL COSTS	$23,410
Indirect Costs		Engineering and Project Manager oversight (20% of direct costs)	NA	1		$4,682	
		CONTINGENCY (20%)				$4,682	
						TOTAL CAPITOL COSTS	**$33,000.00**
						Rounded to nearest $1,000	
Annual O&M Costs		Inspection	days	2	$500.00	$1,000.00	
		Repair/Materials	LS	1	$2,000.00	$2,000.00	
						Annual O&M Costs	$3,000.00
						PRESENT WORTH COST	**$93,000.00**

Alternative 6

Excavate Tailings from Road Area, Replace with Road Surfacing, and Stabilize Sand Dunes to the East of Road

Deadwood Mine, Idaho

Assumptions

Use one D-4 dozer, one D-6 dozer, one 950 loader, and one 135H grader
Assume 1,700 cubic yards of fill needed for road
Assume 280 cubic yards of roadbase needed for road
1,000 yard throughput through screenplant will produce at least 280 yards of road surface
Removed tailings will be placed in dune area and covered
Assume 200 yards of run of pit wil cover dune areas
Assume two 7 yard trucks to haul
Woody debris spread, and seeded with grasses and trees at borrow area

Timber removal costs are estimated excluding costs for regulatory requirements and conditons

Capital Cost Calculations

		Item	Units	Quantity	Unit Cost (1)	Subtotal Cost	Total
Direct Costs		*Mob/Demob* ($500 per piece of equipment)	NA	4	$500.00	$2,000	
	Excavate borrow area	Labor/Equipment	acres	0.5	$750.00	$375	
		Caterpillar Mfg. D-6 Dozer	hours	50	$93.00	$4,650	
	Excavate, load and transport tailings to dune area	Caterpillar Mfg 950 Loader	hours	40	$96.00	$3,840	
		Haul tailings in 7 yard trucks	hours	60	$82.00	$4,920	
		Caterpillar Mfg. D-4 Dozer	hours	20	$59.00	$1,180	
	Rebuild road	Haul fill in 7 yard trucks	hours	70	$82.00	$5,740	
		Haul fill in 7 yard trucks	hours	10	$82.00	$820	
		Caterpillar Mfg 950 Loader	hours	55	$96.00	$5,280	
		Screen plant for road surfacing	yards	1000	$2.50	$2,500	
		Caterpillar Mfg. 135H grader	hours	50	$82.00	$4,100	
	Grade dunes, place tailings from road, and cover	Caterpillar Mfg. D-4 Dozer	hours	8	$59.00	$472	
		7 yard trucks	hours	10	$82.00	$820	
		Caterpillar Mfg 950 Loader	hours	35	$96.00	$3,360	
	Finish, spread woody debris, and seed		acre	1	$2,000.00	$2,000	
						BARE CAPITOL COSTS	$42,057
Indirect Costs		Engineering and Project Manager oversight (20% of direct costs)	NA	1		$8,411	
		CONTINGENCY (20%)				$8,411	
						TOTAL CAPITOL COST	**$59,000.00**
						Rounded to nearest $1,000	
Annual O&M Costs		Inspection	days	2	$500.00	$1,000	
		Repairs/Materials	LS	1	$2,000.00	$2,000.00	
						Annual O& M Costs	$3,000
						PRESENT WORTH COST	**$119,000.00**

Alternative 7

Remove all Tailings, Transport to an On-Site Repository, and Cover with Clean Native Soils

Deadwood Mine, Idaho

Assumptions

Use one D-4 dozer, one D-7 dozer, one 651 scraper, and one 950 loader
56,000 yards of the total of 75,000 cubic yards of tailings will be moved in the cell
Estimated that 28,000 yards will be moved with scraper and 28,000 yards will be moved with dozer
The cell will be located at the east side of the current tailings area and cover approximately 3 acres
A 1-foot thick cover will be mined in the alluvial fan located south of the old mill
The cover will require 1,700 cubic yards
The cell will be seeded, woody debris spread, and seeded with grasses and trees
No cost allowed for permitting or regulatory issues

Timber removal costs are estimated excluding costs for regulatory requirements and conditons

Capital Cost Calculations

		Item	Units	Quantity	Unit Cost (1)	Subtotal Cost	Total
Direct Costs		*Mob/Demob* ($500 per piece of equipment)	NA	4	$500.00	$2,000	
	Timber and grub area	Labor/Equipment	acres	8	$750.00	$6,000	
	Move Tailings to cell	Caterpillar Mfg. D-7 Dozer	hours	130	$129.00	$16,770	
		Caterpillar Mfg 651 Scraper	hours	130	$235.00	$30,550	
	Import cover	Haul fill in 7yard trucks	hours	120	$82.00	$9,840	
		Caterpillar Mfg 950 Loader	hours	70	$96.00	$6,720	
		Caterpillar Mfg D-7 Dozer	hours	70	$129.00	$9,030	
	Place cover	Caterpillar Mfg. D-4 Dozer	hours	70	$59.00	$4,130	
	Finish, spread woody debris, and seed		acre	11	$2,000.00	$22,000	
						BARE CAPITOL COSTS	$107,040
Indirect Costs		Engineering and Project Manager oversight (20% of direct costs)	NA	1		$21,408	
		CONTINGENCY (20%)				$21,408	
						TOTAL CAPITOL COST	
							$150,000.00
							Rounded to nearest $1,000
Annual O&M Costs		Inpsection	days	2	$500.00	$1,000.00	
		Repairs/Materials	LS	1	$2,000.00	$2,000.00	
						Annual O&M Costs	$3,000.00
						PRESENT WORTH COST	**$210,000.00**

Alternative 8

Excavate and Transport to all Tailings to Licensed Landfill

Deadwood Mine, Idaho

Assumptions

Use one D-4 dozer, and one 950 loader
Material meets acceptance standard for landfill at Cascade, Idaho
Total volume to be hauled equals 75,000 cubic yards
Tractor-trailer trucks will be used to haul from site to landfill
Original surface below tailings will be seeded, woody debris spread, and seeded with grasses and trees
Assume dump fees to be 12 dollars per cubic yard
No cost allowed for permitting or regulatory issues

Timber removal costs are estimated excluding costs for regulatory requirements and conditons

Capital Cost Calculations

		Item	Units	Quantity	Unit Cost (1)	Subtotal Cost	Total
Direct Costs		*Mob/Demob* ($500 per piece of equipment)	NA	2	$500.00	$1,000	
	Timber and grub area	Labor/Equipment	acres	8	$500.00	$4,000	
	Haul from site to Cascade	15 yard tractor trailer trucks	hours	15000	$82.00	$1,230,000	
		Caterpillar Mfg 950 Loader	hours	1600	$96.00	$153,600	
		Caterpillar Mfg D-4 Dozer	hours	1000	$59.00	$59,000	
		Dump fees	yards	75,000	$12.00	$900,000	
	Final grading	Caterpillar Mfg. D-4 Dozer	hours	40	$59.00	$2,360	
	Finish, spread woody debris, and seed		acre	11	$2,000.00	$22,000	
						BARE CAPITOL COSTS	$2,371,960
Indirect Costs		Engineering and Project Manager oversight (20% of direct costs)	NA	1		$474,392	
		CONTINGENCY (15%)				$355,794	
						TOTAL CAPITOL COST	
							$3,202,000.00
							Rounded to nearest $1,000
Annual O&M Costs							$0.00
						ANNUAL O&M COSTS	$0.00
						PRESENT WORTH COST	**$3,202,000.00**

Alternative 9

Remove Waste Rock Pile and Use for Cover for Tailings located East of Road

Deadwood Mine, Idaho

Assumptions

Use one D-4 dozer, one D-7 dozer, 318 excavator, and one 651 scraper
20,000 cubic yards of material will be removed from the cell prior to tailings placement
54,000 cubic yards of tailings will be placed in the cell
Waste rock and rock removed from the cell will be used to cover the tailings
Sufficient waste rock exists to cover the tailings with approximately 5 feet
The material excavated from the cell will be used as a berm to reduce the slope of the hillside under the pile
Face of slope below waste rock pile and cell area will be seeded, woody debris spread, and seeded with grasses and trees
No cost allowed for permitting or regulatory issues

Capital Cost Calculations

		Item	Units	Quantity	Unit Cost (1)	Subtotal Cost	Total
Direct Costs		*Mob/Demob* ($500 per piece of equipment)	NA	4	$500.00	$2,000	
	Excavate cell at base of waste rock pile	Caterpillar Mfg. D-7 Dozer	hours	80	$129.00	$10,320	
	Move Tailings to cell	Caterpillar Mfg. 651 Scraper	hours	250	$235.00	$58,750	
		Caterpillar Mfg. D-7 Dozer	hours	250	$129.00	$32,250	
	Cover with waste rock and excavated material	Caterpillar Mfg. D-7 Dozer	hours	60	$129.00	$7,740	
		Caterpillar Mfg. D-4 Dozer	hours	40	$59.00	$2,360	
		Caterpillar 318 BL	hours	40	$76.00	$3,040	
	Finish, spread woody debris, and seed		acre	8	$2,000.00	$18,000	
						BARE CAPITOL COSTS	$132,460
Indirect Costs		Engineering and Project Manager oversight (20% of direct costs)	NA	1		$26,492	
		CONTINGENCY (20%)				$26,492	
						TOTAL DIRECT COST	
							$185,000.00
							Rounded to nearest $1,000
Annual O&M Costs		Inspection	days	2	$500.00	$1,000.00	
		Repair	LS	1	$2,000.00	$2,000.00	
						Annual O&M Cost	$3,000.00
						PRESENT WORTH COST	**$245,000.00**

Waste Rock Pile Alternative 10

Remove Waste Rock Pile and Use for Cover for Tailings

Deadwood Mine, Idaho

Assumptions

Use one D-4 dozer, one D-7 dozer, 318 excavator, and one 651 scraper
20,000 cubic yards will be removed from the cell prior to tailings placement
75,000 cubic yards of tailings will be placed in the cell
Waste rock and rock removed from the cell will be placed on top of of the tailings
There is enough waste rock to cover the tailings with approximately 3 feet of material
The material excavated from the cell will be used as a berm to reduce the slope of the hillside under the pile
Face of waste rock pile and borrow area will be seeded, woody debris spread, and seeded with grasses and trees
No cost allowed for permitting or regulatory issues

Capital Cost Calculations

		Item	Units	Quantity	Unit Cost (1)	Subtotal Cost	Total
Direct Costs		*Mob/Demob* ($500 per piece of equipment)	NA	4	$500.00	$2,000	
	Timber and grub area	Lobor/Equipment	acres	8	$500.00	$4,000	
	Excavate cell at base of waste rock pile	Caterpillar Mfg. D-7 Dozer	hours	80	$129.00	$10,320	
	Move Tailings to cell	Caterpillar Mfg. 651 Scraper	hours	350	$235.00	$82,250	
		Caterpillar Mfg. D-7 Dozer	hours	350	$129.00	$45,150	
	Place excavated material back as cover	Caterpillar Mfg. D-7 Dozer	hours	80	$129.00	$10,320	
		Caterpillar Mfg. D-4 Dozer	hours	40	$59.00	$2,360	
		Caterpillar 318 BL	hours	40	$76.00	$3,040	
	Finish, spread woody debris, and seed		acre	13	$2,000.00	$26,000	
						BARE CAPITOL COSTS	$185,440
Indirect Costs		Engineering and Project Manager oversight (20% of direct costs)	NA	1		$37,088	
		CONTINGENCY (20%)				$37,088	
						TOTAL DIRECT COST	
							$260,000.00
							Rounded to nearest $1,000
Annual O&M Costs		Inspection	days	2	$500.00	$1,000.00	
		Repairs/Materials	LS	1	$2,000.00	$2,000.00	
						Annual O&M Costs	$3,000.00
						PRESENT WORTH COST	**$320,000.00**

Appendix D

SAIC Data Validation Summary

DATA VALIDATION SUMMARY REPORT
Deadwood Mine Project, SAIC September Sampling

Laboratory: SVL Analytical, Inc.
SOW #: 103094

Soil Samples
Metal Parameters

Sample Numbers:	Field#	Lab#
	090602-1	S309898
	090602-2	S309899
	090602-3	S309900
	090602-4	S309901
	090602-5	S309902
	090602-6	S309903
	090602-7	S309904
	090602-8	S309905
	090602-9	S309906

Analyses: Antimony, Arsenic
Barium, Beryllium
Cadmium, Chromium
Copper, Iron
Lead, Manganese
Mercury, Nickel
Selenium, Silver
Thallium, Zinc
Molybdenum

Holding Times: All analytical holding times were met.

Calibration: All calibration CCV, ICV, and linearity criteria were achieved.

Method Blanks: All laboratory method and instrumentation blanks were free of contamination.

LCS: Mercury LCS recovery was slightly elevated resulting in mercury values being qualified as estimated "J". All other LCS % recovery values were acceptable.

Matrix Spike: Matrix spike recoveries for antimony and copper were low, while recovery for barium was high. These deviations resulted in elemental values being estimated "J or UJ" in the data set. Other MS % recovery values were acceptable.

Lab Duplicates: Laboratory duplicate analysis performed on these samples exhibited an elevated relative percent difference for copper, iron, lead, and zinc causing the results to be estimated "J or UJ".

Serial Dilution: ICP serial dilutions were acceptable, however, lead and zinc percent differences were slightly elevated, resulting in their data being estimated "J".

General: Data package contents were complete and acceptable. Attached are the validated Form 1's, the data review checklists, and definitions for SAIC's data validation reason codes.

Summary: Data produced for this study demonstrates that it can withstand scientific scrutiny, is appropriate for its intended purpose, is technically defensible, and is of known and acceptable sensitivity, precision, and accuracy. The environmental information presented has an established confidence that allows utilization for the project objectives and provides data for future needs.