5.0 DESCRIPTION OF ALTERNATIVES

Human health and ecological alternatives for the basin were developed, analyzed, and compared following EPA guidance (USEPA 1988). Section 5.1 summarizes the components of each of the alternatives, which are organized as follows:

- Section 5.1.1: Alternatives for protection of human health in the residential and community areas of the upper basin and lower basin
- Section 5.1.2: Alternatives for protection of ecological receptors in the upper basin and lower basin
- Section 5.1.3: Alternatives for Coeur d'Alene Lake
- Section 5.1.4: Alternatives for protection of human health and ecological receptors for the Spokane River between the Washington-Idaho state line and Upriver Dam.

Section 5.2 introduces the criteria used to analyze and compare the alternatives and presents tabular summaries of the results of the comparative evaluations.

5.1 SUMMARY OF ALTERNATIVES

Alternative development included identification of all potentially applicable technologies and process options; screening of technologies and process options on the basis of technical implementability only; and evaluation and screening of retained technologies and process options based on effectiveness, implementability, and cost. The retained process options were then assembled into alternatives that provide decision-makers with a range of remedial options, including "no action," as required by the NCP.

The alternatives developed in the FS are not mutually exclusive choices and do not limit the choice of a remedy. A preferred alternative, as developed in the Proposed Plan, or, subsequently, the selected remedy, as developed in the ROD, can combine elements of the various alternatives developed in the FS, refine or modify those elements, or add to them. Although the FS supplies information for helping select a remedy, information supplementing the FS may be incorporated into the remedy selection process at any time.

Cleanup plans for the basin have also been developed by the State of Idaho (State of Idaho Cleanup Plan) and the mining companies (Mining Companies Cleanup Plan). Because the ecological components of these plans enhance the range of remedial options available to decisionmakers, these plans are presented as ecological Alternatives 5 (State plan) and 6 (mining companies plan), based on interpretation of available documentation. The human health alternatives include the human health components of these plans, with minor exceptions, and the State plan and mining companies plan are not presented as distinct alternatives.

Alternatives are developed and evaluated in the FS only to the level of detail appropriate to provide information needed to support a Proposed Plan and ROD. The level of detail in the FS is considered a planning level, not a design level. The FS is not a design document, and results from the FS are not adequate to support site-specific remedial actions. Any actual remedial actions would require appropriate site-specific remedial designs, which may generally include collection of site-specific chemical, hydrologic, hydraulic, and geotechnical data from areas identified as requiring cleanup. This may include areas where previous cleanup actions have taken place, such as floodplain areas of the Union Pacific Railroad right of way or other areas where previous removal actions have addressed some, but not all, contamination present. Remedial design and construction (remedial action) are post-ROD activities that are based on the remedy selected in the ROD.

5.1.1 Human Health Alternatives for Residential and Community Areas

Human health alternatives were developed for residential and community areas of the upper basin and lower basin. Sets of alternatives were developed for each of the primary potential exposure media:

- Soil
- Drinking water
- House dust
- Aquatic food sources

Risk from eating homegrown vegetables is addressed by the yard soil alternatives. Alternatives for each medium were assembled independently of the other media to allow maximum flexibility in future decision-making. The ultimate effectiveness of the fish consumption alternatives would be highly dependent on the reductions of fish uptake of metals achieved through implementation of ecological remedies.

Human health issues associated with the Spokane River between the Idaho-Washington state line and Upriver Dam are addressed by the Spokane River alternatives, which are described in Section 5.1.4.

Institutional controls, including the ongoing ICP described in Section 3.1.2, are a component of each of the action alternatives. To ensure the effectiveness of alternatives enacted throughout the basin, the ICP would be expanded to become a basinwide program that would also see that future actions do not create new human health risks. The basinwide ICP would include records maintenance, permitting, surveillance, inspections, and local construction regulations developed and implemented in conjunction with local zoning, building, or planning commissions.

Future uses of undeveloped areas could be addressed by local ordinance as part of the ICP. For drinking water, expansion of the BHSS "area of drilling concern" would advise drillers of the unpotable nature of the main valley aquifer and of source area side gulches. For commercial and residential development, permitting would ensure that a local entity could evaluate the area for development and require standardized measures to prevent exposure to contaminants. This approach has been very successful as implemented by the PHD in Kellogg, Smelterville, Page, and Pinehurst.

The "information and intervention" components of the human health alternatives include both the Lead Health Intervention Program and the Institutional Controls Program.

5.1.1.1 Soil Alternatives

5.1.1.1.1 Soil Alternative S1—No Action. This alternative would leave contaminated soil in place with no change in existing conditions. It would not remove contaminated soil from residential yards and gardens in the basin, it would provide no information, education, or counseling for residents with contaminated yards, and it would not monitor blood lead levels to evaluate the impacts of continued exposure. The no action alternative provides a baseline from which to compare the action alternatives.

5.1.1.1.2 Soil Alternative S2—Information and Intervention. This alternative would include deed notices, pamphlet distribution, press releases, public meetings, publicly posted notices, and advisory signs in public areas to both inform the public of risk mitigation and new risk information and solicit public input and involvement. This alternative would also include a program similar to the PHD's Lead Health Intervention Services, which provides personal health and hygiene information to help mitigate exposure to contaminants. Services also include biological monitoring, yard and home sampling, and nursing follow-up services. An institutional controls program which would include local construction regulations (developed and implemented in conjunction with local zoning, building, or planning commissions) may also be considered in certain areas if risk conditions warrant.

There are some possible conditions that might warrant relocation of residents in some limited areas, rather than implementation of this alternative. Information about these possible conditions

and the procedures that would be followed for relocation are discussed in Section 4.1.2.7 of Part 2 of this FS.

5.1.1.1.3 Soil Alternative S3—Information and Intervention and Access Modifications. In addition to information and intervention, this alternative would include constructing fences or other barriers around certain areas and providing maintenance to prevent or limit access to certain areas where risk level and persistency warrant. This alternative is not intended for use at residential properties.

5.1.1.1.4 Soil Alternative S4—Information and Intervention and Partial Removal and Barriers. In addition to information and intervention, this alternative would include removing a limited amount of contaminated soil and placing clean barriers. Contaminated yards would be excavated to a typical depth of about 1 foot. Garden areas would be provided with a minimum of 2 feet of clean fill. In order to mitigate potential exposure pathways, the excavated areas would be backfilled with clean soils and/or capped. Where appropriate, exteriors of structures would be pressure-washed before remedial measures are performed, to reduce the potential for recontamination from lead-based paint. Risk would be further reduced by installing visual markers to delineate the limits of soil removal. In addition to residential yards, common use areas such as streets, alleys, rights-of-way, and playgrounds would also be candidates for remediation if soil contamination and exposure risks warrant. This alternative would also include revegetation and interim dust control during soil excavation. For recreational areas this alternative would include site improvements to reduce exposure risks. These would be specific to individual recreational areas and, in addition to partial soil removal and access restrictions, could include stabilizing river banks, constructing paved boat ramps and parking areas, excavating or capping day-use areas, and providing picnic tables.

There are some possible conditions that might warrant relocation of residents in some limited areas rather than implementation of this alternative as discussed for Alternative S2.

5.1.1.1.5 Soil Alternative S5—Information and Intervention and Complete Removal. In addition to information and intervention, this alternative would attempt to completely remove soil from properties and dispose of soil that exceeds action levels. The depth of contaminated soil is expected to vary considerably within the basin, but complete removal is considered to be excavation of residential yard and garden areas to a depth of 4 feet. If warranted, exteriors of structures would be pressure-washed to reduce the potential for recontamination from lead-based paint. This alternative would include backfilling the properties with clean soil to reestablish site grades and revegetating the reclaimed ground surface. It would also include interim dust control during soil excavation. This alternative is not envisioned for recreational areas.
There are some possible conditions that might warrant relocation of residents in some limited areas rather than implementation of this alternative as discussed for Alternative S2.

5.1.1.2 Drinking Water Alternatives

5.1.1.2.1 Drinking Water Alternative W1—No Action. This alternative would leave contaminated drinking water sources in place with no changes in existing use. It would take no action to prevent exposure to COPCs in drinking water, and would provide no information or education to exposed residents. The No-Action Alternative provides a baseline from which to compare the action alternatives.

5.1.1.2.2 Drinking Water Alternative W2—Public Information. This alternative would include pamphlet distribution, press releases, public meetings, and publicly posted notices to inform the public of risk mitigation and new risk information and solicit public input and involvement. Because this alternative would require an ongoing effort, it is considered primarily for use at the community level and is generally not considered feasible for individual residences, except for raising general awareness of risks.

5.1.1.2.3 Drinking Water Alternative W3—Public Information and Residential Treatment. In addition to public information, this alternative would include wellhead filtration (if applicable) and point-of-use filtration. Filters would be placed at each tap or other point of use in residences. If possible, a single filter would be placed on the main residence service line to avoid potential confusion and change-out costs for multiple filters. A change-out program would be required to ensure that filters are changed on the required schedule.

5.1.1.2.4 Drinking Water Alternative W4—Public Information and Alternative Source, Public Water Utility. In addition to public information, this alternative would include permitting and constructing drinking water conveyances from public water utilities to residences or common-use areas. Information programs would be used to better inform residents about lead risks from in-home plumbing.

5.1.1.2.5 Drinking Water Alternative W5—Public Information and Alternative Source, Groundwater. For properties currently supplied by contaminated water wells or other unregulated sources, this alternative would include (in addition to public information) permitting and constructing new wells into a suitable alternative aquifer, installing necessary appurtenances, and abandoning existing contaminated wells. The suitability of the alternative aquifer (for example, water yield and quality) would need to be evaluated before drilling any new wells. After well construction, groundwater sampling would be conducted to verify that new wells supply water capable of achieving the RAOs. Subsequent monitoring would also be conducted to ensure continual achievement of RAOs. Information programs would be used to better inform residents about lead risks from in-home plumbing.

5.1.1.2.6 Drinking Water Alternative W6—Public Information and Multiple Alternative Sources. This alternative would include public information, in addition to one of the above-described alternatives, depending on geographic issues. For areas inside water districts, the alternative would provide individual residences or common areas with a hookup to the existing public conveyance system. For areas outside water districts (mostly in the tributary gulches), it is assumed that public water utilities will not be able to provide an alternative water source because of the annexation and engineering issues of constructing distribution systems; therefore, the assumed alternative for these areas would be to provide either point-of-use treatment or new groundwater wells. Alternative W6 would include a survey of residences during remedial design to determine whether they were served by public water utilities, and to determine residences at which COPCs in drinking water exceed maximum contaminant levels.

5.1.1.3 House Dust Alternatives

5.1.1.3.1 House Dust Alternative D1—No Action. The No Action alternative would leave contaminated house dust in place and would not change existing conditions. It would take no action to prevent exposure, and provide no information or education to exposed residents. The no action alternative provides a baseline from which to compare the action alternatives.

5.1.1.3.2 House Dust Alternative D2—Information and Intervention and Vacuum Loan Program/Dust Mats. This alternative has three major components. The first component, information and intervention for house dust would include pamphlet distribution, press releases, public meetings, and publicly-posted notices to inform the public of remedial actions and to provide exposure education. In addition, public input and involvement would be sought. This program has been administered as part of the PHD's Lead Health Intervention Program at the BHSS for approximately 15 years and throughout the basin since 1996. The second component of this alternative would be expansion of the Vacuum Loan Program initiated at Bunker Hill, which allows residents to use a heavy-duty vacuum cleaner equipped with high efficiency particulate air (HEPA) filters. The third component would be free dust mats for entryways, which would be provided to residents to reduce tracking exterior dust into the home. Monitoring would also be conducted to ensure continued achievement of RAOs.

5.1.1.3.3. House Dust Alternative D3—Information and Intervention, Vacuum Loan Program/Dust Mats, Interior Source Removal, and Capping/More Extensive Cleaning. In addition to the components of Alternative D2, this alternative would include interior cleaning, and removing and replacing some household items that are either difficult to clean effectively or which provide a source for recontamination. Interior cleaning would include a one-time cleaning of hard surfaces and heating and cooling systems and removal and replacement of major interior dust sources such as carpet and some soft furniture. These activities would occur only after exterior sources of contamination had been permanently remediated, to ensure cost-effectiveness

and prevent recontamination. Based on observations from yard remediation in the BHSS, once exterior yard soil is cleaned up, relatively few homes are expected to require the extensive interior cleaning provided by Alternative D3. In addition, this alternative would consider crawl spaces, attics, and basements. Contaminated crawl spaces would be capped with a sand or synthetic cover to prevent generation of dust and tracking of soil into the home. Accessible attics and basements would also be cleaned. The exact scope of this alternative will depend on the conditions of each residence. Temporary relocation of residents might be required during cleaning to protect their safety. Monitoring would also be conducted to ensure that RAOs continue to be achieved after the remedy is implemented.

5.1.1.4 Aquatic Food Sources Alternatives

5.1.1.4.1 Aquatic Food Sources Alternative F1—No Action. This alternative would take no action to address the potential human health risk to residents and Tribal members of eating contaminated fish. It would take no action to prevent exposure and provide no information or education to people likely to consume contaminated aquatic food sources. The No-Action Alternative provides a baseline from which to compare the action alternatives.

5.1.1.4.2 Aquatic Food Sources Alternative F2—Information and Intervention. In addition to the information and intervention efforts of other alternatives, this alternative would educate fishermen, water potato harvesters, and other recreational users of the potential health risk of consuming contaminated aquatic food sources from waterways and wetlands. All printed materials, press releases, and public meetings developed to inform the public of basin metals issues would include information about the fish risks, how to reduce exposure, prevention, and other pertinent issues. Aquatic food source hazard information programs would be expanded to the Coeur d'Alene Reservation communities, as appropriate, to ensure that Tribal members are kept informed. Targeted community education programs would be implemented in Benewah, Kootenai, and Shoshone Counties. A well-maintained signage program to educate fishermen, Tribal members, and other water users of metals hazards would be implemented at all river/lake access sites and common use areas, including the Coeur d'Alene River Trail system corridor. IDFG, Idaho State Parks, USFS, and BLM field personnel who regularly contact basin fishermen, Tribal members, and recreational users would be trained in metals risk management and supplied with appropriate pamphlets and signs.

5.1.1.4.3 Aquatic Food Sources Alternative F3—Information and Intervention and Monitoring. This alternative would build on the efforts of informing and educating fishermen, water potato harvesters, and other of risks from consumption of metals-contaminated aquatic food sources included under Alternative F2. An effort to gain more fish and water potato metals load data from various areas within the basin is the keystone of this alternative. The current limited fish flesh and water potato data would be expanded so that wetland- and lake-specific

recommendations and intervention can be accurately provided to the public. Surface waters, wetlands, and fish species that are totally free of metals risks would be identified and highlighted. As basin cleanup and mitigation efforts proceed, periodic resampling would provide valuable effectiveness monitoring data for biological response to cleaner waters, sediment, and upstream soils. A trained seasonal "river ranger" program would be instituted to make daily contacts with fishermen, boaters, water potato harvesters, and Tribal members to inform and educate them of metals hazards and prevention methods. Fishermen and water potato harvesters could be directed to lakes or rivers where metals risks are known to be the lowest.

5.1.2 Ecological Alternatives for the Upper Basin and Lower Basin

For development of ecological alternatives, the affected media retained are soil, sediment, and surface water. Groundwater is not a medium for direct exposure to ecological receptors; however, it is an important pathway for migration of metals from soil and sediment to surface water, and was retained as a pathway throughout the FS analysis. The COPCs retained are:

- Arsenic
- Cadmium
- Copper
- Lead
- Mercury
- Silver
- Zinc

Because of the widespread occurrence of cadmium, lead, and zinc in affected media throughout the basin, the analysis of the ecological alternatives was focused on these three metals, with arsenic also evaluated for human health exposure at waste piles and mill sites.

Six ecological alternatives, Alternatives 1 through 6, have been developed for the basin (CSM Units 1, 2, and 3). Alternative 1 is "no action," as required by the NCP (National Contingency Plan). Alternatives 2, 3, and 4 are EPA's action alternatives, which are organized in order of increasing levels of cleanup action and cost. Alternative 5 is the State alternative, as developed by IDEQ. Alternative 6 is the Mining Companies Cleanup Plan. Alternative 6 is based on interpretation of reports prepared by Steve Werner (Werner 1999) and Tom Wesche (Wesche 1999) for the mining companies. Existing infrastructure (including urbanized areas, I-90, and

other roads) and development is left in place in all alternatives. The six alternatives are listed as follows:

- Alternative 1—No Action
- Alternative 2—Contain/Stabilize with Limited Removal and Treatment
- Alternative 3—More Extensive Removal, Disposal, and Treatment
- Alternative 4—Maximum Removal, Disposal, and Treatment
- Alternative 5—State of Idaho Cleanup Plan
- Alternative 6—Mining Companies Cleanup Plan

Table 5.1-1 summarizes the quantities of source material that would be remediated under each alternative. The areas (for example, wetland and lake areas) identified for remediation under each of the alternatives could change during development of the Proposed Plan based on stockholder comments. Adding or deleting areas would not materially affect the analysis of the alternatives. The costs could change slightly, but are anticipated to remain within EPA's RI/FS guidance range of -30 to +50 percent.

The ecological alternatives are expected to be generally protective of human health where containment is used to isolate source material from human exposures. Supplementary generic actions for protection of human health at source areas (including mill sites and waste piles) are also included in the ecological alternatives. Although specific sites where these generic actions might be applied have not been identified, assumed numbers of generic actions have been used for costing purposes. Site-specific applications will be considered in the Proposed Plan and ROD.

5.1.2.1 Alternative 1—No Action

The No-Action Alternative provides a baseline from which to compare the action alternatives. Its inclusion is meant to help assure that the consequences of no action are fully evaluated so that unnecessary remedial action is not taken where no action is appropriate.

Evaluation of the No-Action Alternative, as well as the five action alternatives, includes consideration of long-term natural recovery over time due to source depletion. In particular, metal concentrations and loadings in basin streams are expected to generally decrease over time as the natural processes that transport metals from sources to surface water gradually deplete the mining-related metal sources. However, as the metals reach the streams in the basin they become a source for metal contamination of down-stream areas, including surface water, groundwater, sediments, and soils. The potential reduction of metal loadings in basin streams due to source depletion is quantitatively analyzed, as discussed in Section 1.4.3 of the FS Part 3.

5.1.2.2 Alternative 2—Contain/Stabilize with Limited Removal and Treatment

Of EPA's three action alternatives, Alternative 2 represents the lowest level of cleanup action. Actions are generally aimed at controlling sources having the highest metal loadings to groundwater and surface water and the highest levels of ecological exposure.

Limited removals and in-place and on-site waste containment and isolation are used to control ecological and human exposures and metal transport via erosion and leachate loading to groundwater and surface water. Bioengineering is used to provide bank and stream stabilization, control erosion of contaminated sediments, and support natural recovery of riverine and riparian habitat in chemically affected areas. Chemical treatment is limited to passive treatment[6] of adits that are major metals loaders of zinc to surface water and groundwater that is collected as part of hydraulic isolation[7] (limited to the Star Hecla tailings piles in Canyon Creek and the Cataldo/Mission Flats dredge spoil area). Residual risks would be associated with contaminated media left in place or only partially contained.

5.1.2.2.1 Alternative 2 Upper Basin, CSM Units 1 and 2. Principal remedial actions include the following:

- Tailings piles and impoundments—Regrading and capping in place, as practical; otherwise, removal (excavation) with disposal in on site or local repositories (to consolidate removals from adjacent or nearby sites). Hydraulic isolation used for the Star Hecla tailings impoundments in Canyon Creek

- Waste rock piles—Within the 100-year floodplain, in-place regrading and capping, as practical, or removal; no action otherwise

- Adits:

  - Major load sources—Treatment using passive, on-site technologies
  - Minor load sources—No action

[6] Passive treatment removes metals from water by passing the water through a reactive medium, such as apatite. Passive treatment is accomplished on site using treatment beds, trenches, or reactive barriers. Although apatite has been assumed for the FS, other treatment media could be used, based on the remedy selected in the ROD.
[7] Hydraulic isolation uses groundwater cutoff walls (assuming bentonite or bentonite/cement slurry construction) to control transport of metals in groundwater to surface water. Hydraulic isolation also includes collection and treatment of groundwater within the isolated area.

- Floodplain sediment—Removals of tailings-impacted deposits in the 100-year floodplain (excluding in-stream deposits) with disposal in local repositories; bank and stream stabilization using bioengineering methods

5.1.2.2.2 Alternative 2 Lower Basin, CSM Unit 3. Principal remedial actions include the following:

- River banks and levees—Partial removal of contaminated "bank wedges" with disposal in a regional repository at Cataldo/Mission Flats

- Riverbeds—No action

- Wetlands: Strobl Marsh and Thompson Marsh—Limited removals, capping and protective dikes to control potential re-contamination from flood events

- Lateral Lakes: Thompson Lake—Dredging from the shore to a water depth of approximately 6 feet with disposal in a repository adjacent to the lake

- Other floodplain areas—Soil amendments to promote vegetation for erosion control and provide chemical stabilization to reduce metal availability to ecological receptors and transport to surface water

- Cataldo/Mission Flats dredge spoil area—Hydraulic isolation (using a groundwater cutoff wall with a reactive barrier for passive in situ treatment of groundwater); surface water diversion structures, as needed; amend soils to provide a suitable growth medium combined with planting of suitable vegetation. Construction of an engineered repository for disposal of river bank, levee, and wetland removals.

5.1.2.3 Alternative 3—More Extensive Removal, Disposal and Treatment

Alternative 3 extends the cleanup level of Alternative 2 to include more extensive and effective removal, containment, and treatment options than Alternative 2**.** These include:

- Regional repositories in Canyon Creek, Ninemile Creek, and along the South Fork Coeur d'Alene River, in addition to Cataldo/Mission Flats

- A regional treatment plant for active treatment of adit discharges and collected groundwater[8]

- Areas of hydraulic isolation with groundwater collection, conveyance, and treatment at the regional treatment plant

Disposal of materials removed from the lower basin (including river banks, levees, and beds; wetlands; and lateral lakes) would be at a regional repository at Cataldo/Mission Flats, or by confined aquatic disposal (CAD) in Coeur d'Alene Lake or one or more of the lateral lakes.[9] Contaminated media left in place or only partially contained and associated residual risks would be less than Alternative 2.

5.1.2.3.1 Alternative 3 Upper Basin, CSM Units 1 and 2. Principal remedial actions include the following:

- Tailings piles—Similar to Alternative 2 but greater use of removals with disposal in on-site, local, or regional repositories; and greater use of hydraulic isolation

- Waste rock piles—Similar to Alternative 2 but with more removal and less regrading

- Adits:

  - Major Load Sources—Collection and conveyance to a regional water treatment plant.

  - Minor Load Sources—Treatment using passive, on-site technologies

- Floodplain sediment—Same as Alternative 2 plus removal of accessible tailings-impacted deposits on the channel-side of I-90, with disposal in regional repositories; bank and stream stabilization using bioengineering methods; selected

[8] Active water treatment assumes high-density sludge hydroxide precipitation with media filtration, processes that are similar to what is being used for the BHSS Central Treatment Plant. It is assumed that the regional treatment plant would be located near Pinehurst. Pipelines would be used in Canyon Creek, Ninemile Creek, and the South Fork Coeur d'Alene River to transport collected adit discharge and groundwater to the regional treatment plant. Collected groundwater from the Cataldo/Mission Flats dredge disposal area would be pumped to the regional treatment plant.

[9] Use of CAD would consolidate and isolate contaminated media already existing in the lower basin or Coeur d'Alene Lake.

areas of hydraulic isolation with collection, conveyance and treatment of groundwater to a regional water treatment plant

5.1.2.3.2 Alternative 3 Lower Basin, CSM Unit 3. Principal remedial actions include the following:

- River banks and levees—Complete removal of contaminated "bank wedges;" disposal in a regional repository at Cataldo/Mission Flats or consolidation via CAD in Coeur d'Alene Lake or one or more of the lateral lakes

- River beds—Complete removal of affected sediments; same disposal options as for river banks and levees

- Wetlands: Strobl Marsh, Campbell Marsh, Orling Slough, Hidden Marsh, Moffit Slough, Thompson Marsh, Lane Marsh, and wetland areas of Thompson, Killarney, Swan, and Medicine Lakes—Sediment removal; same disposal options as for river removals; revegetation with native plants and soil amendments

- Lateral Lakes: Thompson, Killarney, Swan, and Medicine Lakes—Dredging from the shore to water depths of approximately 6 feet; same disposal options as for river removals

- Other floodplain areas—Sediment removal; disposal in a local repository at Cataldo/Mission Flats; revegetation with native plants and soil amendments

- Cataldo/Mission Flats dredge spoil area—Same as Alternative 2 except collection and conveyance of groundwater discharge for active treatment at a regional water treatment plant

5.1.2.4 Alternative 4—Maximum Removal, Disposal and Treatment

Alternative 4 calls for the removal of sources to the maximum practicable extent with containment in regional repositories. Sources beneath developed or urbanized areas (including I-90 and other public infrastructure and commercial/industrial and residential areas) would be contained using hydraulic isolation with groundwater collection and treatment at a regional water treatment plan. Contaminated media left in place or only partially contained and associated residual risks would be minimized to the maximum extent practicable.

5.1.2.4.1 Alternative 4 Upper Basin, CSM Units 1 and 2. Principal remedial actions include the following:

- Tailings piles and impoundments—Maximum excavation and use of regional repositories

- Waste rock piles—Removal from the 100-year floodplain with disposal in regional repositories; regrading and vegetative cover otherwise

- Adits:

  - Major load sources—Same as Alternative 3, but applied to more adits
  - Minor load sources—Same as Alternative 3, but applied to more adits

- Floodplain sediment—Same as Alternative 3 but with maximum removal of tailings-impacted deposits and maximum use of hydraulic isolation with collection, conveyance, and treatment of groundwater at a regional water treatment plant[10]

5.1.2.4.2 Alternative 4 Lower Basin, CSM Unit 3. Principal remedial actions include the following:

- River banks and levees—Same as Alternative 3

- River beds—Same as Alternative 3

- Wetlands—Maximum sediment removal; revegetation with native plants and soil amendments; disposal same as for Alternative 3

- Lateral lakes—Maximum dredging; disposal same as for Alternative 3

- Other floodplain areas—Same as wetlands

- Cataldo/Mission Flats dredge spoil area—Removal and disposal in an on-site regional repository

[10] One plant located near Pinehurst as for Alternative 3

5.1.2.5 Alternative 5—State of Idaho Cleanup Plan

Alternative 5, developed by the IDEQ, focuses on containing or stabilizing the largest sources of metals loading to surface water. Alternative 5 includes measures generally similar to Alternatives 2 and 3; it includes regional repositories, but not water treatment plants. Residual risks would be associated with contaminated media that is left in place or only partially contained.

To help avoid potential misinterpretation, the State's summary of its plan (K. Johnson 2000) has been included here in its entirety with quotes identified by *italics*. *Overall, the guiding principle in the State's alternative is a balance between benefit, cost and impact to the environment in both the long term and short term. Impacts to the environment are primarily the degradation in water quality and the loss of vegetated areas caused by removals and the soil stripping required for covers and capping. In addition, the State's alternative calls for development of improved tools for treating water, reducing bioavailability of lead in soil, and managing the River and Lake system.*

5.1.2.5.1 Alternative 5 Upper Basin, CSM Units 1 and 2. Principal remedial actions for Alternative 5 would include the following (quotes from K. Johnson are *italicized*):

- Tailings piles and impoundments—Removal from the 100-year floodplain with disposal in local or regional repositories; in-place closure of existing impoundments. *All tailing ponds and piles are either removed or closed in place with low permeability covers.*

- Waste rock piles—Regrading or relocation out of the 100-year floodplain, with selected capping. *Waste rock piles were selected or eliminated for remediation after field inspection. Piles selected for relocation are located close enough to a stream to be subject to erosion, are not highly stabilized by natural processes and have data suggesting that the pile may be significantly metal bearing. Piles that are reasonably accessible to children will be capped to prevent exposure. In addition, soil caps will be placed on piles left in place if soil is locally available.*

- Adits—Discharge from selected adits would be passively treated**.** *Adits selected for water containment and treatment are those listed in the TMDL as major loaders.*

- Floodplain sediment—Selected removals from the 100-year floodplain, with capping; bioengineering and vegetative stabilization of selected stream banks and floodplains; selected use of riprap**.** *All accessible floodplain tailings are the*

subject of removal. The volumes were estimated by field observation of the presence of tailings, measurement of length of river with tailings, and estimated depths.

5.1.2.5.2 Alternative 5 Lower Basin, CSM Unit 3. Principal remedial actions for Alternative 5 would include the following (quotes from K. Johnson are *italicized*):

- River banks and levees—Partial removal and stabilization by grading and bioengineering. *The entire length of banks along the lower river will be stabilized from erosion. Removals of bank material are necessary in about half of the river banks length to provide a stable slope for bioengineering. The State's alternative calls for implementation of a river management plan to prevent unacceptable erosion of the banks.*

- River beds—Partial removal and disposal of contaminated sediments. *Removal of a portion of riverbed sediments is included to eliminate hot spots and create hydraulic capacity as needed. Considering that the source of lead into Lake Coeur d'Alene is predominately from the banks and that transport of bed sediments is predicted to happen only under extreme events, the release of metals from the river bed can be managed.*

- Wetlands and lateral lakes—Spot removals, capping and/or chemical treatments and re-vegetation to areas within or surrounding Orling Slough, Strobl Marsh, Lane Marsh (including seven splay areas), Hidden Marsh, Campbell Marsh, Thompson Marsh, Moffit Slough; Medicine Lake, Swan Lake, and Thompson Lake. *Wetlands and lakes selected for remediation are those identified by U.S. Fish and Wildlife Service as those with high lead concentrations and high use by water fowl. Initial pilot projects in Thompson Lake and Orling Slough will provide information to design activities in the remaining areas. The State's thinking on the range of designs reflects the concerns of State Fish and Game that the minimum amount of cover be used because the wetlands and lakes are already filling too rapidly and that disturbance of the submerged sediments creates long-term water quality impacts. Fish and Game would like to see an increase in water levels without dredging of sediments.*

- Other floodplain areas—Soil treatment and re-vegetation for highly contaminated areas

- Cataldo/Mission Flats dredge spoil area—Groundwater cutoff walls; spot removals, soil treatment and re-vegetation

5.1.2.6 Alternative 6—Mining Companies Cleanup Plan

Alternative 6 is based on interpretation of reports prepared by Steve Werner (Werner 1999) and Tom Wesche (Wesche 1999) for the mining companies. Alternative 6 consists of prioritized actions primarily focused on regrading or removing source materials from water courses to reduce erosion and the potential for contact with surface and groundwater that could result in leaching and surface water loading. Localized areas of bioengineered and vegetative stream bank stabilization are included. Regional repositories and water treatment plants are not included.

5.1.2.6.1 Alternative 6 Upper Basin, CSM Units 1 and 2. Principal remedial actions for Alternative 6 include the following (quotes from the Werner report are *italicized*):

- Tailings piles and impoundments—Soil cover in place
- Waste rock piles—Removal from the 100-year floodplain; no action otherwise
- Adits:
  - Major load sources—Infiltration and water level control followed by wetland treatment if necessary
  - Minor load sources—No action
- Floodplain sediment—Limited removals; bioengineering

5.1.2.6.2 Alternative 6 Lower Basin, CSM Unit 3. Principal remedial actions for Alternative 6 include the following (quotes from the Werner report are *italicized*):

- River banks and levees—Revegetation, bioengineering, and limited removals characterized as *no to limited action, moderate action*, and *aggressive actions*
- River beds—No action
- Wetlands—*Habitat shifting techniques*, and consideration of *selective in situ chemical stabilization and/or capping with bio-solid material of some of the most lead-enriched sediments*
- Lateral Lakes—Similar to wetlands

- Other floodplain areas—Similar to wetlands
- Cataldo/Mission Flats dredge spoil area—No action

The six alternatives are described and evaluated in detail in the FS Part 3.

5.1.3 Alternatives for Coeur d'Alene Lake

Two alternatives have been developed for the lake (CSM Unit 4). Alternative 1 is "no action," as required by the NCP. Alternative 2 involves implementation of the Lake Management Plan (CLCC 1996).

5.1.3.1 Alternative 1—No Action

Under Alternative 1, no actions would be taken to improve lake water quality or protect against potential future releases of metals from the contaminated lake bottom sediments. Nutrients, including nitrogen and phosphorus, affect water quality in the lake and may control the rate of release of metals from the lake bottom into the lake water. No actions would be taken to control nutrient inputs to the lake.

5.1.3.2 Alternative 2—Implement Lake Management Plan

Alternative 2 involves implementation of the Lake Management Plan (CLCC 1996) and includes institutional controls such as signage and monitoring. The Lake Management Plan divides the lake into four water quality management zones that differ from EPA's segments as described previously. Furthermore, "slow improvement in water quality" was identified as a goal in the Lake Management Plan. This was identified based on a recognition that "no action" was unacceptable because water quality standards had been exceeded and that "rapid improvement in water quality" was too expensive.

5.1.3.2.1 Nearshore Zone. Elevated phosphorus and zinc concentrations were identified as the primary water quality issues in this zone. Management goals were primarily directed toward phosphorus control because lowering zinc concentration required action to address mining-impacted areas in the Coeur d'Alene Basin, which was beyond the scope of the Lake Management Plan. Phosphorus control measures would include implementation of best management practices to control erosion from watersheds that feed the lake, including actions directed toward forest management practices, stormwater, roads, and agriculture. Nearshore domestic septic systems and municipal wastewater treatment plants would also be addressed to reduce nutrient loadings entering the lake.

5.1.3.2.2 Shallow, Southern Lake Zone. Depleted dissolved oxygen, heavy metals, sedimentation, and nutrient loading were identified as the water quality issues for this zone. Best management practices would be employed to reduce sediments entering the lake through erosion from littoral areas of the lake, riverbanks, and watersheds. Systematic mechanical harvest of aquatic plants was suggested as a means of reducing nutrient loads from lakebed sediments.

5.1.3.2.3 Lower Rivers Zone. Riverbank erosion was identified as the principal issue for this zone. The Lake Management Plan attributed erosion to three factors. First, since mine tailings impoundments became commonplace in the mid-1960s, the river has had increased sediment transport capacity, which caused it to expand laterally. Second, boat wakes contribute to bank erosion. Finally, seasonal lake level fluctuations cause soughing, due to elevated pore water pressures. The bank erosion problem would be addressed using bank stabilization techniques and establishing "no wake" zones to protect stream banks. (Note that EPA has considered this category of actions within CSM Unit 3.)

5.1.3.2.4 Deep, Open Water Zone. Improving water and sediment quality was identified as the issue for this zone. The management practices employed in the other three lake zones would also be used to improve water and sediment quality in this zone. Deep water in the lake would also benefit from actions taken to reduce erosion and nutrient loading within the basin.

The alternatives are described and evaluated in detail in Section 8 of the FS Part 3.

5.1.4 Alternatives for the Spokane River

Five remedial alternatives have been developed for CSM Unit 5, the Spokane River. These alternatives include actions for in-stream sediments and beach deposits in the upper portion of the Spokane River between the Idaho border and Upriver Dam. The Washington State Department of Ecology (Ecology) has prioritized this portion of the river based on USGS sampling results (Horowitz 1999). The five alternatives are:

- Alternative 1—No Action
- Alternative 2—Institutional Controls
- Alternative 3—Containment with Limited Removal and Disposal
- Alternative 4—More Extensive Removal, Disposal, and Containment
- Alternative 5—Maximum Removal and Disposal

Ecology is currently evaluating contaminant concentrations in sediments and beach deposits downstream from Upriver Dam. The need for additional actions (e.g. to address elevated zinc concentrations detected in Long Lake) will be considered in the future.

The alternatives include site-specific actions to address human health and environmental risks from mining-related metals. In CSM Unit 5, these risks are associated with dermal contact and ingestion of sediments containing elevated levels of metals, primarily lead, arsenic, and zinc. The overall goal of the cleanup actions in CSM Unit 5 is to reduce human and ecological exposures to the contaminated sediments. The overall cleanup approaches employed in the alternatives are described in the following paragraphs.

5.1.4.1 Alternative 1—No Action

As discussed for CSM Units 1, 2, and 3, the No-Action Alternative provides a baseline from which to compare the action alternatives. Its inclusion helps assure that the consequences of no action are fully evaluated and that instances in which no action may be appropriate are fully recognized, so that needless remediation expenses can be avoided when only marginal benefits are expected.

5.1.4.2 Alternative 2—Institutional Controls

Alternative 2 includes institutional controls to limit potential exposures to contaminated deposits and control activities that may increase the erosion potential of the contaminated deposits. No active cleanup measures would be undertaken to remediate concentrations of metals that are above the PRGs.

The health postings and advisories that are currently in place at beaches would be maintained. Although pedestrian access to the sites would not be restricted, the postings and advisories may encourage some individuals to reduce their exposures to the contaminated deposits. Vehicular access would be restricted at key locations to help reduce erosive transport of the contaminated deposits and allow vegetation to naturally re-establish. Restricting vehicular access may also allow contaminated deposits to be covered with new material that is deposited periodically during high-flow events, which may provide some risk reduction through natural capping if these new materials contain lower levels of metals than the existing deposits.

5.1.4.3 Alternative 3—Containment with Limited Removal and Disposal

Alternative 3 includes actions focused on addressing potential human health risks. Containment actions, supplemented by removals where necessary, would be used to reduce or eliminate the direct contact and ingestion human health exposure pathways. Beach material posing potential human health risks would generally be left in place and covered with a clean layer of imported beach material. In locations where habitat may be adversely affected by the grade changes created by a cover, other actions such as excavation and disposal, or excavation and on-site consolidation, would be used. In these areas, the excavated areas would be backfilled with

suitable material to restore desired grades and elevations. In-stream sediments would receive no action under Alternative 3.

5.1.4.4 Alternative 4—More Extensive Removal, Disposal, and Containment

Alternative 4 includes actions to address potential human health risks and ecological risks. Actions for beach and bank deposits would include all areas addressed under Alternative 3, as well as critical habitat areas that may pose significant ecological risks. The affected beach and bank materials would be excavated and disposed of off-site, permanently eliminating the human health and ecological exposure pathways of concern. All excavated areas would be backfilled with suitable material, to restore desired grades and elevations. In-stream sediments (behind Upriver Dam) exceeding PRGs would be capped to minimize direct ecological exposures.

5.1.4.5 Alternative 5—Maximum Removal and Disposal

Alternative 5 includes more extensive beach and in-stream sediment cleanup actions to remove, where practicable, all materials posing significant human health or ecological risks. The affected beach and bank materials would be excavated and disposed of off-site, permanently eliminating the human health and ecological exposure pathways of concern. All excavated areas would be backfilled with suitable material, to restore desired grades and elevations. In-stream sediments behind Upriver Dam that exceed PRGs would be dredged and disposed of off-site, eliminating the ecological exposures of concern.

The five alternatives are described and evaluated in detail in Section 7 of the FS Part 3.

5.2 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Once the alternatives are defined, they are evaluated in detail to determine whether they satisfy statutory and regulatory criteria. In the FS, each alternative is analyzed with regard to the following seven criteria prescribed by EPA guidance (USEPA 1988):

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Two additional criteria that are prescribed by EPA guidance are state acceptance and community acceptance. These criteria will be evaluated in the ROD after the public comment period on the RI/FS reports and the Proposed Plan.

The alternatives are first analyzed individually against the criteria, without considering the other alternatives. After the individual analysis, the alternatives are compared in relation to one another to determine their relative benefits or drawbacks, using the seven evaluation criteria listed above. The results of these comparative analyses are presented below.

5.2.1 Human Health Alternatives

For the human health alternatives, the comparative evaluations are presented in Section 6 of the FS Part 2. The results of these comparative evaluations are summarized in Tables 5.2-1 through 5.2-4, as follows:

- Table 5.2-1 summarizes the evaluation of human health soil alternatives
- Table 5.2-2 summarizes the evaluation of human health drinking water alternatives.
- Table 5.2-3 summarizes the evaluation of human health house dust alternatives.
- Table 5.2-4 summarizes the evaluation of human health aquatic food sources alternatives.

5.2.2 Ecological Alternatives

For the ecological alternatives, the comparative evaluation is presented in Sections 5.5, 6.4, 7.4, and 8.6 of the FS Part 3. The results of these comparative evaluations are summarized in Tables 5.2-5 through 5.2-7, as follows:

- Table 5.2-5 summarizes the evaluation of ecological alternatives for CSM Units 1, 2, and 3.
- Table 5.2-6 summarizes the evaluation of alternatives for CSM Unit 4.
- Table 5.2-7 summarizes the evaluation of alternatives for CSM Unit 5.

Table 5.1-1
Summary of Basin Ecological Alternatives Source Quantities Addressed by Alternative

Source Type	Units	Total Quantity	Quantity of Source Material Addressed, by Alternative				
			2	3	4	5	6
Upper Basin							
Floodplain Sediments[a]	cy	7,100,000	2,000,000	5,700,000	7,100,000	195,000	170,000
Tailings[b]	cy	11,000,000	3,800,000	8,600,000	9,300,000	2,800,000	3,500,000
Waste Rock[c]	cy	11,700,000	5,600,000	7,000,000	9,800,000	2,500,000	5,300,000
Adit Drainage[d]	#Zn/d	101	89	101	101	94	65
Lower Basin							
Riverbed Sediments[e]	cy	17,600,000	0	17,600,000	17,600,000	350,000	0
Bank Wedges[e]	cy	1,780,000	610,000	1,780,000	1,780,000	180,000	27,000
Wetland Sediments[e]	cy	5,900,000	480,000	2,000,000	5,900,000	240,000	0
Lateral Lake Sediments[e]	cy	5,900,000	67,000	570,000	5,900,000	94,000	0
Floodplain Sediments[e]	cy	10,200,000	430,000	2,300,000	10,200,000	2,300,000	0
Cataldo/Mission Flats Dredge Spoils	cy	13,600,000	10,900,000	10,900,000	10,900,000	10,900,000	25,000
Spokane River[f]							
Beach/Bank Deposits and In-Stream Sediments	cy	Not estimated	0	20,000	110,000	260,000	Not used

Table 5.1-1 (Continued)
Summary of Basin Ecological Alternatives Source Quantities Addressed by Alternative

[a]Sediment total volume does not include either less-impacted, generally-deeper and more dispersed sediments that are potential source of zinc loading or impacted materials within fills or embankments (e.g., I-90 and UPRR rights-of-way); these additional sediment volumes may be as high as approximately 20,000,000 cy.
[b]Tailings volumes include unimpounded tailings and impounded tailings in both inactive and active facilities.
[c]Waste rock volumes include waste rock in floodplains and uplands, as well as waste rock at active facilities.
[d]Data used to calculate average zinc loading are available for only 53 of 114 discharging adits in the upper basin. Although data are available for the largest loaders, the cumulative average zinc load from all discharging adits may exceed the amount shown in this table.
[e]Volumes estimates for all impacted media in the lower basin, CSM Unit 3, are based on lead concentrations exceeding 1,000 mg/kg. Additional volumes of impacted sediments that are potential sources of zinc loading are not included in these estimates.
[f]The study area for the Spokane River ecological alternatives is limited to selected sites identified by the Washington State Department of Ecology between the Washington-Idaho state line and Upriver Dam.

Notes:
This is a condensed summary with approximate quantities—for a detailed accounting of sources and remedial actions see the FS Part 3, Sections 5 and 6 and appendices as referenced therein. Quantities of source materials within the BHSS are not included in this table.
Quantities of source material potentially addressed by institutional controls (e.g., access restrictions) or bioengineering actions (e.g., floodplain/riparian zone revegetation or bank stabilization) are not included.
Alternative 1 is no action. Alternatives 2 through 6 are integrated alternatives for the Upper Basin and Lower Basin. Alternatives 2 through 5 were developed separately for the Spokane River.
cy = cubic yards
#Zn/d = pounds of zinc per day

Table 5.2-1
Comparative Evaluation of Soil Alternatives

Alternative	Overall Protectiveness	Compliance with ARARs	Long-Term Effectiveness	Reduction of Toxicity, Mobility, Volume	Short-Term Effectiveness	Implementability	Cost
Recreational Areas							
Alternative S1	⊘	⊘	⊘	⊘	⊘	●	$0
Alternative S2	◗	⊘	◗	⊘	◗	●	$243,000
Alternative S3	◗	⊘	◗	⊘	●	○	$692,000
Alternative S4	◗	◗	◗	◗	●	◗	$2,020,000
Residential Yards							
Alternative S1	⊘	⊘	⊘	⊘	⊘	●	$0
Alternative S2	○	⊘	○	⊘	○	●	$4,850,000
Alternative S4	◗	◗	◗	◗	●	◗	$43,800,000
Alternative S5	●	●	●	●	●	◗	$70,900,000
Other Areas							
Alternative S1	⊘	⊘	⊘	⊘	⊘	●	$0
Alternative S2	○	⊘	○	⊘	○	●	$312,000
Alternative S3	◗	⊘	◗	⊘	●	○	$2,210,000
Alternative S4	◗	◗	◗	◗	●	◗	$35,200,000
Alternative S5	○	●	●	●	●	◗	$52,500,000

For residential yards, Alternatives S2, S4, and S5 do not include access modifications and do include relocation, if necessary. For recreational areas, Alternative S4 includes site improvements, if necessary, and Alternative S5, complete removal, is not included.

All costs are rounded to three significant digits.

Rating system:
- ● High
- ◗ Medium
- ○ Low
- ⊘ Lowest

Alternative S1 = No Action
Alternative S2 = Information and Intervention
Alternative S3 = Information and Intervention and Access Modifications
Alternative S4 = Information and Intervention, Access Modifications, and Partial Removal and Barriers
Alternative S5 = Information and Intervention and Complete Removal

Table 5.2-2
Comparative Evaluation of Drinking Water Alternatives

Alternative	Overall Protectiveness	Compliance with ARARs	Long-Term Effectiveness	Reduction of Toxicity, Mobility, Volume	Short-Term Effectiveness	Implementability	Cost
Alternative W1 (No Action, all areas)	⊘	⊘	⊘	⊘	⊘	●	$0
Alternattive W2 (Public Information, all areas)	○	⊘	○	⊘	○	●	$428,000
Alternative W3 (Residential Treatment, all areas)	◗	◗	◗	○	●	●	$1,418,000
Alternative W4 (Public Water)[a]							
Upper Basin (inside water district)	●	●	●	⊘	◗	●	$22,000
Upper Basin (outside water district)	●	●	●	⊘	◗	○	$6,610,000
Lower Basin and Kingston (inside water district)	●	●	●	⊘	◗	◗	$592,000
Lower Basin and Kingston (outside water district)	●	●	●	⊘	◗	○	$2,760,000
Alternative W5 (Groundwater)[a]							
Upper Basin (inside water district)	●	●	◗	⊘	◗	○	$152,000
Upper Basin (outside water district)	●	●	◗	⊘	◗	○	$268,000
Lower Basin and Kingston (inside water district)	●	●	◗	⊘	◗	●	$1,245,000
Lower basin and Kingston (outside water district);	●	●	◗	⊘	◗	●	$1,245,000
Alternative W6 (Multiple Alternative Sources)	●	●	●	○	●	●	$2,210,000

[a] Does not include Public Information or 1% discount for relocation.

Rating system:
- ● High
- ◗ Medium
- ○ Low
- ⊘ Lowest

Alternative W1 = No Action
Alternative W2 = Public Information
Alternative W3 = Public Information and Residential Treatment
Alternative W4 = Public Information and Alternative Source, Public Water Utility
Alternative W5 = Public Information and Alternative Source, Groundwater
Alternative W6 = Public Information and Multiple Alternative Sources

Notes:
Upper basin (inside water district) includes Mullan, Wallace, Silverton, Woodland Park, Cornwall, Mace, Burke, Big Creek, Montgomery Gulch, and Pine Creek.
Upper basin (outside water district) includes McCarthy, Day Rock, Black Cloud, Zanettiville, Gem, Frisco, Black Bear, Yellow Dog, Sunny Slopes, Osburn, Moon Gulch, Nuckols Gulch, Terror Gulch, and Two Mile Creek.
Lower basin and Kingston (outside water district); status of areas outside lower basin water district boundaries is not known.

Table 5.2-3
Comparative Evaluation of House Dust Alternatives

Alternative	Overall Protectiveness	Compliance with ARARs	Long-Term Effectiveness	Reduction of Toxicity, Mobility, Volume	Short-Term Effectiveness	Implementability	Cost
Alternative D1	⊘	⊘	⊘	⊘	⊘	●	$0
Alternative D2	◗	●	◗	❍	❍	●	$1,380,000
Alternative D3	●	●	◗	●	◗	◗	$4,290,000

Rating system:
● High
◗ Medium
❍ Low
⊘ Lowest

Alternative D1 = No Action
Alternative D2 = Information and Intervention and Vacuum Loan Program/Dust Mats
Alternative D3 = Alt. D2 + Interior Source Removal and Capping/More Extensive Cleaning

Table 5.2-4
Comparative Evaluation of Alternatives for Aquatic Food Sources

Alternative	Overall Protectiveness	Compliance with ARARs	Long-Term Effectiveness	Reduction of Toxicity, Mobility, Volume	Short-Term Effectiveness	Implementability	Cost
Alternative F1	⊘	⊘	⊘	⊘	⊘	●	$0
Alternative F2	◗	⊘	◗	⊘	◗	◗	$230,000
Alternative F3	●	⊘	●	⊘	◗	◗	$912,000

Rating system:
● High
◗ Medium
❍ Low
⊘ Lowest

Alternative F1 = No Action
Alternative F2 = Information and Intervention
Alternative F2 = Information and Intervention and Monitoring

Table 5.2-5
Comparison of Ecological Alternatives for the Upper Basin and Lower Basin Using CERCLA Criteria

Criterion	Alternative 1 No Action	Alternative 2 Contain/Stabilize with Limited Removal and Treatment	Alternative 3 More Extensive Removal Disposal and Treatment	Alternative 4 Maximum Removal, Disposal and Treatment	Alternative 5 State of Idaho Cleanup Plan	Alternative 6 Mining Companies Cleanup Plan
Overall Protection of Human Health and the Environment	⊘ - Not protective	◗ - Intermediate level of long-term effectiveness and time to achieve RAOs, including ARARs. Significant potential short-term impacts and implementability problems.	● - Slightly lower long-term effectiveness and slightly longer time to achieve RAOs, including ARARs, compared to Alternative 4 outweighed by lesser short-term impacts and greater implementability.	● - Slightly greater long-term effectiveness and slightly shorter time to achieve RAOs, including ARARs, compared to Alternative 3 outweighed by greater short-term impacts and reduced implementability.	❍ - More protective than Alternative 6, particularly in the Lower Basin, but less protective than Alternative 2. Lower protectiveness relative to Alternative 2 balanced by fewer short-term impacts and implementability concerns.	❍ - Least protective of action alternatives.
Compliance with ARARs	⊘ - Would not comply with ARARs within a reasonable timeframe	◗ - Intermediate time to achieve ARARs compliance. Estimated time to achieve compliance 150% longer than Alternative 4.	● - Second shortest time to achieve ARARs compliance. Estimated time to achieve compliance 30% longer than Alternative 4.	● - Shortest time to achieve ARARs compliance.	❍ - Second longest time to achieve ARARs compliance. Estimated time to achieve compliance 170% longer than Alternative 4.	❍ - Longest time to achieve ARARs compliance among action alternatives. Estimated time to achieve compliance 180% longer than Alternative 4.
Long-Term Effectiveness and Permanence	N/E - Alternative does not meet the threshold criteria	❍ - Residual risk includes moderate potential for future erosion of impacted bed and bank sediments in Lower Basin and loading from sediments in Upper Basin. Most wetlands unremediated. Estimated reduction of dissolved metals load of 26% at completion of remedy implementation. Passive water treatment used, which is less reliable than active treatment. Effectiveness of soil treatment in Lower Basin is uncertain.	◗ - Substantially greater long-term effectiveness than Alternatives 2 and 5, due to more extensive actions to control metals loads from sediments and river beds. Estimated reduction of dissolved metals load of 57% at completion of remedy implementation. Hydraulic isolation used to limit loading from inaccessible sediments in Upper Basin, which may be less reliable than removals. Residual risk includes unremediated wetlands. Active water treatment used, which is more reliable than passive treatment.	● - Fewest residual risks. Greatest long-term effectiveness and permanence as a result of most widespread use of removal and disposal. Estimated reduction of dissolved metals load of 64% at completion of remedy implementation. Most extension remediation of wetlands.	❍ - Residual risks result from limited actions to address sediments and associated dissolved metals loads in Upper Basin. Generally similar level of long-term effectiveness in Lower Basin as Alternative 2. Estimated reduction of dissolved metals load of 12% at completion of remedy implementation. Passive water treatment used, which is less reliable than active treatment. Effectiveness of soil treatment in Lower Basin is uncertain.	❍ - Highest residual risks among action alternatives, resulting from fewest actions to address sediments in Upper Basin and contaminated banks, beds, and wetlands in Lower Basin. Estimated reduction of dissolved metals load of 9% at completion of remedy implementation. Relies primarily on institutional controls to reduce waterfowl exposure to metals. Uses passive water treatment, which is less reliable than active treatment.
Reduction of Toxicity, Mobility, or Volume through Treatment	N/E	◗ - Drainage from major adits using passive treatment; no groundwater treatment. Total reduction through treatment similar to Alternative 5.	● - Maximum reduction of water toxicity through treatment of adit drainage, groundwater, and surface water.	● - Maximum reduction of water toxicity through treatment of adit drainage and groundwater.	◗ - Drainage from major adits using passive treatment; no groundwater treatment. Total reduction through treatment similar to Alternative 2.	❍ - Wetlands treatment of drainage from four adits. Least reduction of toxicity through treatment of action alternatives.
Short-Term Effectiveness - Short-term impacts to community and environment	N/E	◗ - Intermediate level of potential short-term water quality impacts. Moderate potential for short-term habitat loss. Greater potential risks to community from increased truck traffic and dust generated by remedial activities than Alternatives 5 and 6.	❍ - Substantial potential for short-term water quality impacts, especially from riverbed dredging, and for short-term loss of habitat. Second greatest potential risks to community from increased truck traffic and dust generated by remedial activities among alternatives.	⊘ - Greatest potential for short-term water quality impacts and short-term loss of habitat . Greatest potential risks to community from increased truck traffic and dust generated by remedial activities among alternatives.	◗ - Relatively little potential for short-term water quality impacts. Moderate potential for short-term habitat loss. Relatively few risks to the community from remedy implementation.	● - Relatively little potential for short-term water quality impacts or habitat loss. Relatively small risks to the community from remedy implementation.
- Time to achieve RAOS		❍ - Longer implementation period than Alternative 5, but shorter period of natural recovery would be needed to achieve surface water RAOs.	◗ - Relatively long implementation period, but soil/sediment RAOs would be achieved at most locations, and a relatively short period of natural recovery would be needed to achieve surface water RAOs.	◗ - Longest implementation period, but soil/sediment RAOs would be achieved at the largest number of locations, and the shortest period of natural recovery would be needed to achieve surface water RAOs.	❍ - Relatively short implementation period, but soil/sediment RAOs would be achieved at a limited number of locations, and a long natural recovery period would be needed to achieve surface water RAOs.	❍ - Relatively short implementation period, but soil/sediment RAOs would be achieved at relatively few locations, and the longest natural recovery period would be needed to achieve surface water RAOs.
Implementability	N/E	◗ - Potential concerns with availability of topsoil (or other growth media) and clean fill needed for revegetation of removal areas and repositories. Siting/permitting of repositories with 2.5 million cy capacity may be feasible. Potential problems with feasibility of sediment removals.	❍ - Limited availability of topsoil (or other growth media) and clean fill needed for revegetation of removal areas and repositories. Substantial siting/permitting problems associated with 26 million cy of repository capacity. Potential problems with feasibility of sediment removals and hydraulic isolation.	⊘ - Greatest implementability problems related to availability of materials, technical feasibility, and siting/permitting of repositories with 67 million cy of capacity.	● - Relatively small materials requirements, siting/permitting of repositories with 1.4 million cy capacity should be feasible.	● - Least materials requirements, siting/permitting of repositories with 260,000 cy capacity should be feasible.
Cost	N/E	Total present worth cost = $370,000,000 Present worth O&M cost = $44,000,000	Total present worth cost = $1,300,000,000 Present worth O&M cost = $133,000,000	Total present worth cost = $2,600,000,000 Present worth O&M cost = $200,000,000	Total present worth cost = $257,000,000 Present worth O&M cost = $25,000,000	Total present worth cost = $194,000,000 Present worth O&M cost = $21,000,000
State/Tribal Acceptance	To be completed following receipt of state and tribe comments on FS and proposed plan					
Community Acceptance	To be completed following receipt of public comments on FS and proposed plan					

N/E – Not Evaluated – Alternatives 1 and 2 do not meet the requirements of the threshold criteria

Rating System:
● High
◗ Medium
❍ Low
⊘ Lowest

Table 5.2-6
Summary of Comparative Analysis of Alternatives for CSM Unit 4, Coeur d'Alene Lake

Criterion	Alternatives	
	1 No Action	2 Implement Lake Management Plan
Overall protection of human health and the environment	⊘	●
Compliance with ARARs	⊘	●
Long-term effectiveness and permanence	⊘	●
Reduction of toxicity, mobility, or volume through treatment - Surface water - Sediment	 ⊘ ❍	 ● ❍
Short-term effectiveness - Protection of community, workers, environmental impacts - Time to achieve RAOs	 ● O	 ● ❍
Implementability	●	⊘
Cost	$0	$8,800,000

Rating System:

● High
◗ Medium
❍ Low
⊘ Lowest

Table 5.2-7
Summary of Comparative Analysis of Alternatives—CSM Unit 5, Spokane River

Criterion	1 No Action	2 Institutional Controls	3 Containment with Limited Removal and Disposal	4 More Extensive Removal, Disposal, and Containment	5 Maximum Removal and Disposal
Overall Protection of Human Health and the Environment	⊘	⊘	◗	◗	●
Compliance with ARARs	⊘	⊘	◗	●	●
Long-Term Effectiveness and Permanence	N/E	N/E	❍	◗	●
Reduction of Toxicity, Mobility, or Volume through Treatment	N/E	N/E	◗	◗	◗
Short-Term Effectiveness - Protection of community, workers, environmental impacts - Time to achieve RAOs	N/E	N/E	 ● ❍	 ◗ ◗	 ❍ ●
Implementability	N/E	N/E	●	●	◗
Cost (Total Present Worth)	$0	$900,000	$1,800,000	$6,500,000	$28,000,000

N/E – Not Evaluated – Alternatives 1 and 2 do not meet the requirements of the threshold criteria

Rating System:
● High
◗ Medium
❍ Low
⊘ Lowest