FINAL
Engineering Evaluation / Cost Analysis (EE/CA) for Removal of Mine Wastes at the Idora Mill Site and Downstream along Beaver Creek, Shoshone County, Idaho

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1.0 Introduction

The Idora Mill site is located near the headwaters of Beaver Creek, a tributary to the North Fork Coeur d'Alene River. Few records exist concerning operation of the Idora Mill. It began operation in the early twentieth century and operated into the 1950s when many of the mines of the Beaver Creek and Nine Mile Creek area ceased operations. Mill tailings were deposited in the floodplain of Beaver Creek, often behind plank dams, during the operation. Some of these tailings were subsequently eroded and deposited downstream. The most apparent area of tailings deposition is between the mill site and the Carbon Creek confluence approximately 1.2 miles downstream. For purposes of this investigation and any removal action, the Idora Mill site means this larger area while "mill site" means just the immediate area of the former operations including the waste rock pile.

Mine wastes at the mill site and deposited downstream present potential human health impacts to site users related to lead and water quality impacts to Beaver Creek related to zinc and cadmium. Potential human health and environmental impacts addressed in this document are associated with tailings and soils contaminated with metals and arsenic. Arsenic is not chemically defined as a metal, but it is often found with metals that also pose health or ecological risks and often can be removed together with those metals. Because of this, for purposes of general discussion, arsenic is often included in the term "metals," especially when discussing "metals-contaminated" tailings or soils.

1.1 Purpose and Objective

This engineering evaluation/cost analysis (EE/CA) was developed in accordance with the "non-time critical removal" process as described by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended and the National Oil and Hazardous Substances Contingency Plan (NCP). For this proposed removal of mine wastes, the Forest Service would lead the effort on federally managed lands at the mill site and immediately downstream using the authorities delegated to federal agencies under CERCLA Section 106. Section 106 permits a federal agency to take expedited action when there may be an imminent and substantial endangerment to the public health or welfare or the environment because of an actual or threatened release, but potential responsible parties have not been determined/proven to be responsible. The State of Idaho would lead remedial efforts on the private land downstream of the mill as a party that did not cause the contamination but is addressing its impacts (a "good Samaritan") as outlined in Section 107 of the CERCLA. Following the EPA's Guidance for Conducting Non-time Critical Removal Actions (EPA 1993), the EE/CA provides the logic and process to screen, develop and evaluate potential remedial alternatives that may be used to clean up mine wastes. The objective of this EE/CA is to develop potential alternatives including their engineering and cost parameters that can be used to reduce or eliminate human health and/or environmental risks associated with tailings and metals

contamination of soils and substrate at the mill and downstream along Beaver Creek to the impacts of the Carlisle Mill near the Carbon Creek confluence.

1.2 Project Background

The Idora Mill site was recognized as a source of metals contamination to water and a potential human health threat to visitors by abandoned mine lands surveys developed by private contractors (SAIC 1993). Subsequent water quality monitoring by DEQ and sediment geochemistry analysis by the U.S. Geological Survey (Box et. al. 2004) demonstrated water quality impairment and bed load contamination of upper Beaver Creek associated with the Idora Mill site. The Army Corps of Engineers and the Forest Service acted on this information by commissioning site investigations on the Idora Mill site by Bitterroot Restorations, Inc. (2003) and MCS Environmental, Inc. (2004). The Forest Service recognized that the tailings eroded and deposited downstream of the Idora Mill site on private land contributed to the water pollution. As a result, the site investigations addressed both the affected federal lands and the private property downstream to the Carbon Creek confluence.

As a matter of policy the Forest Service does not exercise its authorities under Section 106 of CERCLA on private property. The Forest Service asked the State of Idaho, Department of Environmental Quality (DEQ), if DEQ wished to deal with the private portion of the site. In response, DEQ developed and submitted a Section 319 CWA grant request for support in removal of the downstream tailings deposits along Beaver Creek. The grant was awarded to DEQ in June 2009. The Forest Service made the Idora Mill site a top priority for abandoned mine reclamation funding associated with the American Recovery and Reinvestment Act of 2009. Funds were subsequently appropriated to support removal of tailings and contaminated soils at the Idora Mill site.

1.3 Report Organization

This EE/CA report is organized into nine sections plus appendices. Section 1 provides a brief introduction while Section 2 provides a more detailed site description including the physical setting, resources and contaminants found on the site. Specific data on contaminants found on the site is provided in Section 3 and a conceptual risk model and assessment are provided in Section 4. The removal action objectives and associated applicable or relevant and appropriate requirements (ARARs) are covered in Section 5. The applicable removal technologies are reviewed in Section 6 and removal alternatives are developed. The removal alternative rating factors are listed and applied to each alternative in Section 7 and the alternatives are compared against each other. Section 8 identifies the selected alternative. Section 9 provides details of the public review and comment process and the response to comments received. Section 10 provides the references.

2.0 Site Description

The Idora Mill site is situated near the headwaters of Beaver Creek approximately 1.75 miles northeast of Carbon Center and 7.33 miles northeast of Wallace in Shoshone County, Idaho (Figure 1). The extended site is located on a mixture of private and public land. The Idora mill is on lands managed by the U. S. Forest Service with other mill-related building areas on private lands. Downstream of the mill site, the contaminated stream areas are on private property and lands managed by the U.S. Forest Service and the U. S. Bureau of Land Management (BLM).

2.1 Site Location and Ownership

The Idora Mill site is within the Coeur d'Alene National Forest (Coeur d'Alene River Ranger District) unit of the Idaho Panhandle National Forests. The mill site is contained in a narrow mountain valley. The mill remnant is composed of a collapsed mill structure and tailings fill within the valley. Beaver Creek has eroded the tailings from its floodplain and mobilized them downstream during high discharge events. The majority of the identifiable tailings are deposited along the stream to the Carbon Creek Confluence. These tailings are in deposition zones and fill areas along the course of Beaver Creek in a non-continuous pattern.

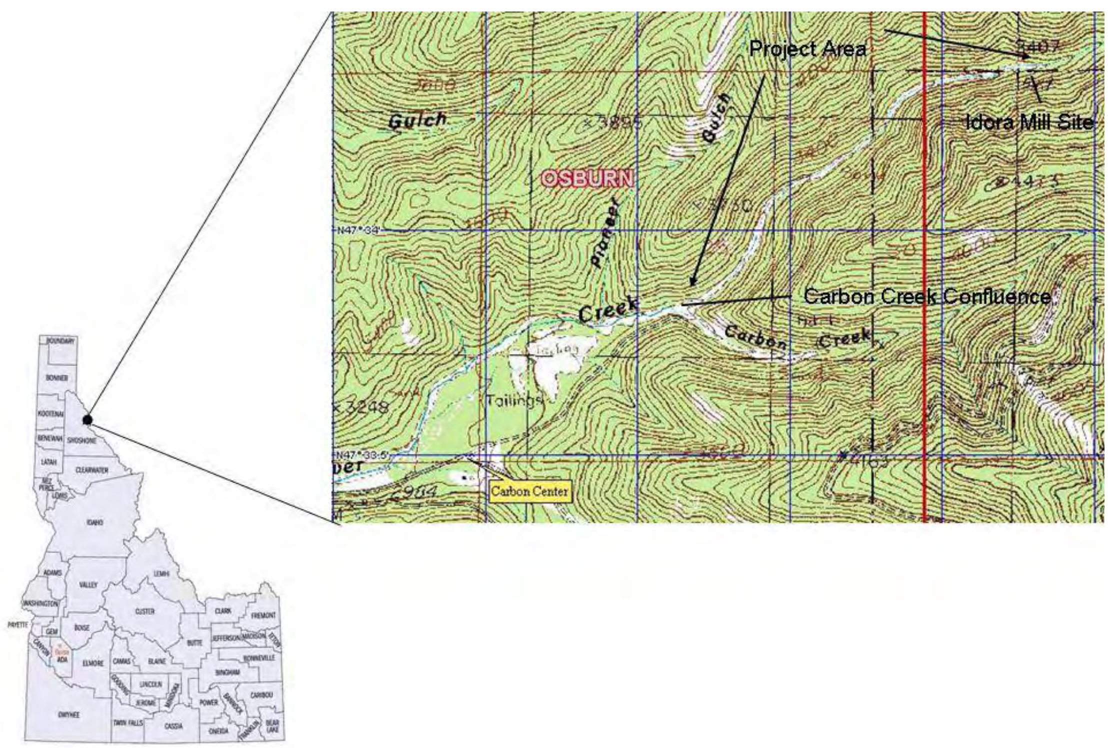

Figure 1. Location of Idora Project Area along upper Beaver Creek between the mill site and Carbon Creek confluence in northeast of Carbon Center in Shoshone County, Idaho

The contaminated site is largely within the floodplain boundaries of Beaver Creek and has a length of approximately 6,336 feet (1.2 miles). The site has three managers/owners. The mill and one collapsed adit are located on lands managed by the U.S. Forest Service. A small parcel of private land owned by Forest Capital Timber intervenes between the Forest Service- and BLM-managed lands. These private lands have old mill-related buildings areas and an adit. Below the mill site, the stream passes through a short segment of Forest Service lands, then through a BLM-managed parcel and then another small Forest Service segment. The remainder of the floodplain down to near the Carbon Creek confluence is owned by Forest Capital Timber Company (Figure 2). None of the current mangers/owners engaged in the mining activity.

2.2 Idora Mill Operational History

According to SAIC (1993), little was recorded concerning the operation of the Idora Mill. It is believed to have begun operations in the early 1900s and ceased operations during the mid-1950s. This pattern is similar to those of the nearby Interstate-Raymond Carlisle, Rex and Sunset Mines. During its period of operation, 12,509 tons of ore were recorded as milled. Lead dominated the recovered metals with zinc and silver also recovered. Small quantities of gold and copper were recovered. If these reports are accurate, the ore milled (12,509 tons) would equate to 9,546 cubic yards of tailings initially (Appendix 1). The tailings mixed over time with other sediments and waste rock while leaching of metals contaminated soil and other substrates at the site. Better estimates of the contaminated material are presented later in the document when site investigations are discussed.

2.3 Surrounding Land Use and Sensitive Ecosystems

The land use surrounding the Idora Mill and upper Beaver Creek is forest land managed primarily for timber production. Several mining claims and abandoned mine workings can be found in the surrounding land, but none of these features are active. Several mining claims still exist around and on the project area. The nearest homes are 1.5 miles to the west along Beaver Creek. The population of the Carbon Center area does not exceed 20 during the summer months. The closest population centers are Murray (573) 3.5 miles to the north over a mountain ridge and Wallace (861) 7.3 miles southwest over a mountain ridge.

The forest ecosystem surrounding the Idora site supports threatened and endangered and species of special concern including grey wolf, grizzly bear, wolverine and lynx. Bull trout potentially used Beaver Creek, but the species has been functionally extirpated from its waters. A biological assessment of the impacts of the project has been developed. Based on the assessment an informal consultation with the U.S. Fish & Wildlife Service is underway to address concerns for threatened and endangered species under section 7 of the Endangered Species Act.

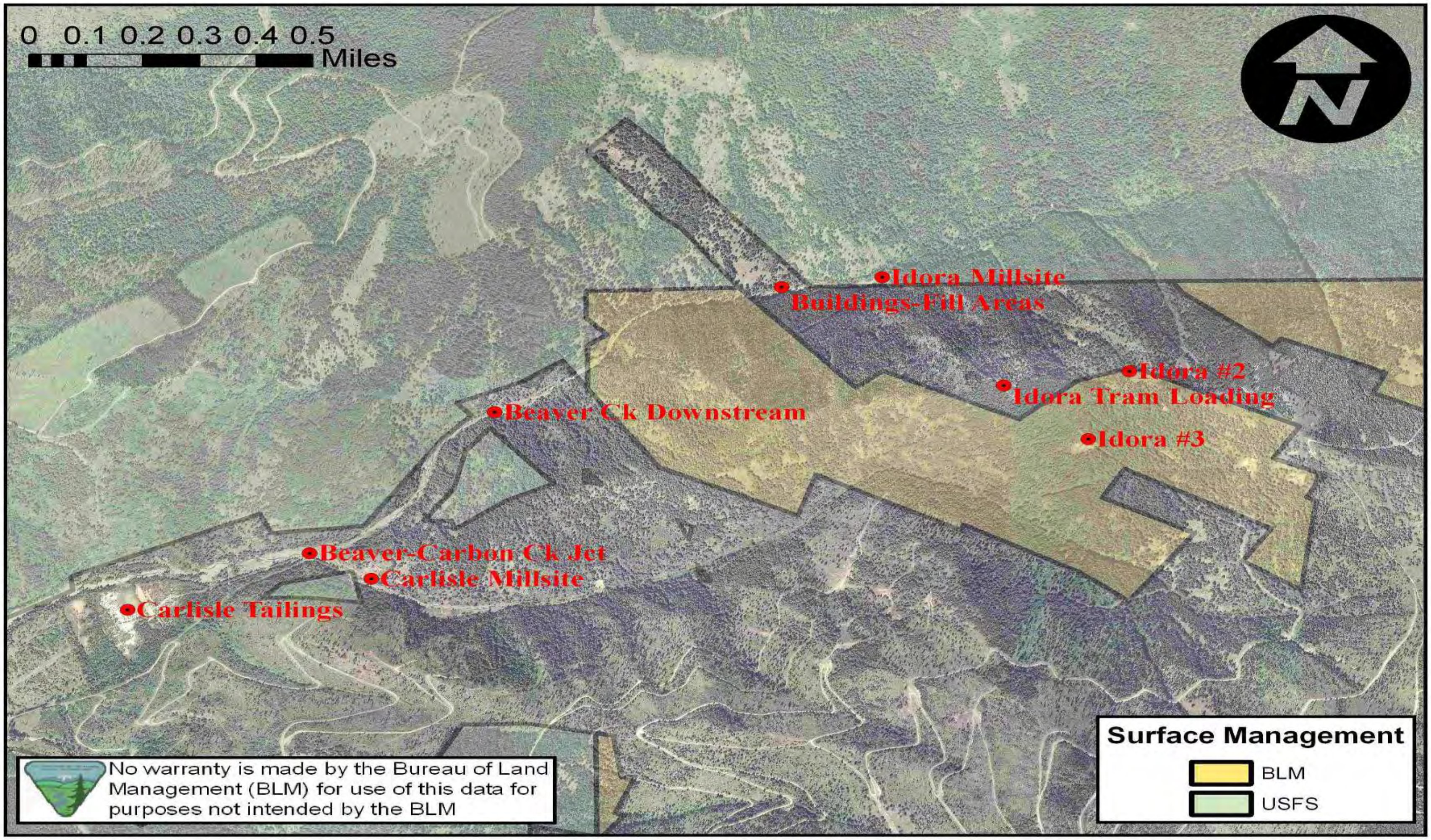

Figure 2. Idora Mill project area with Forest Service and Bureau of Land Management boundaries and location of mine and mill features.

2.4 Site Physical Plan

As it currently exists, the physical characteristics of the site are uncomplicated (Figure 3 and Figure 4). The mill site is found at the top (upstream limit) of the project area. Little of the mill structure exists. The collapsed mill building is present on the hill above the tailings deposit. A single footing wall remains erect. A mill waste deposit (waste rock dump) is located on the left bank (looking downstream) just below the mill building (Appendix 2, Picture A).

Tailings are present on both sides of one of two Beaver Creek channels that flow through the site. The site was dramatically altered since it was last assessed, likely by the 2008 snow melt event. A water impoundment feature above the site recently failed causing down-cutting of the channel adjacent to the mill. Beaver Creek's perennial channel remains the channel located furthest from the mill. During this impoundment failure event, a significant volume of the tailings deposit was exported downstream (Appendix 2, Pictures B and C).

Associated with the mill is an adit feature with waste rock deposited to create flat land at its entrance and spilling into the creek channel. This adit is probably not directly associated with the upper Idora Mine workings which are located at higher levels on the mountain. Ore delivery from these higher adits was done mainly by tramway. Further downstream on private land, a cabin and several pieces of rusted heavy machinery are located on the waste rock and tailings fill area (Appendix 2, Picture D).

Beaver Creek has recognizable tailings-contaminated deposits along its course to near the Carbon Creek confluence. A tailings-rich area was impounded behind a breached plank dam feature (Appendix 2, Picture E). At least two other areas were "cribbed" and filled with contaminated materials to create flat areas for building construction (Appendix 2, Picture F). Waste rock from the adit and filled areas has been eroded and transported down Beaver Creek, adding to its sediment load.

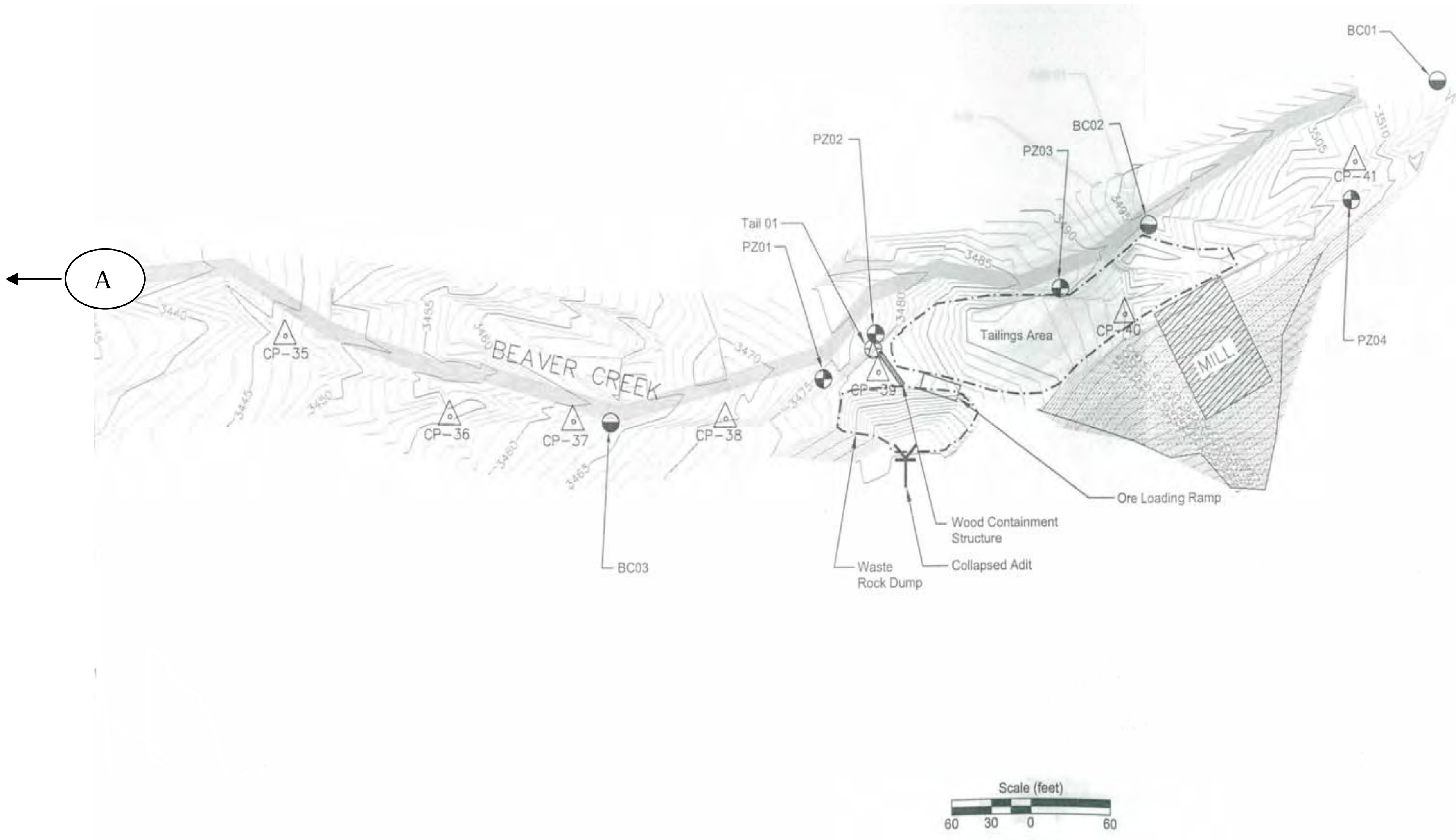

Figure 3. Detail Survey Map of Idora Mill site and the immediate downstream portion of Beaver Creek, to just above sampling location CP-34. Note: Figure adapted from MCS Environmental (2004) graphics; triangles and circles show ground water and surface water sampling stations

A

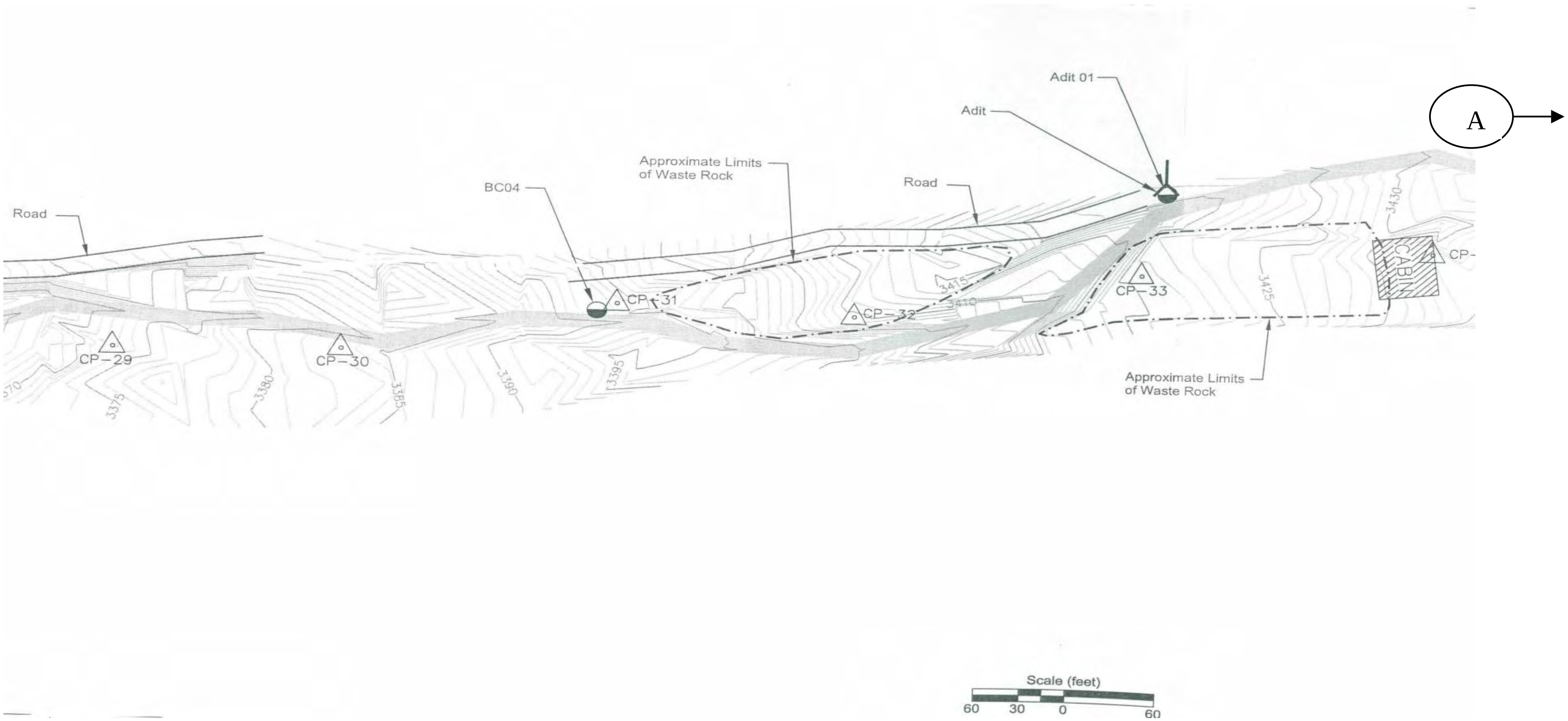

Figure 4. **Detail Survey Map of Idora Mill site and the immediate downstream portion of Beaver Creek, from sampling point CP-34.** Note: Figure adapted from MCS Environmental (2004) graphics; triangles and circles show ground water and surface water sampling stations

The stream has a high gradient (5-8%) throughout its course to Carbon Creek and the bed stability is controlled by boulders and large woody debris, primarily logs (Appendix 2, Picture G). Increased sediment load from tailings and waste rock has caused instability in the stream bed evidenced by a wider channel with reduced vegetation and braiding especially in the reach immediately above Carbon Creek where the stream gradient decreases to 5% (Appendix 2, Picture H). However, several reaches of the stream are stable with excellent riparian vegetation (Appendix 2, Picture G).

An old road in poor condition and rapidly being overtaken by vegetation parallels the stream. In some locations, the road encroaches on the stream and its floodplain. In two locations along the road, significant sections have been eroded during high discharge events adding to the in-stream sediment load (Appendix 2, Picture I).

2.5 Site Geology

The site is located in the Coeur d'Alene Mountains, generally recognized as part of the Bitterroot Range stretching along the Idaho-Montana Border from Clark Fork to Lost Trail Pass. The site bedrock is part of the lower Belt meta-sedimentary super group. The bedrock is composed of quartzites and siltites of the Prichard Formation. Development of mineralized zones within the Prichard and lower Wallace Belt Formations is believed to have occurred during the Cretaceous period fostered by the intrusion of igneous batholith. Granite Peak to the east and Tiger and Custer Peaks to the south are believed to be surface expressions of the batholith. The entire area of the Coeur d'Alene Mountains is believed to have been covered during the most recent glacial period. The landscape is, as a result, only moderately developed in terms of unconsolidated deposits and soils. An additional result of glaciations is the common stream structure in the region that is very steep near the headwaters and rather quickly declines to a low gradient. The Idora Mill site is located sufficiently close to the headwaters (2.5 miles) to be in the high-gradient area of the watershed.

Soils of the area are poorly developed and are, at best, a thin mantle over colluvial or, in stream bottoms, alluvial deposits. These soils are not mapped for the area by the Natural Resource Conservation Service or U.S. Forest Service, but given the elevation, climate, vegetation and terrain, soils could most likely be described as poorly developed brown podzolic regosols.

2.6 Climate

Climate local to the Idora Mill site is influenced by both Pacific maritime air masses from the west and continental air masses from Canada to the north. The annual weather cycle generally consists of cool to warm summers with cold and wet winters. The relative warmth of summers or winters depends on the dominance of the warmer, wetter Pacific or cooler dryer continental air masses. Precipitation is greatest during the winter.

Although intervening mountain ranges progressively dry the Pacific maritime air masses, these air masses deposit appreciable moisture primarily as snow on the North Fork watershed of which Beaver Creek is a part. Maritime air masses originating in the mid-Pacific are relatively warm, often yielding their precipitation as rain. Elevations in the watershed are generally between 3,000 and 5,000 feet with the majority of the watershed in the rain-on-snow elevation range of 3,300 to 4,500 feet. However, the upper Beaver Creek watershed is primarily above the rain-on-snow zone. In most winters, the high elevation snowpack remains intact until the spring snow melt event. Snow pack may total 6 to 15 feet at its maximum height dependent on location in the upper Beaver Creek watershed.

2.7 Site Hydrology and Hydrogeology

The site hydrology is dominated by upper Beaver Creek. No tributaries of significance enter Beaver Creek between the Idora Mill site and Carbon Creek. The stream gradient is very steep, from 8% in the reaches through and below the mill site, declining to 5% in the reach immediately above the Carbon Creek confluence. As a consequence of its steep gradient, the stream is incised between the adjacent mountain slopes, has a narrow floodplain that broadens slightly downstream and has very low sinuosity with stream-bed stability controlled by boulders and large woody debris. Due primarily to mining impacts but also the upstream location of the reach, sediment loads are high in the stream and cause stream-bed instability.

Ground water depth was measured at the mill site during low-discharge conditions at 2 to 3 feet below ground surface and at the same level as the water in the stream (MCS Environmental 2004). Under low discharge conditions, the ground water, with the exception of a seep area, was below the tailings deposit. However, under high-discharge conditions, the ground water level is likely within the tailings deposit. The hydrogeologic data collected is consistent with a very close connection between the stream and its associated ground water system. Surface and ground water are likely exchanged rapidly, dependent on the micro-gradient and porosity of the substrate at any given point in the stream. Although gaining and losing reaches (where the stream gains or loses ground water) occur along the stream course especially at the mill site, the stream is generally gaining discharge from mountain slope aquifers as it traverses the valley below the mill site.

2.8 Vegetative Cover

The Idora Mill site is surrounded with fairly dense mixed coniferous forest. The mill site is devoid of most vegetation due to the poor water retention of the course tailings and waste rock substrate, its correspondingly low cation exchange capacity and the presence of divalent metals that tightly bind phosphate. Areas of poor vegetation cover are found downstream of the mill site, also likely due to course substrates and the phosphate-

binding characteristics of metals-contaminated substrates. In addition, stream bed instability retards full vegetation development. The valley bottom and the adjacent lower mountainsides are covered with dense forest dominated by western red cedar. The habitat type is western red cedar (*Thuja plicata*)/lady fern (*Athyrium filex femina*) (*ThPl/AtFe*). Long-lived serial components of the forest include Douglas fir, western larch and western white pine while climax species are mixed and include western hemlock, grand fir and Engelmann spruce. Riparian tree and shrub species include mountain alder, red osier dogwood, Rocky mountain maple, currant and thimbleberry.

3.0 Summary of Site Investigation Results

The water quality 2.5 miles downstream was monitored by DEQ during water years 1999 through 2002 (DEQ 2002). DEQ has also completed an assessment of whether the water in Beaver Creek in the Idora Mill site supports the beneficial use for cold water biota (cold water biota are the animals, especially trout and other cold water fish species, that will only live in waters cold enough for them). A study of metals in stream sediment was completed by the USGS (Box et. al. 2004). Site investigations for hazardous materials have been conducted for the U.S. Army Corp of Engineers as part of the Restoration of Abandoned Mines Sites (RAMS) program by Bitterroot Restoration, Inc. (2003) and for the U.S. Forest Service by MCS Environmental, Inc. (2004).

3.1 Water Quality Results

Water quality was measured by DEQ during part of water year 1999, water years 2000 and 2001 and part of water year 2002 at the Carbon Center Bridge approximately 2.5 miles below the Idora Mill (DEQ 2002). Water quality is likely affected at this site by the Carlisle Mill site as well. In assessing water quality, the difference between low-discharge and high-discharge conditions was taken into account. Also in many cases, the water quality standards are set at different levels for chronic (long-term) exposure than for acute (immediate) exposure. Water quality exceeded chronic cold water biota standards related to any discharge conditions for cadmium, lead and zinc. Acute cold water biota standards for cadmium and zinc were exceeded under both high and low discharge conditions (Table 1). Bio-monitoring completed by DEQ confirms that the cold water biota of Beaver Creek is not fully supported in the vicinity of Carbon Center (Appendix 3).

Table 1. Average dissolved cadmium, lead, and zinc concentrations in Beaver Creek at the Carbon Center Bridge under high- and low-discharge conditions compared to chronic and acute standards at the average hardness

Discharge Condition	Average Cadmium (ug/L)	Average Lead (ug/L)	Average Zinc (ug/L)	Average Hardness (mg/L CaCO3)
High (n=7)	2	4	405	20.5
CCC (chronic std.)	0.25	0.54	36	
CMC (acute std)	0.42	14	36	
Low (n=32)	2.8	2.0	640	40.3
CCC (chronic std)	0.34	0.92	55	
CMC (acute std)	0.62	24	54	

3.2 USGS Stream Sediment Investigation

The focus of the USGS study was identification of trace (heavy) metals contamination sources to Beaver and Prichard Creeks. Sediment samples were collected along the main stems and tributaries of Beaver and Prichard Creeks. The Beaver Creek reach between the Idora Mill site and Carbon Creek confluence has zinc sediment concentrations in the range of 2,001-4,000 mg/kg and lead in the range of 4,001 to 10,500 mg/kg. Control stream reaches by comparison have stream sediments of 90 to 250 mg/kg zinc and less than 250 mg/kg lead. These data demonstrate that the Idora Mill site and its associated metals contaminate upper Beaver Creek. Both zinc and lead concentrations in the sediments of Beaver Creek decline in a downstream direction. These observations indicate that removals at the Idora and Carlisle Mills and the stream reaches immediately below these sites should remove the sources and allow improvement in the sediment and likely in the water quality of Beaver Creek.

3.3 Bitterroot Restoration Project Assessment

Bitterroot Restoration, Inc. (Bitterroot) completed a site investigation during October 2002 (Bitterroot Restoration 2003). Bitterroot collected field portable X-ray fluorescence (FPXRF) data from several locations and strata at the mill site and downstream to Carbon Creek. Samples were collected for chemical analysis and calibration of the FPXRF data. Strong correlations between the FPXRF data and the laboratory analysis were found for lead and zinc. Bitterroot investigated the metals-containing material for its acid-producing characteristics. Bitterroot collected a limited number of surface water samples for chemical analysis and divided the stream into five segments to assess the stream type and the relative health of the stream system. Based on stream and floodplain particle counts, Bitterroot calculated a volume of metals-contaminated material for the entire site.

3.3.1 Surface Metal Data

The results of both FPXRF data and chemical analysis demonstrated that lead is widespread on the site in soil and substrate in concentrations well above levels of concern (Table 2 and Table 3). Both sets of results demonstrate that lead is widespread on the site at levels that pose a human health hazard. Lead and zinc are clear risks to terrestrial biota (land-living animals that range from insects to large game), while arsenic, cadmium and copper pose risks at least in the isolated areas where high concentration were found.

Table 2. Soils total metals FPXRF sample results summary, Bitterroot Restoration study

Chemical of Potential Concern	Average Concen-tration (mg/kg)	Minimum Concen-tration (mg/kg)	Maximum Concen-tration (mg/kg)	Risk Threshold for Recreational Users (Bunker Hill HHRA*) (mg/kg)	Risk Levels for terrestrial biota (Bunker Hill Eco RA*) (mg/kg)
Arsenic	29	22	167	700	40
Cadmium	122	90	623	19,500	386
Copper	201	34	1,301	27,100	1,102
Lead	4,190	15	58,297	1,100	522
Zinc	1,247	131	14,649	220,000	261

* The Bunker Hill HHRA and the Bunker Hill Eco RA both refer to the document titled Human Health Risk Assessment and Ecological Risk Assessment developed for Bunker Hill Superfund Site Operable Unit 3 Record of Decision. A recreational user is characterized as a casual user of the area on an infrequent basis for recreational purposes

Table 3. Soils total metals concentrations summary from laboratory results, Bitterroot Restoration study

Chemical of Potential Concern	Average Concen-tration (mg/kg)	Minimum Concen-tration (mg/kg)	Maximum Concen-tration (mg/kg)	Risk Threshold for Recreational Users (Bunker Hill HHRA*) (mg/kg)	Risk Levels for terrestrial biota (Bunker Hill Eco RA*) (mg/kg)
Arsenic	21	9	48	700	40
Cadmium	7	2	17	19,500	386
Copper	207	28	896	27,100	1,102
Lead	4,754	31	17,000	1,100	522
Zinc	1,164	168	3,740	220,000	261

* The Bunker Hill HHRA and the Bunker Hill Eco RA both refer to the document titled Human Health Risk Assessment and Ecological Risk Assessment developed for Bunker Hill Superfund Site Operable Unit 3 Record of Decision. A recreational user is characterized as a casual user of the area on an infrequent basis for recreational purposes

3.3.2 Metals Extraction and Acid/base Testing

Water extraction tests demonstrated that all the metals and arsenic could be liberated from contaminated tailings and substrates by simulated rainwater and in concentrations capable of affecting water quality at least in the case of zinc and cadmium. Tests of pH and conductivity and acid/base accounting demonstrate acid generation occurs from these materials but is buffered by the water chemistry of the stream. The acid generation may affect plant growth.

3.3.3 Water Quality

Surface water quality samples collected from Beaver Creek by Bitterroot personnel demonstrate exceedances of acute and chronic water quality standards for zinc and chronic water quality standards for lead (Table 4). Detection limits for the methods used for arsenic, cadmium and copper interfered with the assessment of whether standards were exceeded. No exceedances of drinking water maximum concentration limits (MCLs) were observed.

Table 4. Water quality data from Beaver Creek at the Idora Mill Site, Bitterroot Restoration

Analyte	Average Concentration (ug/L)	Minimum Concentration (ug/L)	Maximum Concentration (ug/L)	Aquatic Life Standard* (ug/L)				MCL for Drinking Water (ug/L)
				Acute @ 100 mg/L CaCO3	Acute @ 25 mg/L CaCO3	Chronic @ 100 mg/L CaCO3	Chronic @ 25 mg/L CaCO3	
Arsenic	<10**	<10	<10	340		150		10
Cadmium	<2	<2	<2	25	0.42	2	0.25	5
Copper	<3	<3	<3	13	4.6	9	3.5	1,300
Lead	9	<5	14.4	65	14	2.5	0.54	15
Zinc	239	118	341	120	36	86	36	N/A

Notes:

* Aquatic life standards are for a hardness of 100 mg/L CaCO3, but a more realistic hardness at this point in this watershed would be 25 mg/L CaCO3.

** The symbol < indicates the analyte was below the method detection limit. Shaded cells highlight standards exceedances

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3.3.4 Streambed Sediment Analysis

Streambed sediments were analyzed for metals and arsenic content using chemical analysis (Table 5). The data are expressed in milligrams per kilogram dry weight of total metal or arsenic. The results indicate that only lead is present in the sediment at concentrations above that which constitutes a human health risk concern. Lead and zinc are both at concentrations concerns for aquatic birds and mammals.

Table 5. Analysis results for streambed sediment from Beaver Cr. in the Idora Mill site

Analyte	Average Concen-tration (mg/kg)	Minimum Concen-tration (mg/kg)	Maximum Concen-tration (mg/kg)	Risk Threshold for Recreational Users (Bunker Hill HHRA*) (mg/kg)	Risk Levels for mammals & birds (Bunker Hill Eco RA*) (mg/kg)
Arsenic	86	65	113	700	138
Cadmium	24	18	37	19,500	664
Copper	240	108	323	27,100	2,209
Lead	4,250	877	6,390	1,100	718
Zinc	3,399	1,770	5,900	220,000	390

* The Bunker Hill HHRA and the Bunker Hill Eco RA both refer to the document titled Human Health Risk Assessment and Ecological Risk Assessment developed for Bunker Hill Superfund Site Operable Unit 3 Record of Decision. A recreational user is characterized as a casual user of the area on an infrequent basis for recreational purposes. Shaded cells highlight standards exceedances.

The sediment results mirror the substrates results suggesting that tailings and contaminated substrate are being loaded to the sediments regularly, possibly by mass wasting into the stream.

3.3.5 Riparian Health Assessment

The overall health of the riparian zone along the stream was assessed. All the reaches assessed were found to be in the functional but at-risk category. The upper reaches of the stream (higher gradient - Type A3 channel) scored higher overall than the more downstream reaches (lower gradient – Type A4 channel). The difference is likely the deposition of additional sediment along the lower gradient reaches.

3.3.6.1 Contaminated Volume Estimate

Particle size distribution was assessed at several locations both at the mill site and downstream along Beaver Creek. Based on the particle size distribution and assuming that only particles smaller than cobble size would be removed from the site, the volume of contaminated materials to be removed was estimated to be 2.3 million cubic feet or 85,185 cubic yards. Additional estimates for tailings mill wastes and waste rock were developed in the Idora Reclamation Options section at the end of this document (Table 6). These estimates are based on some assumptions and estimations from memory and do not provide an estimate of the obvious contaminated sediment deposits of floodplain.

Table 6. Bitterroot Restoration's volume estimates of tailings and waste rock

Location and material	Volume (cubic yards)
Mill site tailings	970
Mill wastes	667
Sub-reach 3 waste rock	1,923
Total	3,520

Note: Sub-reach 3 includes waste rock that is associated with the adit near the mill site and the fill area downstream at the cabin site.

3.4 MCS Environmental Inc. Site Investigation

The Forest Service commissioned a supplemental investigation of the Idora Mill site by MCS Environmental Inc. (MCS, 2004). The earlier site investigation had neglected the hydrogeology of the mill site and the ground water interaction with the tailings. The MCS investigation addressed interactions between ground water and surface water at the mill site, but also measured metals concentrations in some sediments and tailings and in ground and surface water.

3.4.1 Sediment and Tailings Metals Concentration

Metals concentrations in the three sediment samples collected at the mill site reflected the results developed earlier by Bitterroot Restoration. Lead and zinc concentrations were elevated in the sediment samples while the other metals and arsenic were below the risk thresholds. The single tailings sample was enriched in all the metals and arsenic with lead and zinc concentrations above the levels of concern.

3.4.2 Surface and Ground Water Quality

The surface water data developed by MCS was from samples collected during low-discharge conditions as supported by the physical pH and temperature measurements. Lead and zinc concentrations in two of the four samples constituted exceedances similar to those collected by Bitterroot while two other samples had quite low metals and arsenic values. MCS did test the adit drainage downstream from the mill site. This water sample had metals and arsenic below the detection levels which suggests it is not a significant metals source under low-discharge conditions.

Ground water quality was assessed in three wells (Table 7). Four lead concentrations observed were above the drinking water MCLs; however, ground water use or ingestion at the site is not a likely risk pathway. The lead and zinc concentrations observed in the ground water are sufficiently elevated to contaminate the surface water of Beaver Creek at levels above the aquatic life standards, especially under low-discharge conditions.
A dilution factor of 295 times is required to bring the observed lead concentration below the standard while a dilution factor of 21 times is required to meet the zinc standard. Under low-discharge conditions, it is doubtful such high dilution with uncontaminated water would occur. The water quality data collected by both Bitterroot and MCS document the observation.

Table 7. Ground water quality results for four wells and a seep at the Idora Mill Site

Analyte	Well PZ01	Well PZ02	Well PZ03	Well PZ04	Seep
Arsenic (ug/L)	<10	<10	<10	<10	<10
Cadmium (ug/L)	5	5.6	5.9	<2	4.2
Copper (ug/L)	16	3.4	<3	<3	4.3
Lead (ug/L)	350	16.6	38.5	6.2	37.6
Zinc (ug/L)	958	1,010	903	86.7	808

The ground water level observed under low-discharge conditions indicated the ground water surface level and that of the stream were the same. This observation confirms the stream and its valley aquifer have close connectivity as is typical with mountain stream-valley aquifers. This result indicates the aquifer is below the tailings during low-discharge conditions, but within the tailings during high-discharge conditions. During the low-discharge conditions, the contaminated aquifer yields dissolved metals to the stream.

3.5 DEQ Mine Waste Volume Estimate

During September 2009, DEQ personnel made another assessment of the volume of metals-contaminated deposits at the Idora Mill site, downstream to wastes associated with the Raymond-Carlisle Mill site (Appendix 5; Figures 10 and 11). Nineteen distinct deposits were identified visually and confirmed to have significant metals (lead and zinc) contamination using a FPXRF instrument. The total volume of each deposit was estimated typically by multiplying length, average width and average depth based on a box model. For one deposit (mine waste deposit 14), a triangular wedge model was assumed instead of a box. Based on the amount of coarse material greater than 1 inch in diameter (the 1-inch plus fraction of the total material), the advantage of sorting the material was estimated. Metals contaminants are known to be associated with smaller particles; in this case, smaller than 1 inch in diameter (the “1-inch minus fraction”). Therefore, there is no need to remove the fraction of the material that is larger than 1 inch in diameter. For deposits that already consist mostly of 1-inch minus material, there is no advantage in sorting. For those deposits in the Idora Mill project site that would be sorted if the recommendation were accepted, the expected reduction in the volume of contaminated material was based on experience from sorting of contaminated sediments at the Monarch and Beartop Mill sites (DEQ, 2008). For this project, an estimated 2,834 cubic yards of material that does not need sorting was identified, primarily at the mill site. Another estimated 5,276 cubic yards would be developed from sorting downstream deposits and fills. An estimated total of 8,100 cubic yards would require removal.

Table 8. Mine Waste Volume Estimates: Initial, Non-Sorted, and Post-Sorting Totals

Mine Waste Deposit	Estimated Initial Volume (yd^3)	Sorting Recommendation	Volume Reduction Factor[a] if Sorted	Estimated Remaining Volume After Sorting (yd^3)*
1A	**61.2**	**No sort**	-	**61.2**
1B	**462.0**	**No sort**	-	**462.0**
2	**2252.5**	**No sort**	-	**2252.5**
3	173.4	Sort	0.47	81.5
3A	33.2	Sort	0.47	15.6
4	**29.3**	**No sort**	-	**29.3**
5	**18.7**	**No sort**	-	**18.7**
6	3884.9	Sort	0.47	1825.9
7	1710.5	Sort	0.47	803.9
8	163.0	Sort	0.47	76.6
8.5	336.1	Sort	0.47	158.0
9	138.9	Sort	0.47	65.3
10	1777.8	Sort	0.47	835.6
11	1083.3	Sort	0.47	509.2
12A	466.7	Sort	0.47	219.3
12B	249.5	Sort	0.47	117.3
12C	331.9	Sort	0.47	156.0
13	231.1	Sort	0.47	108.6
14	646	Sort	0.47	303.6
Total	**14,050**			**8,100**

* Estimated volume of contaminated material after sorting is based on experience at the Monarch Mill site, where 47% of the volume was 1-inch-minus metals-contaminated material (DEQ 2008). Of the initial estimated volume, the total volume of deposits that would not be sorted (shown in bold in this column) is 2,824 cubic yards.

4.0 Risk Assessment

The risk assessment for the site will be streamlined, but will consist of a conceptual model, selection of complete pathways to receptors, a human health risk analysis and an ecological risk analysis. Complete pathways consist of physical connections between contaminants and receptors (which might be humans, animals or plants). When contaminants can be delivered to the receptor in large enough amounts to pose a potential risk, a pathway is consider complete. Human health risks are considered separately from ecological risks which could include health risks to animals and/or other types of ecological risk.

4.1 Conceptual Model

The conceptual model of the Idora site is provided in Figure 5. The tailings are distributed along Beaver Creek which has bisected the deposit. Mill waste is perched along the south wall of the valley at the mill. A collapsed adit with drainage to Beaver Creek is located below the mill site in the south wall of the valley. Another adit is located downstream in the north wall of the valley. Tailings-contaminated sediments are

deposited intermittently along the course of Beaver Creek, either as plank dam areas or as cribbed fill, nearly to the Carbon Creek confluence. All of these features could load metals directly to Beaver Creek by mass wasting or runoff during snow melt and high-discharge conditions and by ground water discharge under low-discharge conditions.

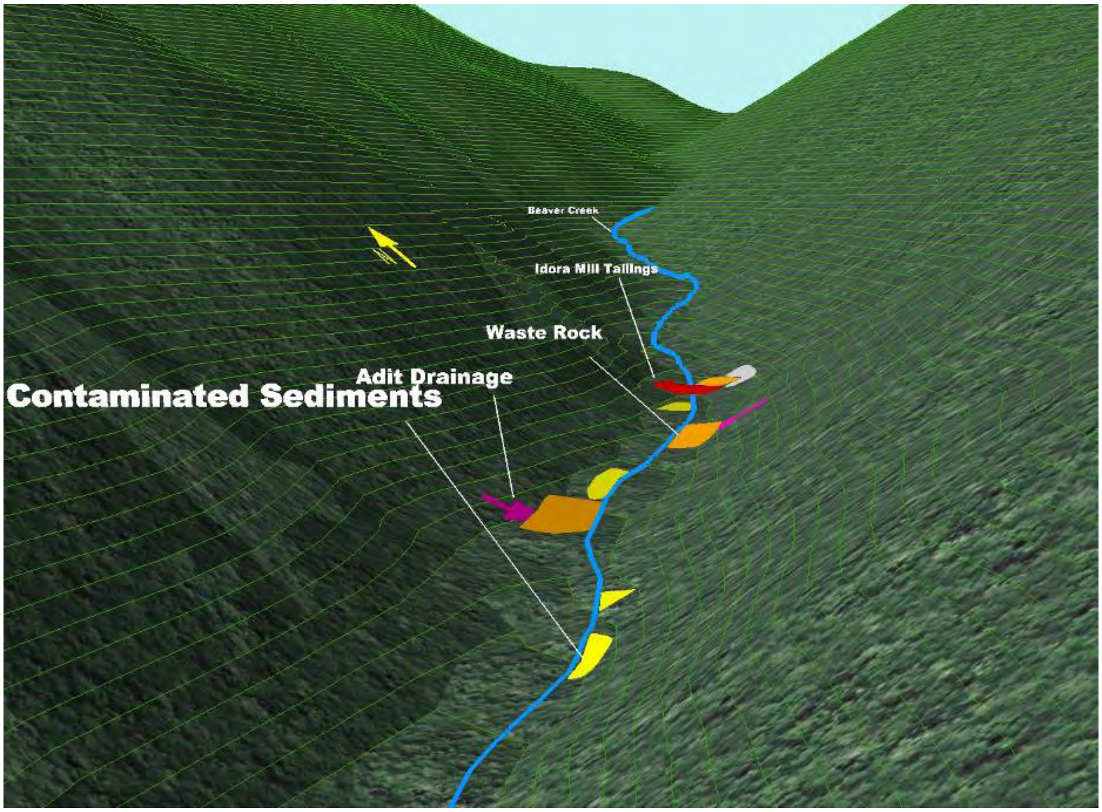

Figure 5. Conceptual physical model of metals loading to Beaver Creek from tailings, mine wastes, adits, and contaminated sediments associated with the Idora Mill site and downstream migration of its wastes.

Potential pathways of metals impacts to human health and the environment include:

1) Human contact with waste rock, tailings and deposited sediments with subsequent ingestion.
2) Human ingestion of surface and ground water.
3) Terrestrial biota contact with waste rock, tailings and deposited sediments with subsequent ingestion.
4) Adit discharge of metals and arsenic to Beaver Creek where aquatic biota is adversely affected.
5) Metals and arsenic dissolved from waste rock and carried via the shallow ground water into Beaver Creek where aquatic biota is adversely affected.
6) Metals and arsenic dissolved from the tailings and delivered from the valley ground water system into Beaver Creek where aquatic biota is adversely affected.

7) Metals and arsenic dissolved from deposited sediments and delivered from the valley ground water system into Beaver Creek where aquatic biota is adversely affected.

4.2 Completed Pathways

The conceptual model outlined in Section 4.1 demonstrates the seven potential pathways listed above. The site data summarized in Section 3 demonstrates that only three of the potential pathways might be complete and they would be complete only for the four metals (cadmium, copper, lead and zinc). Closer examination of the existing data will determine which pathways are actually complete.

Ingestion of ground water at the site would be unexpected since no domestic water wells exist. The surface water meets drinking water standards (maximum contaminant levels) for the metals of concern and arsenic even under low-discharge conditions. The data demonstrate that an insignificant amount of metals is contributed to the stream by the adit drainage precluding concern with this pathway. Data developed by Bitterroot indicates the waste rock also contributed only a small amount of the metals to the stream, precluding concern with this pathway.

Human health of recreational users is put at risk by the surface lead concentrations found in the tailings and sediments. Recreation is the only expected human use of the site. Terrestrial biota are at risk from the metals concentrations demonstrated as being present in the tailings and sediment. Ground water and surface water quality sampling results demonstrate that lead and zinc concentrations exceed the water quality standards that are protective of aquatic biota, at least under low-discharge conditions. One source of these metals is the valley aquifer contaminated by the tailings and another possible source is the contaminated sediments deposited along the streambed.

4.3 Streamlined Human Health Risk Assessment

4.3.1 Lead

In general, human health risk can be defined at different levels depending on several factors. One is the initial default target level (IDTL) identified in the Idaho Risk Evaluation Manual which is the concentration deemed by risk models to be fully protective of human health. The IDTL for lead is 49.6 mg/kg (DEQ 2004). A lead concentration of 1,100 mg/kg is considered a more relevant threshold in a remote recreational site like the Idora Mill site (Table 9 on page 23). Visitation to the site is considered to be quite infrequent and for relatively short durations thus lowering the potential risk of exposure so that only a higher lead concentration would present a human health risk. Even with the higher risk threshold, the tailings and some contaminated sediments at the site contain lead in concentrations well above threshold. Human health is at risk at the Idora Mill site.

4.3.2 Other Metals and Arsenic

For the other metals analyzed and arsenic, levels are uniformly below the risk levels developed for remote recreation situations for incidental human ingestion (Table 9).

4.4 Streamlined Ecological Risk Assessment

Terrestrial and aquatic biota are both at risk from the metals present at the Idora Mill site.

4.4.1 Aquatic Biota

The lead and zinc standards protective of freshwater aquatic biota are exceeded by the waters of Beaver Creek on the Idora Mill site (Table 4 on page 14). The collected data conclusively demonstrates that ground water of the valley aquifer is contaminated with lead, zinc, and cadmium in levels capable of causing exceedances of at least lead and zinc standards under low-discharge conditions (Table 7; Table 4). Although the existing data does not adequately address the issue, sediments deposited along Beaver Creek below the Idora Mill site likely contribute some zinc and possibly lead as well.

4.4.2 Terrestrial Biota

Terrestrial biota are at some risk from contact with tailings and contaminated sediments at the site. Threshold values protective of the biota are exceeded for cadmium, copper, zinc and lead (Table 9). However, the magnitude of the risk requires examination. The actual surface area at the Idora Mill area is less than an acre and that area is devoid of most vegetation. The downstream component of the site is a narrow ribbon of habitat. It is unlikely that much large terrestrial biota spends much time in this small area; however, smaller species with limited home ranges may.

5.0 Removal Action Scope and Objectives

The risk assessment (Section 4 of this document) completed for the Idora Mill site demonstrates a risk to human health from lead ingestion, a small but existing risk to terrestrial biota (animals of all sizes on land),and a clear unacceptable risk to aquatic biota (animals of all sizes in water). Lead and zinc are the primary contaminants of concern (COCs) creating the risks. However, cadmium and copper play some role, at least with terrestrial biota. Ingestion and inhalation of lead during infrequent recreational use of the site is the primary risk to human health. The ecological risk identified is primarily to aquatic biota through water polluted with lead and zinc, but there is some risk to wildlife using the area. Lead and zinc are the primary chemicals of concern, but there is some concern with cadmium and copper as well. All objectives and remedial approaches that address lead and zinc will address cadmium and copper as well because they are all present in the same material so any action involving the material will address

all of them. Most objectives that address these metals to protect human health would be protective of biota as well.

5.1 Scope of the Removal Action

It is proposed that the contamination at and downstream of the Idora Mill be cleaned up by removing sufficient amounts of the contaminated material. Proposed removal actions are required to meet specific cleanup levels, meaning that the levels of contaminants that remain after the cleanup action is completed must be below specified levels. At the same time, the cleanup action must work within regulatory limits and comply with applicable or relevant and appropriate requirements (ARARs) to the extent practicable. Removal actions must consider the potential for additional follow up removal actions at the site and must not preclude such actions even if none are currently planned. The actions planned at the Idora Mill project site are initial actions, thus any action must meet the standard of not precluding additional actions if any are later warranted.

The scope of the action at the Idora Mill project site involves reducing lead and zinc to below concentrations that adversely affect water quality, human health and terrestrial biota (the water quality standards are already protective of aquatic biota). Some actions such as enacting institutional controls may adequately address the primary human health concern, but these solutions would not likely address the ecological risk to water quality or wildlife. Institutional controls consist of controlling use of the site through means such as road removal and caution signs. The most superior alternatives should address both human health and ecological concerns.

5.2 Preliminary Removal Action Objectives

The preliminary removal action objectives are:

- Reduce or eliminate human health hazards associated with the presence of lead.
- Reduce or eliminate water quality impairment associated with zinc and lead loaded into the creek.
- Reduce or eliminate the hazards to wildlife associated with lead, cadmium, copper and zinc.
- Remove any safety hazards from equipment or features remaining from the mining operation.

5.3 ARAR-Based Goals

Some known applicable or relevant and appropriate requirements (ARARs) are already included as project goals. The ARARs for specific contaminants as well as some potential

ARARs that may need to be considered depending on the project location and the action selected are discussed in the following sections.

5.3.1 Contaminant-specific

To determine appropriate risk levels, the values for lead, cadmium and copper identified in the Idaho Risk Evaluation Manual (DEQ 2004) are initial default target levels (IDTLs) that must be considered first. These IDTL values do not have regulatory standing but are considered by Idaho DEQ as the default at this time because they are the most conservative values based on risk models. However, applying the IDTLs in a mineralized zone like upper Beaver Creek would be a misapplication of the IDTLs. In this case, the more applicable values are those identified in the Human Health and Ecological Risk Assessment for Bunker Hill Superfund Site Operable Unit 3. For human health, terrestrial biota, and aquatic biota species, these values are provided in Table 9.

Table 9. Threshold risk levels for trace (heavy) metals of concern at the Idora Mill site

Chemical of Potential Concern	Risk Threshold for Recreational Users (Bunker Hill HHRA*) (mg/kg)	Risk Levels for terrestrial biota (Bunker Hill Eco RA*) (mg/kg)	Risk Levels for sediment for aquatic mammals & birds (Bunker Hill EcoRA*) (mg/kg)
Cadmium	19,500	386	664
Copper	27,100	1,102	2,209
Lead	1,100	522	718
Zinc	220,000	261	390

* The Bunker Hill HHRA and the Bunker Hill Eco RA both refer to the document titled Human Health Risk Assessment and Ecological Risk Assessment developed for Bunker Hill Superfund Site Operable Unit 3 Record of Decision.

5.3.2 Location-specific

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. Potential location-specific ARARs are listed in Table 10.

Table 10. List of potential location-specific ARARs.

Media	Citation	Applicability
Historic Preservation	The National Historic Preservation Act of 1966 as amended. Public Law 89-665; 80 Stat. 915; 16 U.S.C. 470)	Federal Act protecting historic buildings and other structures of historic significance. May be applicable to smelter structures or equipment.
Endangered Species	Endangered Species Act (16 USC 1531; 40 CFR Pt 6.302; 50 CFR Pt 402)	Requires action to conserve endangered species within critical habitat upon which species depend. Includes consultation with Dept. of Interior.
Wetlands	Protection of Wetlands Order (40 CFR Part 6)	Avoid adverse impacts to wetlands
	Clean Water Act, Section 404 (33 CFR Part 336)	Regulates the discharge of dredge and fill material into waters of the U.S. including wetlands.
Floodplains	Floodplain Management Order (40 CFR Part 6)	Requires federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid the adverse impacts associated with direct and indirect development of a floodplain.

5.3.3 Action-specific

Action-specific ARARs are usually technology- or activity-based requirements or are limitations on actions taken with respect to hazardous substances. Any 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. Potential action specific ARARs are listed in Table 11.

Table 11. List of potential action-specific ARARs.

Media	Citation	Applicability
Air	Clean Air Act – National Ambient Air Quality Standards (40 CFR Part 50) Rules for the Control of Air Pollution in Idaho (IDAPA 58.01.01.577)	Federal and State requirements related to air quality in the area during the removal action.
Wetlands	Protection of Wetlands Order (40 CFR Part 6)	Avoid adverse impacts to wetlands
	Clean Water Act, Section 404 (33 CFR Part 336)	Regulates the discharge of dredge and fill material into waters of the U.S. including wetlands.
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 ore beneficiation, but could be considered relevant and appropriate.	Federal and State requirements related to the management of hazardous and solid waste generated from the removal actions performed at the Idora Mill site.
	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). Applies to the management of non hazardous solid waste.	

6.0 Screening of Removal Technologies and Development of Removal Alternatives

The COCs at the site are specifically lead, zinc, cadmium and copper. Some technologies such as soil treatment or soil amendment are not effective with these elements because those technologies rely on the acid level in the soil remaining mostly unchanged once the treatment is finished; however, once ingested, stomach acidity can release the contaminants. For each technology considered here, an associated level of efficacy will be listed. The technologies retained after the screening process are described below and listed in Figure 6.

Several of the potential removal technologies involve putting contaminated material into a repository designed for that purpose. There are two possible types of repository. The primary difference between them, for purposes of differentiating them in this evaluation, is location. An on-site local repository would be within the immediate project area – from the mill site downstream to the Carbon Creek confluence. An on-site centralized watershed repository would be anywhere within the Prichard and Beaver Creek watersheds.

6.1 Potential Removal Technologies

6.1.1 No Action

Taking no action is an alternative that must be considered as a base that all other alternatives can be measured against. No action would still require monitoring of the site.

6.1.2 Institutional Controls

Three types of institutional control might be effective in addressing human health issues. These are signing, road removal, and soil management. None of these approaches would address water quality issues.

6.1.2.1 Signing

Placing signs identifying the site as hazardous could keep humans from using the site and thus break the ingestion and inhalation pathways. Signing would not retard use of the site by wildlife.

6.1.2.2 Road Removal

Road removal is an effective barrier system against human use. Although it will not limit all human visitation, it will limit it to those dedicated enough to traverse difficult terrain. The terrain will only become more difficult to access as vegetation grows and matures. In this case, road removal would have an added advantage of removing a source of sediment to the stream.

6.1.2.3 Soil Management

If a barrier system is employed on the site, soil management will be an institutional control necessary to maintain the barriers. A soil management plan would be designed to preserve barriers and properly manage any contaminated material that continues to exist below the barrier.

6.1.3 Barrier System

Typical barrier systems are fencing and /or place a barrier of clean material between the contaminant(s) and the receptor. Fencing would limit human use and some but not all wildlife use. Fences are easily breeched by the public and break down under the heavy snow loads typical of the area. Thus constant maintenance would be required. Fencing would retard use of the site by some, but certainly not all, wildlife. In remote locations like the Idora Mill site, clean soil barriers are typically the most practical. Clean soil barriers are considered here. If the barrier is maintained through the institutional control of soil management, the ingestion and inhalation pathways are interrupted. Barrier systems are less effective for wildlife, especially burrowing animals. However, clean soil depths can be adjusted to compensate to some degree. Barriers can also have a deleterious impact on established vegetation, especially trees. In these cases also, barrier thickness can be adjusted to compensate.

6.1.4 Substrate/ Soil Removal

Removal of the contaminated soil or substrate to an on-site local repository (i.e., within the immediate project area) or on-site centralized watershed repository (i.e., anywhere within the watershed) is a technology that would effectively break the ingestion and inhalation pathway to humans and wildlife. Any such repository would require proper engineering and proper siting. Such repositories can be of considerable expense. In the case of an on-site centralized watershed repository, transportation of the wastes would be an added cost.

The Prichard Repository was constructed as the on-site centralized watershed repository for both Prichard and Beaver Creeks. The repository is located on national forest land off Eagle Road between Murray and Prichard (Figure 6). The Prichard Repository currently holds mine wastes from the Paragon, Monarch and Beartop mill sites in two cells. The Monarch cell, which was reopened to accept the Beartop wastes, has additional suitable area on its southwest side where the Idora wastes could be housed. Placement of the Idora wastes in the Monarch cell will require its modification to expand its current footprint on its southwestern side. The modification will require alteration of the clay max cap drainage features and expansion of the fenced area. Figure 7 is a diagram of the Monarch Cell showing the conceptual placement area for the Idora mine wastes. The haul distance to the Prichard Repository from the Idora Mill site is 16 miles.

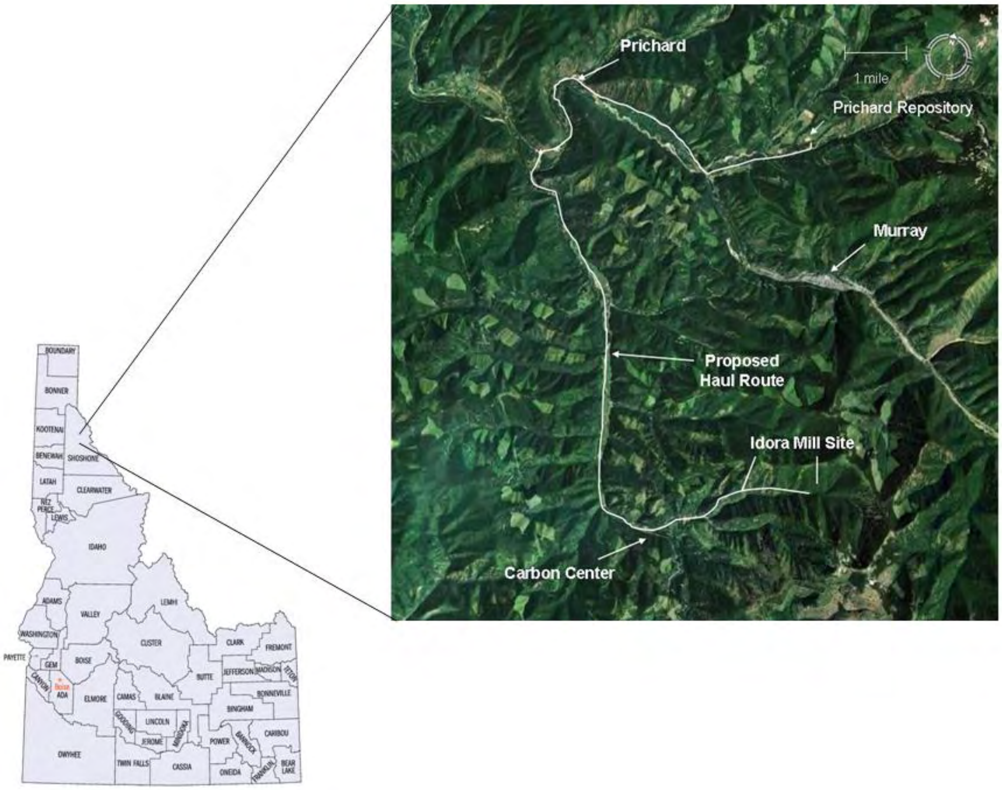

Figure 6: Location of Prichard Repository in relation to Idora Mill site and proposed haul route.

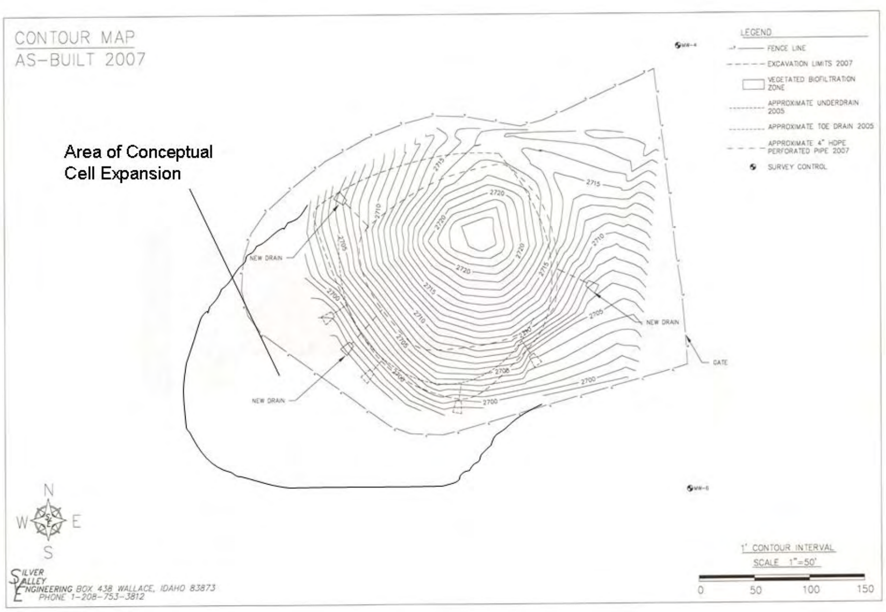

Figure 7. Monarch Cell of Prichard Repository after Beartop waste additions showing conceptual area of Idora mine wastes additions.

Table 12. Removal technologies retained after screening.

General Response Action	Response Technology	Process Option
No Action	None	None
Institutional Controls	Warning	Signing
	Barrier maintenance	Soil management
Engineered Controls	Access restriction	Road removal
	Barriers	Soil barrier; fencing
	Removal	To on-site local repository
		To on-site centralized watershed repository

6.2 Removal Alternatives

Of all the potential removal alternatives, the most reasonable alternatives are listed in Table 13, and discussed in the paragraphs following the table.

Table 13. Removal alternatives developed for the Idora Mill site.

Alternative No.	Alternative Description	Response Technology/ Process Action
1	No Action	None
2	Institutional controls, barriers, and road removal	Install fence and sign, and place a soil barrier over the most-exposed tailings and waste deposits; remove the access road
3	Removal to on-site local repository; soil application; and road closure.	Remove tailings, mill waste, and obvious contaminated sediment deposits of floodplain to on-site local repository; stabilize waste rock at an on- site location probably associated with the road; place soil on mill removal area; remove the access road.
4	Full removal of all mine wastes to on-site centralized watershed repository; soil application; and road removal.	Remove tailings and mill waste to a project repository; remove and sort stream sediments, then remove all one-inch minus material to an on-site centralized watershed repository and redistribute larger material (the “oversort”) on the floodplain; remove and stabilize waste rock, probably placing it on the road bed; place soil on removal sites; and remove some floodplain sediment.
5	Removal of concentrated mine wastes to on-site centralized watershed repository; and road removal	Remove tailings, mill waste, and obvious contaminated sediment deposits of floodplain to on-site centralized watershed repository; remove and stabilize waste rock, probably by placing it along the road bed; place soil on removal sites and remove some floodplain sediment as required; remove access road.

A brief description of each alternative is presented below:

Alternative 1 is the required no action alternative against which the four pro-active alternatives are compared. Conditions would not change on the site and human health and wildlife would remain at risk.

Alternative 2 would rely on the institutional controls of signing, soil management and road removal in conjunction with fence and soil barriers. The metals wastes would remain in place. Signs would warn the public of the health risk danger, while the fence around the immediate mill area would physically limit access to the property. Soil barriers at the mill area would be protective of some wildlife. Road removal should deter most human use and limit a sediment source. In theory, human health and wildlife risk would be diminished. However, the risk to wildlife would likely be abated only for the larger animals since small, especially burrowing, animals would likely access the wastes. Fence systems are easily defeated when they are not guarded. The alternative would not address water quality contamination from metals and only marginally for sediment nor would any protection be afforded to floodplain or aquatic biota. Figure 8 shows the location of fenced area, barrier areas and required road grade removals. Figure 11 shows the locations of additional road removals.

Alternative 3 would remove the mine waste materials (tailings and mill waste of approximately 3,500 cubic yards - Table 6) to an on-site local repository. Waste rock would be removed from the stream channel and stabilized at an appropriate site along the road bed. Removal areas would receive a clean soil covering and be vegetated. The road would be removed to limit access by humans particularly those with vehicles that could damage project repositories. The alternative is protective of both human health and wildlife at the mill location, but only partially effective in the downstream floodplain. There is not likely space available for removal of selected contaminated sediments to an on project repository and certainly space does not exist for a full floodplain removal. Impacts to terrestrial and aquatic biota would be diminished but not eliminated. Figure 9 shows the location of the limited removals, the potential on-site local repository and required road grade removals. Figure 11 shows the conceptual location of the waste rock and oversort repository and additional road removals.

Alternative 4 would remove all mine waste materials to an on-site centralized watershed repository. Tailings, mill wastes and all floodplain sediments smaller than one inch (the one-inch minus fraction) would be removed to an on-site centralized watershed repository. The metals-contaminated material is almost wholly contained in the one-inch minus fraction (Paulson et. al. 1996a; Paulson et. al.1996b). Waste rock would be removed from the stream channel and stabilized at an appropriate site, probably along the road bed. Removal areas would receive a clean soil covering and be vegetated. Road removal would not be necessary because threats to human health would be removed and no repositories would remain that could be damaged. The alternative would remove all human health, terrestrial and aquatic biota threats. Water quality impacts by metals and sediment loading would be abated. The approach would require establishment of an on-

site centralized watershed repository that is capable of receiving approximately 85,185 cubic yards of material and is still within a distance that would allow transporting material to the repository to be economically feasible. Considerable floodplain stabilization and restoration would be required. No figure detailing the removal is provided because the entire floodplain shown in figures 10 and figure 11 would be removed and no road removal would occur.

Alternative 5 would remove just the tailings, mill waste and selected contaminated floodplain sediments (the one-inch minus fraction from a sorting process), approximately 8,100 cubic yards of material, to an on-site centralized watershed repository. Waste rock would be removed from the stream channel and stabilized at an appropriate site, probably along the road bed. Removal areas, including any in the floodplain, if required, would receive a clean soil covering and be vegetated. The road would be removed to limit access and to remove its destabilizing effect on the stream. All primary and most secondary threats to human health and to terrestrial and aquatic biota would be abated. Some small residual threats to terrestrial and aquatic biota may remain for some years. The current on-site centralized watershed repository could easily house 8,100 cubic yards unlike the 85,185 cubic yards of material generated by full removal. Damage to the stream and floodplain would be limited and could be repaired with less effort. Figures 10 and 11 show the removal areas and the required road grade removals.

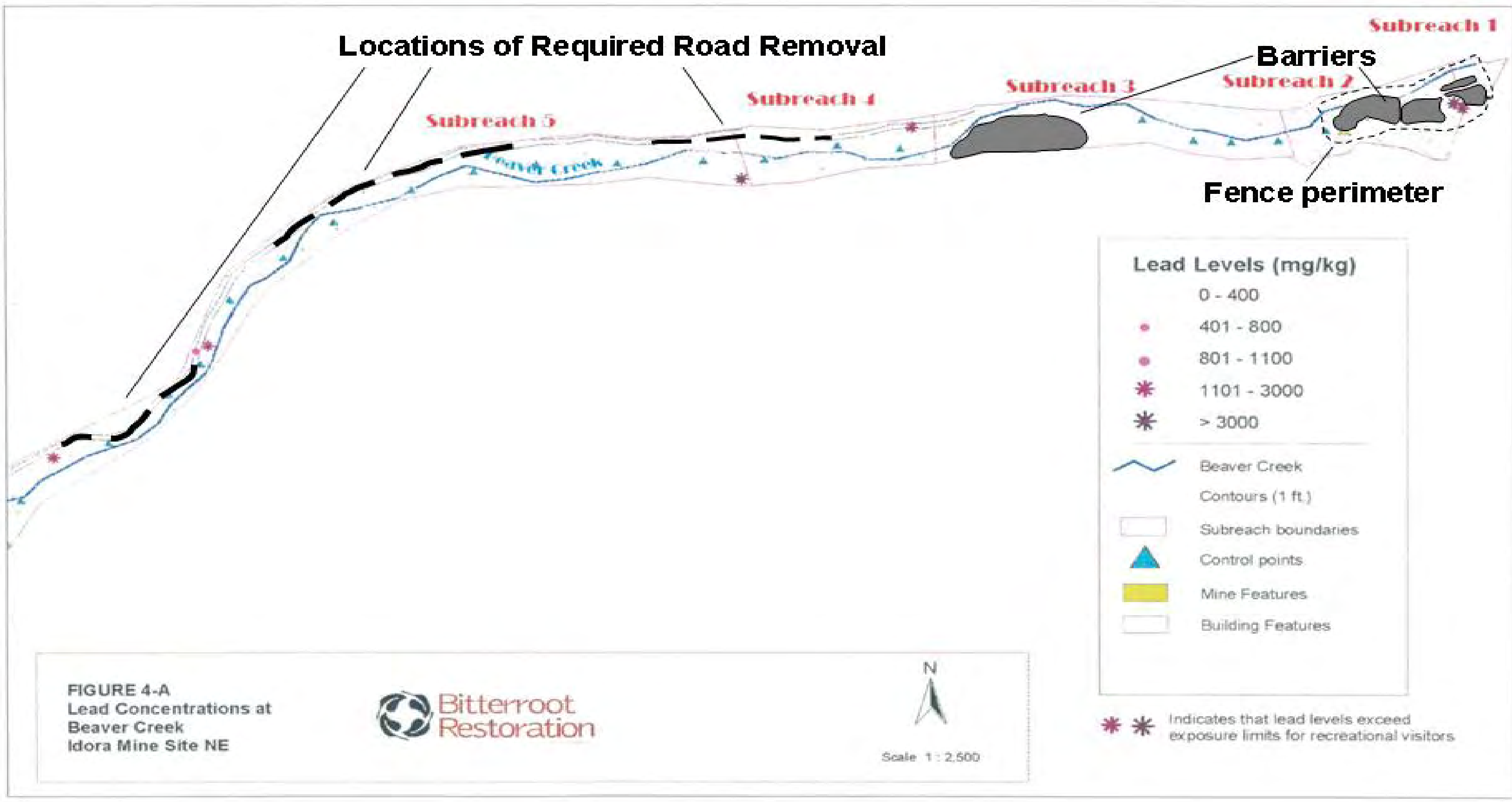

Figure 8. Location of Alternative 2 fencing, soil barriers and required road removal.

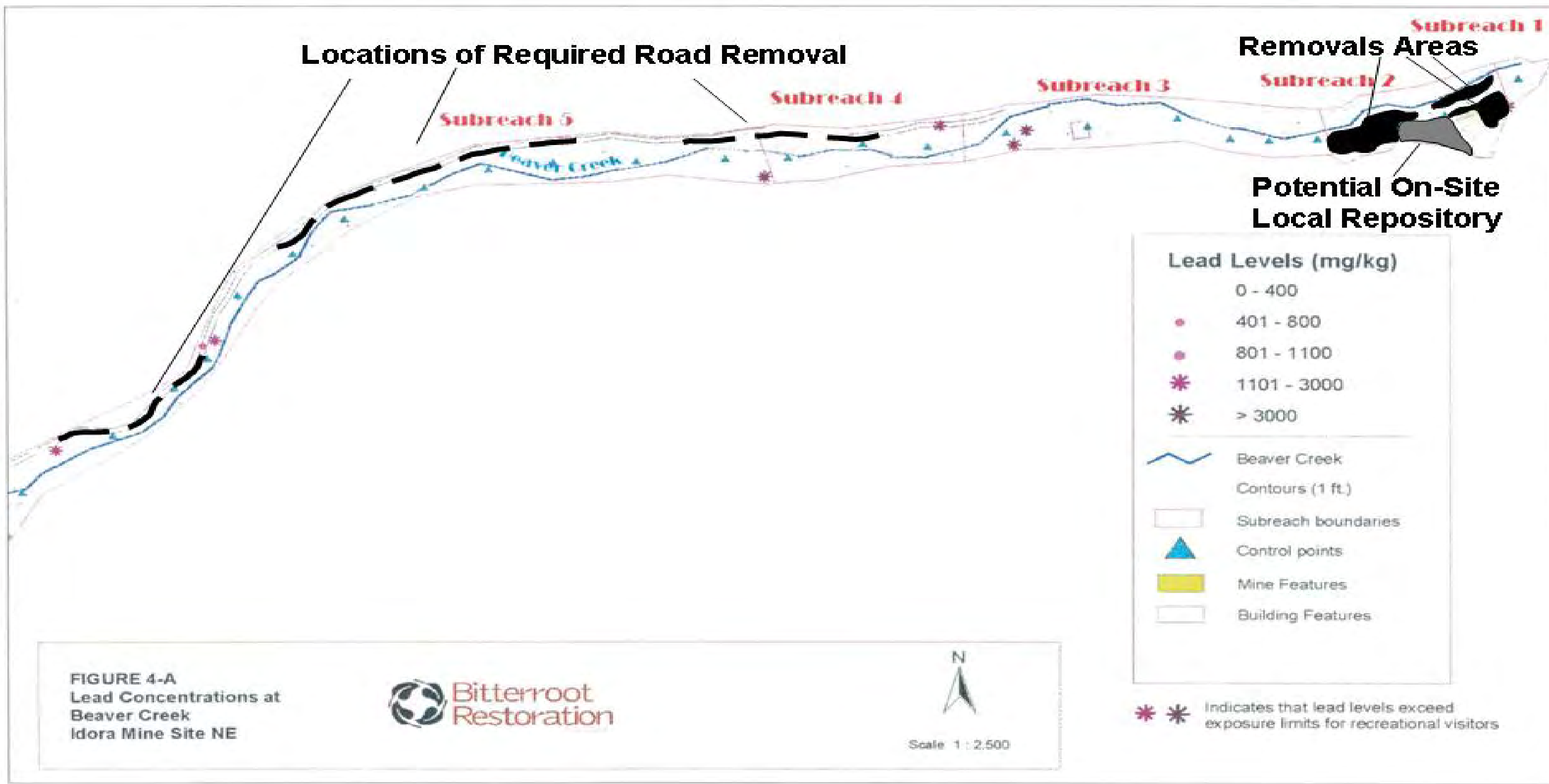

Figure 9. Locations of Alternative 3 removals, on-site local repository and required road removals.

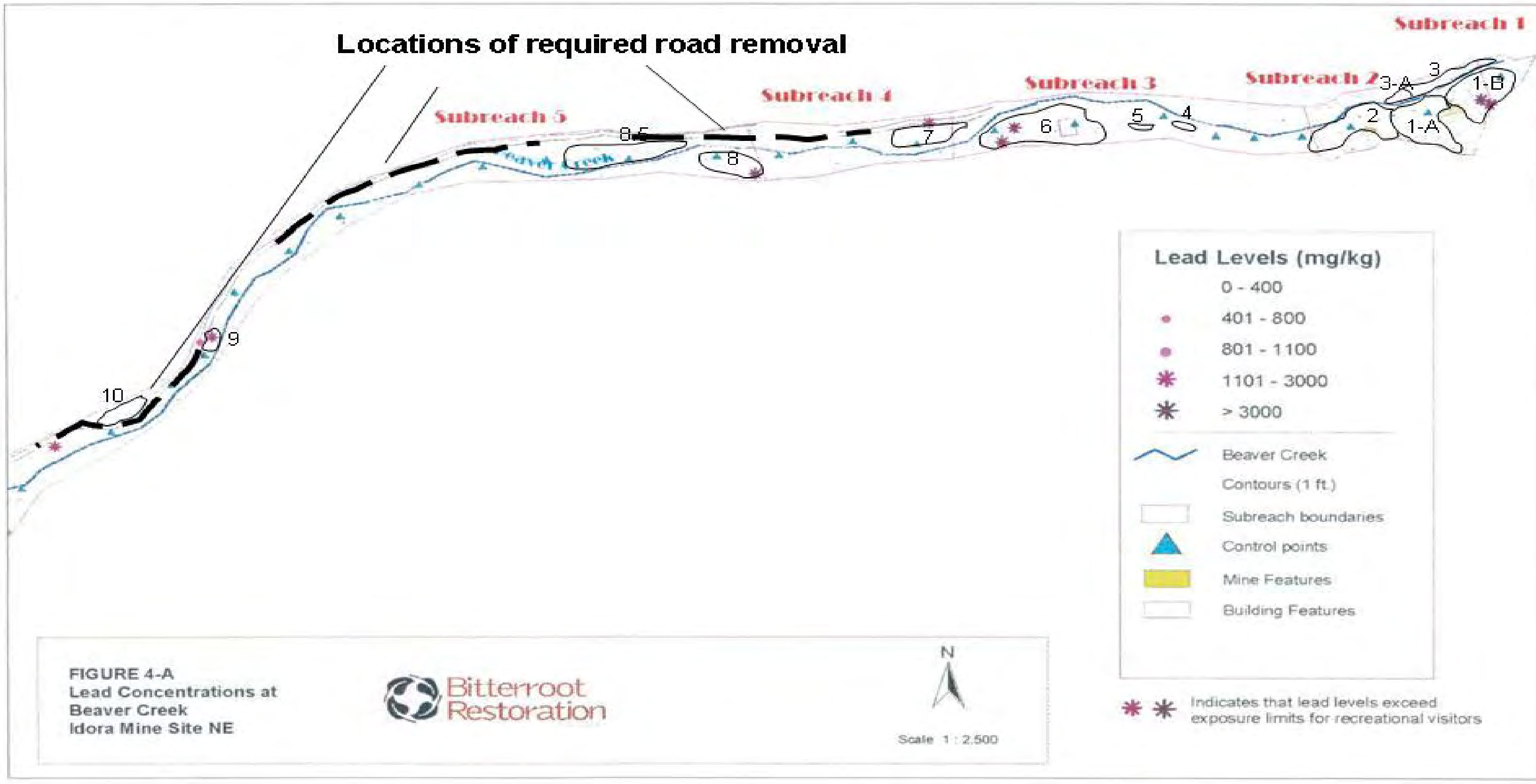

Figure 10. Alternative 5 removal areas and required road grade removals.

Figure 11. Alternative 5 removal areas, conceptual waste rock/oversort repository, and required road grade removals.

7.0 Detailed Analysis of the Removal Alternatives

In this section, the four removal alternatives developed in the previous section, as well as the no-action alternative, are analyzed in detail. The removal alternatives represent a range of potential actions that to some degree can meet the removal action objectives of the project and that achieve differing levels of protectiveness of human health and the environment at a reasonable range of costs.

7.1 Evaluation Criteria

Three criteria are used to evaluate removal action alternatives in accordance with EPA Guidance (EPA 1993): effectiveness, implementability and cost. They are described in the following three paragraphs and then each removal alternative is evaluated for each of the criteria.

7.1.1 Effectiveness

The effectiveness of an alternative is evaluated based on the following criteria: 1) overall protection of human health and the environment; 2) compliance with ARARs; 3) long term effectiveness and permanence; 4) reduction of toxicity, mobility or volume through treatment; and 5) short-term effectiveness. The ARARs that have been preliminarily identified for the project are listed in sections 5.3.1 through 5.3.3.

7.1.2 Implementability

Implementability addresses the technical and administrative feasibility of an alternative. The technical feasibility evaluation addresses the applicability of the technology to the waste source and the availability of equipment, materials, expertise and services to implement the project, and the reliability of the technology. The administrative feasibility evaluation determines the logistical and scheduling constraints. Implementability also considers the appropriateness of a combination of alternatives based on project-specific conditions. Part of the consideration of appropriateness is public acceptance of the alternative. This factor could not be fully assessed until after the public had the opportunity to fully review the EE/CA and comment on it. This step was completed during February and March 2010.

7.1.3 Cost

The relative costs of proposed alternatives are compared. Since designs are preliminary at such an early phase of a proposed project, similar assumptions are made for all alternatives while developing relative cost estimates. Cost is made up of both the capital costs and the

operation and maintenance costs. Capital costs are fixed while operation and maintenance costs continue into time and may inflate over time. Hence, solutions that minimize operation and maintenance requirements after the remedial phase are typically favored. Part of operation and maintenance is any post removal site controls it would be necessary to maintain.

7.2 Detailed Analysis of Alternatives

7.2.1 No Action

The "no action" alternative involves leaving the Idora Mill site as it is. Primarily lead and zinc contamination with some copper and cadmium would remain on the surface of the site. The public would continue to use the site intermittently and risk to human health associated with these elements would not be abated. Risk to terrestrial and aquatic biota would not be abated. Water quality would improve very slowly as metals were naturally attenuated.

7.2.1.1 Effectiveness

Taking no action at the site would not be protective of human health or the environment. The principal ARARs for the COCs would not be met while the other location-specific and project-specific ARARs would be moot. There would be no long term effectiveness or permanence to the solution. The toxicity, mobility and volume of the wastes would remain in place. Short-term effectiveness would be poor.

7.2.1.2. Implementability

The "no action" alternative would be the easiest to implement since nothing additional would be done to address the problem. It is technically feasible. However, it is probably not administratively feasible given that the water quality and human health concerns the site should be addressed. The "no action" alternative would not provide a reliable solution and it might not have public support once all the facts were known to the public.

7.2.1.3. Cost

The "no action" alternative has no monetary costs associated with it. No capital cost would be incurred and no operation and maintenance including post removal site controls would be required.

7.2.2. Institutional Controls and Barriers

Posting signs that communicate the hazard present on the Idora Mill site and fencing it off from the public are the two most practical institutional and engineering controls that could be implemented. Removal of the current primitive road would limit access to the very few

individuals who would traverse the difficult terrain with no road. Signs would warn the public of the lead danger to human health present on the site while a large fence would keep the public from entering the most-contaminated part of the site. The facilities would require maintenance into perpetuity. Clean soil barriers would protect some but not all wildlife. These measures would have little or no effect on metals loading to the stream.

7.2.2.1 Effectiveness

The institutional controls of signing and road removal along with fencing, could in theory effectively break the human health risk pathway, although this alternative does not address water quality or biota impacts effectively. Experience at other undeveloped sites has shown that the public generally ignores human health risk signs and will break into gated-off areas. However, road removal would limit site visitation to the very few individuals willing to cover difficult terrain with no road. Clean soil barriers would add additional protection. The principal ARARs would not be met as the lead and other metals would remain on-site, because all areas would not accept barriers. Steep side slopes and floodplain near the stream would be problematic. The location-specific ARARs would be moot while project-specific ARARs would be few and easily met. The long term effectiveness and permanence of signs and fence without some parallel development of the property is questionable and unlikely. The road removal would be a permanent feature as long as the private owner barred any new road entry. The approach does not reduce the toxicity, mobility or volume of the COCs and would not be protective of all wildlife or any aquatic biota using the site or downstream aquatic biota. It would be effective to some degree over the short term. Overall, the institutional control and barrier approach would in practical terms have low effectiveness.

7.2.2.2 Implementability

The fencing, signing and road removal would be both technically and administratively feasible because these approaches employ commonly used technologies and administrative rules. For road removal, the agreement of the private owner, Forest Capital, would be required. Short-term impacts would involve some erosion from the surface from which the road bed was removed. The alternative would be effective in the long term at removal of the great majority of the human health threat, but would not address concerns for water quality and terrestrial and aquatic biota.

7.2.2.3 Cost

The capital cost of implementing signing, fencing, barriers, and road removal is relatively low at $75,591 over a fifty-year period (Appendix 4). The cost includes replacing the fence every 15 years. Maintenance of the remedy over the long term would be moderate ($500 per year), repairing fence when it is breached and signs when they are destroyed. Some long-term institutional control mechanism would be necessary to maintain the remedy. Certainly post removal site control would be necessary to maintain the remedial solution. Viability of any long-term mechanism of site control is questionable given the lack of a dedicated revenue stream.

7.2.3 Partial Removal to On-site Local Repository

The alternative would complete partial removals of the mine wastes (tailings and mill waste) at the mill site and some obvious contaminated sediments deposited downstream of the mill site. An on-site local repository would be constructed either between the mill structure and the waste rock or along the road bed. It is yet to be determined if sufficient space is available to house the estimated 4,000 cubic yards of contaminated material. Waste rock that is actively eroding would be removed and stabilized, probably along the road bed. Soil would be brought in from another site in sufficient quantity to cover the mill site and the sediment removal areas with soil up to one and a half feet deep. The mill area would be re-vegetated with native species. The road would be removed to prevent any vehicular access that might be used to damage the project repository.

7.2.3.1 Effectiveness

Removing the tailings, mill wastes and some selected contaminated sediments to a capped on-site local repository would effectively remove most of the COCs, greatly reducing the risk to human health and terrestrial biota. Removal of the tailings would likely abate the water quality exceedances attributable to the Idora Mill site and be protective of aquatic biota. The principal ARARs would be attained for the mill site and some of the floodplain, but some areas of the floodplain would still not meet the principal ARARs. Impacts to human health would be further mitigated by the road removal. Both the location and project-specific ARARs could be achieved by permit provisions and application of common best management practices. The remedy would have long term effectiveness and permanence. Residual toxicity in the floodplain should naturally attenuate as the stream stabilizes and the floodplain develops a heavier mantle of vegetation. The toxicity and volume of the wastes would not be reduced, but the mobility and target receptor access to them would be eliminated for the most part. There would be short-term impacts to the site primarily in the areas of removal and soil application and along the removed road bed. This impact would require re-vegetation and then many years of growth to mitigate.

7.2.3.2 Implementability

This alternative is both technically and administratively feasible. Removal actions have been implemented at many sites in North Idaho to remedy mine wastes. It is technically feasible, employing common excavator and truck-haul techniques. Where effectiveness monitoring has been pursued, removal has proven a reliable technology to mitigate stream contamination and health risks. Similar repositories have been constructed in North Idaho, but few on the project area. The Interstate and Douglas Mills are examples. However, these sites had more space. Since the envisioned repository would be located on lands managed by the Forest Service, an agreement to house and maintain the repository would be necessary. Any large scale maintenance activity would be difficult once the road was removed.

7.2.3.3 Cost

Haul distances would be a matter of a few hundred feet. Given the narrow character of the valley and the lack of suitable construction materials, a repository that would retain the wastes would likely require the import of most of the material to construct it. In this case, a base would be constructed from the silt loam soils from the project and a clay-max cap covered with additional soil. Project cost is estimated at $337,471 (Appendix 4). Operation and maintenance would consist of annual repository inspection and ground water monitoring estimated to cost no more than $1,000 per year. Post site control would consist of managing incompatible practices on or around the repository. Such cost would be part of the Forest Services' management of the Forest.

7.2.4 Full Removal of all Wastes to an On-site Centralized Watershed Repository

The full removal of tailings, mill wastes and contaminated sediments to an on-site centralized watershed repository would remove nearly all of the COCs from the site. This remedy would be fully protective of human health and wildlife. The remedy would require much of the floodplain to be disturbed by excavation and sorting of the substrate. The disturbance would necessitate considerable stabilization and re-vegetation on the site over and above the small amount required by partial removal alternatives. It would also necessitate construction of a much larger repository. Location of the repository would be off the project, because insufficient area is available to create a stable repository capable of housing 85,000 - 90,000 cubic yards on the project area. The Prichard Repository may not have sufficient area for such a removal volume. Waste rock would be removed from the stream and stabilized, probably on the road bed, likely near the mill site. Additional "oversort" rock (the material larger than 1 inch in diameter that remains after sorting out the 1-inch minus fraction from stream sediments) might be housed with the waste rock in order to diminish stream and floodplain sediment load. Soil would be brought in from another site in sufficient quantity to cover the mill site and the floodplain where feasible. The areas of soil placement would be re-vegetated with native species. The road would not be removed since it would not be necessary to reduce public access to the area.

7.2.4.1 Effectiveness

Full removal to an off site centralized repository would be effective in removing the COCs from the site. Both the human health risk and risk to terrestrial and aquatic biota using the site and downstream would be abated. The primary ARARs addressing the COCs would be met by removing substrate material until the protective values were achieved. Both the location-specific and project-specific ARARs could be achieved by permit provisions and application of common best management practices. The remedy would have long term effectiveness and permanence. The toxicity and volume of the wastes would not be reduced, but their mobility and target receptor access to them would be eliminated for the most part.

There would be short-term impacts to the site, primarily the loss of some of the vegetation and the stability of the stream. This impact would require re-vegetation and stabilization of the stream followed by many years of growth and channel adjustments.

7.2.4.2 Implementability

Full removal has been implemented at many sites in North Idaho to remedy mine wastes. It is technically feasible, employing common excavator and truck-haul techniques. However, the sheer volume, estimated at over 85,000 cubic yards, could make it a problem to house. This volume of material is over two times the amount housed at any nearby repository. Where effectiveness monitoring has been pursued, removal has proven a reliable technology to mitigate stream contamination and health risks. Locating a feasible on-site centralized watershed repository would be a problem only in terms of the volume of material. The Rex and Prichard Repositories are some 6 and 16 miles distant, respectively, and are the most likely sites. The closer Rex Repository is located on BLM-administered and private lands while the Prichard Repository is located on U.S. Forest Service-administered lands. Detailed study has been made of the Prichard Repository site (Maxim, 2004a). While the Rex site contains wastes from the Rex mill-site exclusively, the Prichard site contain mine wastes from one mill site on Forest Service administered land and two mill-sites on private lands, but in two separate cells. Mine wastes from federally managed and private property were placed in the same repository at the Lakeview and Continental site when this was the best technical solution. Placement of wastes from private property on federally managed land would be the most administratively feasible option for the Prichard Repository for which a memorandum of understanding already exists between the Forest Service and the State of Idaho.

7.2.4.3 Cost

Full removal to an on-site centralized watershed repository would be a costly project, estimated at $4,792,652 (Appendix 4) in capital costs, assuming a suitable existing on-site centralized watershed repository capable of housing the volume could be located and its use allowed. Operation and maintenance would consist of annual repository inspection and ground water monitoring estimated to cost no more than $1,000 per year. Post site control would consist of managing incompatible practices on or around the repository. Such cost would be part of the Forest Services' management of the Forest. The full removal to an on-site centralized watershed repository is the highest-cost alternative.

7.5.5 Partial Removal to an On-site Centralized Watershed Repository

The fifth alternative would remove the tailings, mill waste and a broader scope of obviously contaminated sediments to an on-site centralized watershed repository. Obviously contaminated material would be the one-inch minus fraction in discrete deposits (Table 8). The partial removal of concentrated defined mine wastes materials, those identified by size-sorting, would reduce the required repository volume to approximately 8,100 yards. Removal of this much

smaller volume would make the use of a more distant repository, such as the Prichard Repository, more reasonable. Waste rock would be removed from the stream and stabilized on the road bed at an appropriate location. Soil would be brought in from another site in sufficient quantity to cover the mill site and other selected removal sites. The areas of soil placement would be re-vegetated with native species. The road would be removed since some COCs in lower concentrations would remain, and it would therefore be advisable to curtail human access. Road removal has the added benefit of removing infrastructure that is causing added sedimentation into Beaver Creek.

7.2.5.1 Effectiveness

Removal of the tailings, mill wastes and a larger volume of contaminated sediments to an on-site centralized watershed repository would effectively remove most of the COCs, greatly reducing the risk to human health and terrestrial biota. Removal of the tailings would likely abate water quality exceedances attributable to the Idora Mill site and be protective of aquatic biota. The principal ARARs would be attained for the mill site and some of the floodplain, but some areas of the floodplain still would not meet the principal ARARs. Impacts to human health would be further mitigated by the road removal. Both the location-specific and project-specific ARARs could be achieved by permit provisions and application of common best management practices. The remedy would have long-term effectiveness and permanence. Residual toxicity in the floodplain should naturally attenuate as the stream stabilizes and the floodplain develops a heavier mantle of vegetation. The toxicity and volume of the wastes would not be reduced, but the mobility and target receptor access to them would be eliminated for the most part. There would be short-term impacts to the site, primarily in the areas of removal and soil application and along the removed road bed. This impact would require re-vegetation and then many years of growth to mitigate.

7.2.5.2 Implementability

The alternative is both technically and administratively feasible. Removals have been implemented at many sites in North Idaho to remedy mine wastes. It is technically feasible, employing common excavator and truck-haul techniques. The smaller volume of mine wastes identified for selective removal by size-sorting would simplify the project repository issues. The issue of hauling and housing the material at the Prichard Repository would be more manageable and would add to the advantages this site already has in terms of intergovernmental agreements. The smaller volume could easily be added to a repository cell. Where effectiveness monitoring has been pursued, removal has proven a reliable technology to mitigate stream contamination and health risks.

7.2.5.3 Cost

Partial removal to an on-site centralized watershed repository would be a more reasonable cost alternative at $533,964 (Appendix 4) in capital costs assuming a suitable existing on-site

centralized watershed repository capable of housing the necessary volume could be located and its use allowed. Operation and maintenance would consist of annual repository inspection and ground water monitoring estimated to cost no more than $1,000 per year. Post site control would consist of managing incompatible practices on or around the repository. Such cost would be part of the Forest Services' management of the Forest. Partial removal to an on-site centralized watershed repository would be more costly than partial removal to an on-site local repository; there would be greater cost not only for transportation, but for a larger volume of contaminated materials. Use of an on-site centralized watershed repository assures placement in a repository with optimal site characteristics.

7.3 Comparison of Alternatives

EPA Guidance requires that remedial alternatives be compared to each other for the nine rating factors (EPA 1993). The five alternatives are compared by numeric rating in Table 14. Alternative 5 receives the highest point score.

Table 14. Comparison of the alternative remedial plans for the Idora Mill site.

Alternative /Description **Rating Factor**	**Alternative 1/ No Action**	**Alternative 2/ Fencing , Signing & Road Removal**	**Alternative 3 / Partial Removal to On-Site Local Repository**	**Alternative 4 / Full removal to On-Site Centralized Watershed Repository**	**Alternative 5 / Partial removal to On-Site Centralized Watershed Repository**
Overall Protectiveness of Human Health & Environment	1	2	4	5	4
Compliance with ARARs	1	1	4	5	4
Long Term Effectiveness	1	2	4.5	5	4.5
Reduction in Toxicity, Mobility & Volume	1	1	4.5	5	4.5
Short Term Effectiveness	1	2.5	4	2	4
Technical Feasibility/ Reliability	5	5	3	5	5
Administrative Feasibility	1	5	5	3	5
Appropriateness/ Public Acceptance	1	1.5	2.5	5	4
Cost	5	4	3	1	2
Total	17	23.5	34.5	36	37

Note: Scale of 1 -5 with 1 least superior and 5 most superior

8.0 Selected Alternative

The alternative selected by the USFS, BLM and DEQ is alternative 5. The alternative would excavate, remove and compact approximately 8,100 cubic yards of tailings and contaminated sediment deposits to Prichard Repository. Waste rock and some large alluvium from the sorting process "oversort" would be placed on section(s) of the road bed that are not subject to erosion by Beaver Creek. Soil would be backhauled from the repository and placed to cap (create a soil barrier over) some removal areas. Capped areas would be re-vegetated. Beaver Creek would be stabilized as practicable through the removal area. The existing road would be improved sufficiently to accomplish the removal action. After work is completed on the removal area, those sections of the road subject to erosion by Beaver Creek would be removed. Contaminated wastes would be placed in an expanded Monarch Cell of the Prichard Repository. Decisions on cell expansion will be based on the site reports (Maxim 2004a) and detailed repository engineering (Maxim 2004b).

The selected alternative (5) compares favorably to the other four alternatives. When the preferred alternative was ranked with the nine rating factors required by EPA guidance, it received the highest score.

9.0 Public Comment and Responsiveness Summary

9.1 Public Comment

The draft final Engineering Evaluation / Cost Analysis (EE/CA) for Removal of Mine Wastes at the Idora Mill Site and Downstream along Beaver Creek, Shoshone County, Idaho was released for a thirty-day public comment period on February 3, 2010. The comment period was announced through a DEQ news release date February 3, 2010 (Appendix 6). The comment period closed at 5 PM PST on March 5, 2010. A copy of the EE/CA was posted on the DEQ internet website at www.deq.idaho.gov/public comments.cfm. Two hard copies of the EE/CA were placed for public review. One was located in the public library in Wallace Idaho and a second in the DEQ Coeur d'Alene Regional Office in Coeur d'Alene. In addition, compact disc copies of the EE/CA were provided to EPA's Coeur d'Alene Field Office, Forest Capital Partners L.L.C., Hecla Mining Company and those property owners along Carbon Center Road, who might be affected by haul truck traffic. Comments could be made by e-mail to either the DEQ web-site or the project leader and by letter of comment. Review and consideration of the comments was postponed until March 9, 2010 to allow any comment mailed on March 5, 2010 to be received.

Two comments were received both by e-mail transmission. These were by Earl Liverman of the Coeur d'Alene Field Office of EPA and Justin Hayes on behalf of the Idaho Conservation League (ICL). These comments are attached in Appendix 6. No other comments were received.

9.2 Response to Comment

The comment filed by ICL was fully supportive of the removal action proposed and made no specific comments concerning the EE/CA or its preferred alternative.

The comment made by Earl Liverman of the EPA made substantive “suggestions” for a general improvement of the EE/CA. These included and were responded to as follows:

It was suggested that section 2.0 include an additional subsection addressing the surrounding land use, populations and any sensitive ecosystems. It was further inquired whether an informal consultation under section 7 of the Endangered Species Act (ESA) was underway with the U.S. Fish & Wildlife Service. A new section 2.3 was added to address surrounding land use, populations and sensitive ecosystems as this relates to threatened, endangered and special concern species. Information was provided concerning the biological assessment under development pursuant to an informal consultation under section 7 ESA with the U.S. Fish & Wildlife Service’s Spokane Office.

It was recommended that the term “principal threat materials” be replaced, because this was an inappropriate use of the term in its CERCLA connotation for mine wastes. The phrase and terms suggestive of it were removed from the document and replaced with the term “mine wastes.”

It was pointed out that barriers and fencing are not considered institutional controls under the National Contingency Plan, but rather engineering controls. The EECA referred to barriers as engineering controls and only soil management plans to maintain these barriers as institutional controls. However it did refer to fencing as an institutional control. This error was changes throughout the EE/CA.

It was suggested that operation and maintenance (O&M) or Maintenance and Repair (M&R) of the corrective actions be placed in the cost considerations. In addition post removal site controls should be considered. The cost estimates did include O&M costs and these are called out in the text. Post removal site control considerations were added for each action alternative.

It was suggested that since the Prichard Repository was proposed as the on-site watershed repository, more information should be provided on its location and current configuration. An additional paragraph was added to section 6.1.4 describing the Prichard Repository. Two figures were added showing the location of the removal area, the repository and the proposed haul route and another showing the Monarch Cell of the repository “as built” after the Beartop wastes addition and the conceptual area of cell expansion for the Idora wastes.

It was suggested that typical drawing showing the actions of each action alternative be included as well as barrier and BMP typical drawings. Four figures were added to section 6.2 to illustrate alternatives 2,3 and 5 and by reference alternative 4. The project is too early in the design phase to supply the additional typical drawings requested.

10.0 References

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DEQ 2002. Data from the monitoring of metals contaminated tributaries to the North Fork Coeur d'Alene River. Department of Environmental Quality, Coeur d'Alene Regional Office, 2110 Ironwood Parkway, Coeur d'Alene ID 83814.

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Maxim, 2004a. Baseline Groundwater Assessment and repository design services Prichard-Beaver repository site, Idaho Panhandle National Forests, Shoshone County, Idaho. Maxim Technologies Inc., 2436 Dixon Avenue, P.O. Box 7669, Missoula MT 59806. 28p.

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Ruebke, J. 2003. Personal communication of road decommissioning, storage and maintenance costs. Coeur d'Alene River Ranger District, Idaho Panhandle National Forests, 2502 E. Sherman Avenue, Coeur d'Alene ID 83814. As adjusted for inflation.

SAIC 1993. Clean Up Alternatives for Coeur d'Alene Basin Mine Sites. Prepared for U.S. Environmental Protection Agency, Seattle WA by Science Applications International Corporation, Bothell WA.

Appendix 1. Calculation of Tailings Volume

Calculation of Tailings Volume from Report of Ore Tonnage Processed and Metal Weights Extracted (SAIC 1993)

Tailings Cubic Yard Calculation								
12509	tons processed							
444	tons extracted							
12065	tons tailings							
or	2000	lb/t						
	454	g/lb						
	1.5	cc/g	Note: Ore would have an initial density of 2.6 g/cc.					
	1,000,000	cc/m2	However, gig milling would lower density to 1.5 g/cc bulk density.					
	1.307	yd3/m3						
	9545.5							

Appendix 2. Photographs of the Idora Mill Site and Beaver Creek Downstream of the Site

(Most photographs compliments of Mike Stevenson, BLM)

Photograph A: Idora Mill and associated mill wastes.

Photograph B: Idora Mill Site with associated tailings prior to suspected 2008 snow melt discharge event.

Photograph C: Idora Mill Site with associated tailings post suspected 2008 snow melt discharge event.

Photograph D: Mine waste rock pad with collapsed bunkhouse and machinery.

Photograph E: Remnants of plank dam with contaminated sediment deposit.

Photograph F: Cribbed and filled area created for buildings.

Photograph G: Beaver Creek demonstrating boulder/bedrock and large woody debris control with stable vegetation.

Photograph H: Floodplain instability in lower project area.

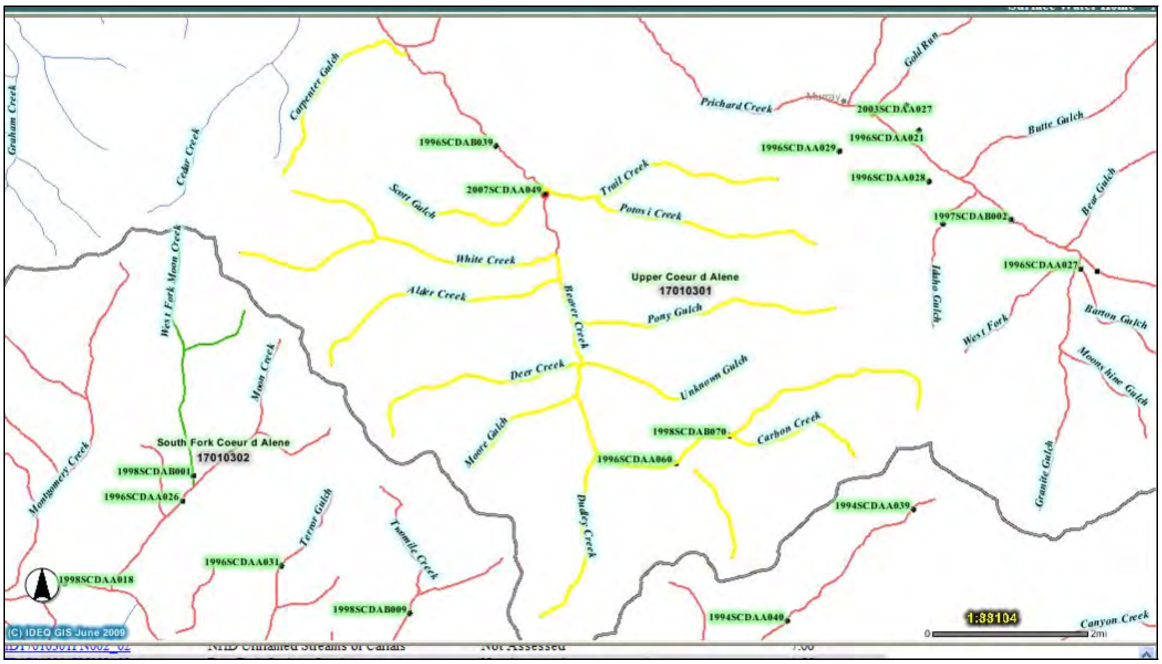
Photograph I: Area of mass wasting of the road bed during a high discharge event.

Appendix 3. Beaver Creek Status and BURP Data

July 1, 2009 – Kajsa Stromberg

Beaver Creek Status and BURP Data

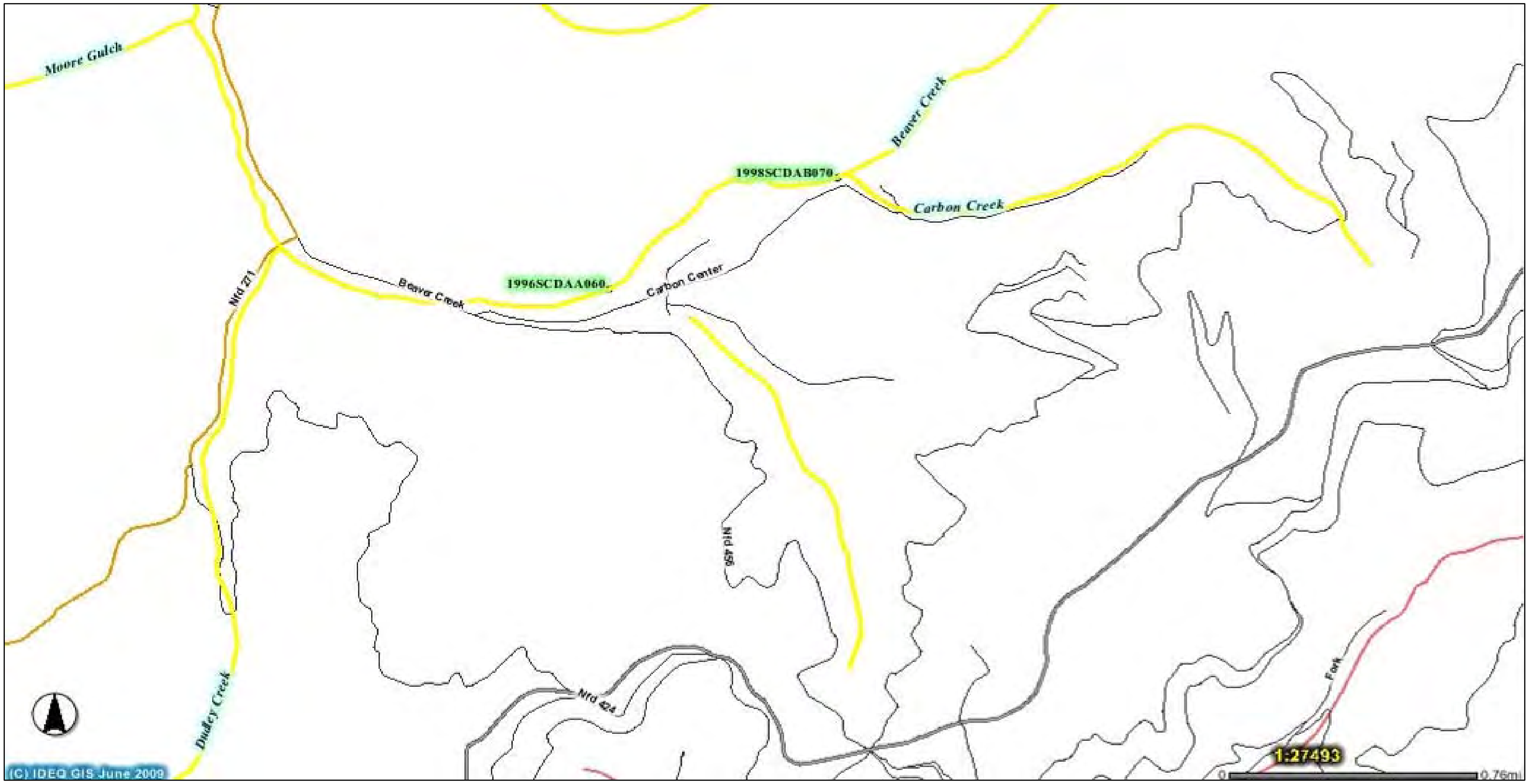
The Assessment Unit that includes Upper Beaver Creek and tributaries is ID17010301PN003_02 (highlighted here in yellow). This map and other related information is available online through our interactive 2008 Integrated Report of Idaho water quality, http://global.deq.idaho.gov/Website/wq2004/viewer.htm.



This section of Beaver Creek is considered water quality impaired and not supporting its beneficial uses, cold water aquatic life and salmonid spawning (2008 Integrated Report). The other beneficial uses are considered not assessed. Pollutants causing impairments are sediment, temperature, cadmium and zinc.

There have been two BURP sampling events on this assessment unit, one in 1996 and one in 1998. These sites are 1996SCDAA060 and 1998SCDAB070 (see map below). In 1998, the crew found the site unsuitable for assessment using BURP protocols due to extensive subsurface flow. The BURP personnel's comments read, "LOCATION RELATIVE TO LANDMARK: .. TO CARBON CREEK. SUBSURFACE FLOW-UNABLE TO BURP. THE SURFACE POOL IS UNDER THE ROAD BRIDGE & IS ONLY ABOUT 80 METERS LONG. LOTS OF GRAZING, (CATTLE) IN THE AREA."

The1996 BURP results produced in scores fish (3), habitat (1), and macro-invertebrate (1) indices with an average of 1.67 indicating impairment of coldwater aquatic life. There were 224 cutthroat, 38 brook trout and 38 sculpin collected.



Moore Gulch
Beaver Creek
1998SCDAB070
Carbon Creek
1996SCDAA060
Beaver Creek
Carbon Center
Nfd 271
Nfd 456
Nfd 424
Fork
Dudley Creek
(C) IDEQ GIS June 2009
1:27493
0
0.76mi

Appendix 4. Costs Assumptions and Calculations for Idora Mill Site Removal Alternatives

Alternative 1: No Action. – No Cost

Alternative 2: Institutional Controls of Signs, Fence, and Road Closure
Measured: 900 feet perimeter fence

Assume: Signs every 100 feet; therefore 9 signs
Assume: $300/ sign: Then: $2,700
Assume: Six foot 9 gage chain link fence with top rail and three strands barb wire: $20/lineal foot: Ball Park quote Idaho Fence on 5/12/09. Therefore, $18,000; plus mobilization of $2,000.
Assume 15 year lifetime of fence; therefore $66,666 over a 50 year timeframe.
Assume Road length from Carbon Creek: 1.13 miles @$5,500/mile = $6,271; plus mobilization of $1,254 = $7,525

Total Initial Cost: $30,225 over 50 years: $75,591

Alternative 3: Removal of tailings, mill wastes and selected contaminated sediments to an on-site local repository; stabilize waste rock on road bed; place topsoil; plant and remove road.

Assume: Repository on hillside between mill and waste rock dump or on road grade.
Costs based on experience at Monarch Mill Removal (DEQ 2008); Ruebke, 2003 adjusted

Mobilization Costs:	$90,000
Site Grubbing: 1 days D8 Cat at $158/hour	$1,264
Excavation of 8,100 yards contaminated material and transport @ $6.50/yard	$26,000
Repository with clay max liner to house 8,100 yards @ $17/yard	$68,000
Move and stabilize waste rock @ $6.50/yard	$12,500
Place soil 1.5 feet on 1.25 acre or 3,025 yd3 @ $15/yard	$45,375
Fertilization and replanting of 1 acre @ $5,000/acr$	$6,250
Remove 1.13 miles of road	$6,271
Subtotal	$255,660
Engineering and oversight @ 20% base costs = $51,132	
Total	$306,792
Plus contingency @ 10%	$337,471

Alternative 4: Full removal of tailings, mill waste and one-inch minus fraction to an on-site centralized watershed repository, top soil placement and re-vegetation.

Assume: Repository at Prichard a 16 mile haul one-way
Costs based on experience and data from Monarch Mill Removal (DEQ 2008); Ruebke, 2003 adjusted

Mobilization Costs:	$90,000
Repository opening: 1 day Cat @ $158/hour; 1 day Excavator @ $124/hr	$2,256
Excavation and sort out of 181,245 yards of alluvium @ $4.79/yd	$868,162
Transport 86,822 (1,637 + 85,185) yd3 of contaminated one-inch minus and mill tailings-waste @ $13.20/ yd	$1,146,050
Clay max liner repository to house 86,822 yards @ $16.66/yard	$1,446,454
Move and stabilize waste rock @ $6.50/yard	$12,500
Place soil 1.5 feet on 1.25 acre or 3,025 yd3 @ $15/yard	$45,375
Fertilization and replanting of 4 acres @ $5,000/acre	$20,000
Subtotal:	$3,630,797
Engineering and oversight @ 20% base costs = $726,159	
Total:	$4,356,956
Plus contingency @ 10%	$4,792,652

Alternative 5: Removal of tailings, mill wastes and selected contaminated sediments to an on-site centralized watershed repository; stabilize waste rock on road bed; place topsoil; plant and remove road.

Assume: Repository at Prichard a 16 mile haul one-way
Costs based on experience and data from Monarch Mill Removal (DEQ 2008); Ruebke, 2003 adjusted

Mobilization Costs	$90,000
Repository opening: 1 day Cat @ $158/hour; 1 day Excavator @ $124/hr	$2,256
Excavation of 8,100 yards contaminated material and transport @ $13.20/yard	$106,920
Repository with clay max liner to house 8,100 yards @ $16.66/yard	$134,946
Move and stabilize waste rock @ $6.50/yard	$12,500
Place soil 1.5 feet on 1.25 acre or 3,025 yd3 @ $15/yard	$45,375
Fertilization and replanting of 1 acre @ $5,000/acre	$6,250
Remove 1.13 miles of road	$6,271
Subtotal	$404,518
Engineering and oversight @ 20% base costs = $56,418	$485,422
Plus contingency @ 10%	$533,964

Table 15. Summary of alternative costs

Alternative	Cost ($)	Comment
1 – No action	0	
2 – Institutional controls	$75,591	
3 – Partial removal to an on-site local repository	$337,471	Assumes on-site local repository
4 – Full removal to an on-site centralized watershed repository	$4,792,652	Assumes Prichard Repository
5 – Partial removal to an on-site centralized watershed repository	$533,964	Assumes Prichard Repository

Appendix 5. Estimates of Metals-contaminated Waste Volume and FPXRF- based Estimates of Lead and Zinc Concentrations

Table 16. Contaminated deposit dimensions, volumes, and metals content.

Area #	Lengt h (ft)	Width(s) & average (ft)	Depth (ft)	Volume (yd^3)	Top Metals	(mg/kg)	Side Metals	(mg/ kg)	Con-trol	(mg/ kg)
					XRF Pb	XRF Zn	XRF Pb	XRF Zn	XRF Pb	XRF Zn
1A	58	57	0.5	61.2	4,317	632				
					59,100	1,440				
1B	84	54	2.75	462			7,845	5,655		
							8,701	5,672		
									352	274
2	339	39	6	2252.5	21,200	2,032	7,514	1,046		
		49	3		3.764	1,701				
		37	2.5		7,538	37,900				
		75	3.8		1,813	851				
		34								
		46.8								
3	37	23	5.5	173.4			8,399	24,700	3	37
							788	540		
3A	78	23	0.5	33.2			5,969	7,212	3A	78
4	36	11	2	29.3	10,200	962	17,000	1,621	4	36
5	28	6	3	18.7	5,367	1,958	16,500	2,190	5	28
6	266	58	6.5	3884.9	3,810	5,752	11,400	2,195	773	671
		63					16,700	24,800		
		61								
		60.7								
7	163	45	8.5	1710.5	16,400	1,065	19,500	1,065		
		36								
		19								
		33.3								
8	44	25	4	163.0			23,600	2,617		
8.5	121	25	3	336.1	2,661	921				
9	50	25	3	138.9	5,942	1,327	7,451	5,950		
							3,376	1,839		
10	200	40	6	1777.8	3,025	360	25,500	9,487		
					5,166	951	7,382	2,141		
11	150	50	5	1083.3	3,632		5,174		11	150
		37								
		30								
		39								
12A	100	42	3	466.7	3,415	1,210	1,989	931		
12B	77	25	3.5	249.5	3,020	696	10,900	3,000		
12C	80	28	4	331.9	1,302	3,000	7,065	2,207		
13	40	52	3	231.1						
14	38	34	2.5	646	2,251	484				
					500					
					1,282					
			Total	14049.9						

Appendix 6. Public Comment News Release and E-Mail Comment Received.

Department of Environmental Quality • February 3, 2010 • For Immediate Release

NewsRelease

MEDIA CONTACT

- **Geoff Harvey**
  DEQ Coeur d'Alene Regional Office
  (208) 666-4614

DEQ seeks public comment on draft analysis of options to clean up contaminated soils at Idora Mill site

COEUR d'ALENE — The Idaho Department of Environmental Quality (DEQ) is seeking public comment on a draft document outlining various options for cleaning up soils contaminated primarily by lead and zinc at the Idora Mill site in Shoshone County.

The objective of the *Engineering Evaluation/Cost Analysis (EE/CA)* is to identify and evaluate cleanup alternatives that could be implemented to reduce risks to human health and the environment at the mill and downstream along Beaver Creek to the Carbon Creek confluence.

The document recommends a preferred cleanup option prescribing removal of approximately 8,100 cubic yards of tailings, mill waste and contaminated floodplain sediments to a centralized watershed repository. Waste rock would also be removed from the stream channel and stabilized at an appropriate site.

Removal areas would receive a clean soil covering and be vegetated. The road would also be removed to limit access and to remove its destabilizing effect on the stream.

The document is available for public review at DEQ's Coeur d'Alene Regional Office, the Wallace Public Library, and in PDF format on DEQ's Web site at *www.deq.idaho.gov/public/comment.cfm.*

Written comments will be accepted through 5 p.m. PST, Friday, March 5, 2010.

Submit questions, requests, and/or written comments electronically on DEQ's Web site or by mail or email to:

Geoff Harvey
DEQ Coeur d'Alene Regional Office
2110 Ironwood Parkway
Coeur d'Alene, ID 83814
Email: *geoff.harvey@deq.idaho.gov*

End

Idaho Conservation League

Geoff Harvey
DEQ Coeur d'Alene Regional Office
2110 Ironwood Parkway
Coeur d'Alene, ID 83814

2/18/10

Idaho Conservation League comments in DEQ draft analysis of options to clean up contaminated soils at Idora Mill site

Dear Mr. Harvey,

Thank you for the opportunity to provide comment on the Draft Final Engineering Evaluation/Cost Analysis (EE/CA) developed for removal of mine wastes at the Idora Mill site and downstream along Beaver Creek in Shoshone County, Idaho.

The Idaho Conservation League has a long history of involvement with water quality and mining issues and is deeply engaged in efforts protect water quality from past and future impacts associated with mining activities. As Idaho's largest state-based conservation organization we represent over 9,800 members, many of whom have a deep personal interest in protecting Idaho's water quality and the health of all Idahoan's from the harmful effects of pollution. A number of our members live downstream in the basin in which the Idora Mine is located and are very concerned about the ongoing harm that this and similar facilities is causing.

Upon review of DEQ's Draft Final Engineering Evaluation / Cost Analysis (EE/CA) developed for removal of mine wastes at the Idora Mill Site and downstream along Beaver Creek we are supportive of DEQ's proposed alternative. We look forward to this action being implemented as soon as possible.

Please keep us apprized of this and other similar matters. Do not hesitate to contact me at jhayes@idahoconservation.org or at 208-345-6933 ext. 24 if you have any questions about our comments on this matter

Sincerely,

S/ Justin Hayes

Justin Hayes

Sent: Thu 2/18/2010 10:21 AM

From: Liverman.Earl@epamail.epa.gov

To: Geoff Harvey

Subject: Idora Mill & Tailings
Geoff,

A couple of quick thoughts. If you would like more, I'll need another week or so.

- Section 2.0. Suggest this section be revised to include subsection re surrounding land use and populations and sensitive ecosystems.

- Regarding sensitive ecosystems, did USFS or someone coordinate with USFWS re T&E species?

- Recommend you delete any reference to principal threat materials or principal threat wastes, both of which have distinct meanings likely unrelated to the project. See attached fact sheet and recall Bunker Hill re PTMs disposed of in a "baggie.".

- Alternative 2 (ICs). See attached fact sheet re ICs, particularly discussion re barriers and fences which are not considered ICs.

- Recommend alternatives address O&M or M&R (and post-removal site controls if USFS maintains) requirements re long-term durability and protectiveness.

- Since you are using an existing repository (?), recommend you discuss in greater detail and include on appropriate site figure.

- Recommend you include typical drawings showing where proposed work would occur for each alternative, components of the the protective barrier, and surface water control features.