Interim
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River

Bunker Hill Mining and Metallurgical Complex Superfund Site

EPA
United States
Environmental Protection
Agency Region 10

August 2012

Part 1
Declaration

Part 1—Declaration

1.0 Site Name and Location

The Bunker Hill Mining and Metallurgical Complex Superfund Site ("the Bunker Hill Superfund Site", or "the Site") is located primarily in northern Idaho. The Site includes mining-contaminated areas in the Coeur d'Alene River corridor, adjacent floodplains, downstream water bodies,[1] tributaries, and fill areas, as well as the 21-square-mile Bunker Hill "Box" where historical ore-processing and smelting operations occurred. The Site was listed on the National Priorities List (NPL) in 1983 and, under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), is assigned CERCLIS identification number IDD048340921.

The U.S. Environmental Protection Agency (EPA) has divided the Bunker Hill Superfund Site into three Operable Units (OUs):

- OU 1 includes the populated areas of the Bunker Hill Box.
- OU 2 comprises the non-populated areas of the Bunker Hill Box.
- OU 3 includes all areas of the Coeur d'Alene Basin outside the Bunker Hill Box where mining-related contamination is located. OU 3 extends from the Idaho-Montana border into the State of Washington and contains floodplains, populated areas, lakes, rivers, and tributaries. OU 3 includes areas surrounding and including the South Fork of the Coeur d'Alene River (SFCDR) and its tributaries, and areas surrounding and including the main stem of the Coeur d'Alene River down to the depositional areas of the Spokane River, which flows from Coeur d'Alene Lake into Washington State.[2]

This Interim Record of Decision (ROD) Amendment is focused on the Upper Basin of the Coeur d'Alene River, which is the main area of historical mining and industrial activities and the primary source of downstream metals contamination. The Upper Basin is mostly located in Shoshone County, Idaho, and contains OUs 1 and 2 (the Bunker Hill Box) and the eastern portion of OU 3 (Figure 1-1). The 300-square-mile Upper Basin includes areas of mining-related contamination along the SFCDR and its tributaries downstream to the confluence of the South and North Forks of the Coeur d'Alene River. The Selected Remedy for the Upper Basin is an interim remedy that includes actions within the Upper Basin and extending downstream one mile to the west to include the town of Kingston. The Selected Remedy includes remedial actions in portions of OU 1, OU 2, and OU 3.

RODs were issued for OU 1 in 1991, OU 2 in 1992, and OU 3 in 2002. This Upper Basin ROD Amendment amends portions of all three RODs (see Section 4.0 of the Decision Summary in Part 2 of this ROD Amendment). The 2002 ROD for OU 3 also selected limited actions in the Lower Basin. Those actions are not being amended by this ROD Amendment. Work in the

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[1] Downstream water bodies extend to portions of the Spokane River, located in eastern Washington.

[2] Note that the river corridor portions of the SFCDR and Pine Creek located within the Bunker Hill Box are considered to be part of OU 3.

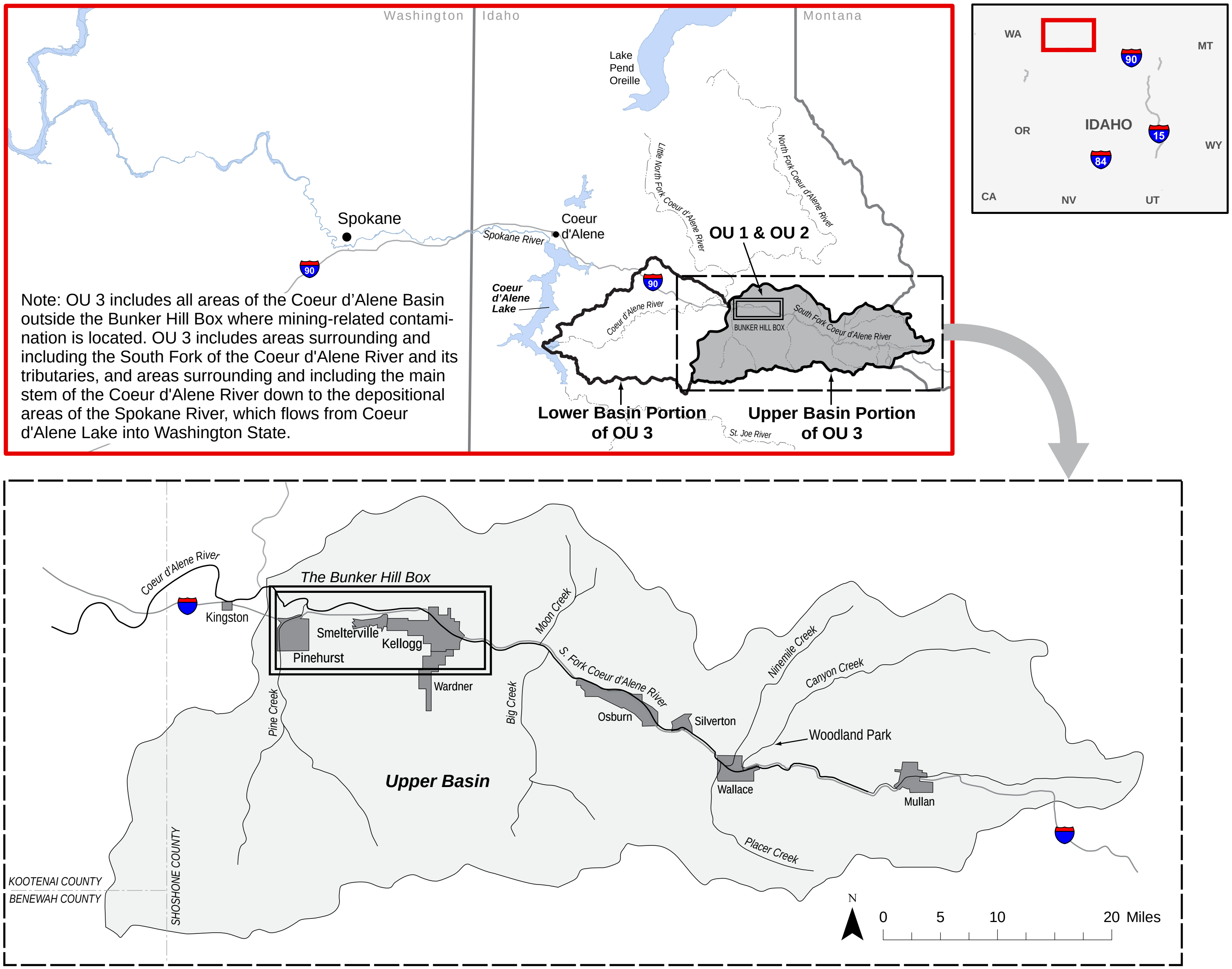
Lower Basin continues with additional characterization and refinement of the conceptual site model and will likely include pilot projects. EPA continues to pursue data collection and analysis efforts in the Lower Basin to support the future development and evaluation of remedial alternatives. After these studies have been completed, EPA expects to select additional cleanup actions, subject to public comment, to address contamination issues in the Lower Basin. Although the Lower Basin is not included in the Selected Remedy documented in this ROD Amendment, actions in the Upper Basin are expected to improve water quality and reduce the movement of contaminated sediments downstream in the Lower Basin. Thus, the Upper Basin cleanup is expected to complement cleanup activities in the Lower Basin by reducing the flow of contaminated materials and minimizing the potential for recontamination from the Upper Basin to the Lower Basin.

It should be noted that sites contaminated as the result of historical mining practices and located along the North Fork of the Coeur d'Alene River and its tributaries are being addressed under CERCLA and other authorities by other (non-EPA) agencies, primarily the U.S. Forest Service and the Idaho Department of Environmental Quality (IDEQ).

Because hazardous substances released upstream have flowed downstream and come to be located in Coeur d'Alene Lake, the Lake is part of the Bunker Hill Superfund Site, and specifically part of OU 3. However, a remedy for lake bed contamination has been deferred contingent on successful contaminant management through the State/Tribal Lake Management Plan (LMP).[3] The LMP's goal is to manage metals in contaminated lake bed sediments through a nutrient management plan as well as outreach and education with property owners related to the potential impacts of contaminated sediments on water quality in the Lake. The LMP has been written and adopted by the State of Idaho and the Coeur d'Alene Tribe, but its implementation is in the initial phase. Continued water quality monitoring, especially with the implementation of remedial actions described in this Upper Basin ROD Amendment, will provide EPA, the State, and the Tribe with data to demonstrate the effectiveness of the LMP. EPA may re-evaluate its deferral of a remedy selection for the Lake considering these data and other relevant information. Although the Lake is outside the scope of this Upper Basin ROD Amendment, EPA continues to recognize the importance of protecting Coeur d'Alene Lake and, as such, is committed to working with interested parties to clarify metrics for determining the effectiveness and sufficiency of the LMP. EPA anticipates that these metrics for the LMP will be more fully defined in the context of assessing the overall protectiveness of selected remedies at the Bunker Hill Superfund Site as part of the next CERCLA-required Five-Year Review scheduled for 2015.

[3] Coeur d'Alene Lake is being managed by state, Tribal, federal, and local governments outside the Superfund process through revision and implementation of the *Coeur d'Alene Lake Management Plan* (Idaho Department of Environmental Quality [IDEQ] and Coeur d'Alene Tribe, 2009).

Vicinity Map of Coeur d'Alene Basin



OU = Operable Unit

Note:
The river corridor portions of the South Fork of the Coeur d'Alene River and Pine Creek located within the Bunker Hill Box are considered to be part of OU 3.

Figure 1-1
Location Map
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA

2.0 Statement of Basis and Purpose

This decision document selects an interim remedy for the Upper Basin. As described in Section 4.0 of this Declaration, the Selected Remedy is an interim remedy that will be finalized in the future as additional knowledge is gained about conditions at specific locations within the Upper Basin and the effectiveness of remedial actions. .

The Selected Remedy for the Upper Basin builds upon the remedies identified in the previous RODs for OUs 1, 2, and 3 and incorporates additional information obtained since the ROD for OU 3 was issued in 2002. Remedy implementation at the three OUs has included continued studies, information gathering, monitoring, and assessment of the performance of remedial actions, all of which have provided a greater understanding of conditions and risks in the Upper Basin. The resulting information indicates that it is necessary to augment the established remedies to ensure continued protection of human health and the environment in the Upper Basin and to minimize the transport of contaminated sediments from the Upper Basin to the Lower Basin. The Selected Remedy includes actions that update, modify, and add to the previous cleanup actions for the Upper Basin described in the RODs for OUs 1, 2, and 3 and related decision documents. Amending the previously selected remedies also provides the opportunity to address recommendations made by the National Academy of Sciences (NAS) in 2005.[4] Actions selected in the previous RODs are not modified and continue to be required by those RODs unless expressly modified in Section 4.0 of the Decision Summary in Part 2 of this ROD Amendment.

This ROD Amendment documents the Selected Remedy for surface water, soil, sediments, and groundwater in the Upper Basin. The Selected Remedy also includes actions to protect portions of the human health remedies selected in previous RODs that have already been implemented. An adaptive management process and implementation approach will be a key component in implementing the Selected Remedy. In accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (known as the NCP), including 40 *Code of Federal Regulations* (CFR) 300.430(b)(7), EPA consulted with the States of Idaho and Washington, the Coeur d'Alene and Spokane Tribes, and federal Natural Resource Trustees during development of the Selected Remedy for the Upper Basin, and sought their concurrence or support for remedial actions selected within their respective jurisdictions. Letters of support and concurrence submitted by these entities are included in this ROD Amendment following this Declaration. EPA also worked extensively with the Coeur d'Alene Basin Environmental Improvement Project Commission ('the Basin Commission") and other community partners to develop the Selected Remedy. The Selected Remedy was developed in accordance with CERCLA, the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the NCP. The decision is based on the Administrative Record supporting the Upper Basin ROD Amendment, which

[4] NAS, National Research Council of the National Academies, 2005. *Report—Superfund and Mining Megasites— Lessons from the Coeur d'Alene River Basin*. The National Academies Press, Washington, D.C.

incorporates by reference all Administrative Records developed for the Bunker Hill Superfund Site.

3.0 Assessment of the Site

The remedial actions selected in this ROD Amendment are necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such releases or threats of releases may present an imminent and substantial endangerment to public health, welfare, or the environment. As stated previously, the Selected Remedy documented in this ROD Amendment is an interim remedy. A final remedy will be selected in the future as additional knowledge is gained about conditions at specific locations within the Upper Basin and the effectiveness of remedial actions over time.

4.0 Description of the Selected Remedy

Within its scope as an interim remedy, the Selected Remedy will protect human health and the environment, and includes the following:

- Remedial actions to protect human health and the environment in the Upper Basin, and
- Remedy protection actions to protect the existing Selected Remedies focusing on human health that are potentially vulnerable to erosion and recontamination from stormwater runoff, tributary flooding, and high-precipitation events in the Upper Basin.

In response to comments on the Proposed Plan, EPA has reduced the scope of the Selected Remedy and is not including all of the remedial actions that were identified in its Preferred Alternative in the Proposed Plan. Therefore, the Selected Remedy is not expected to fully address surface water contamination at all locations in the Upper Basin, and thus is an interim remedy for the Upper Basin. The Selected Remedy is also not intended to fully address groundwater contamination. However, the remedial actions included in the Selected Remedy are expected to result in the achievement of cleanup levels for soil and sediments where actions are taken. The Selected Remedy will address the most significant sources of contamination in the Upper Basin and will significantly contribute to meeting remedial action objectives, thus supporting a final protective remedy for the Upper Basin.

Implementation of the Selected Remedy for the Upper Basin will present unique challenges given the nature and extent of the metals contamination in the Upper Basin, the number of remedial actions needed, and the size and complexity of the area. For these reasons, adaptive management will be a critical component of prioritizing and implementing the Selected Remedy actions because it is not possible for physical, biological, and chemical conditions to be fully defined for this large and complex area. An adaptive management framework provides a methodology to carry out the Selected Remedy in a structured, iterative way. Through the adaptive management process, adjustments to remedial actions will be made as needed to maintain efficient progress towards meeting remedial action objectives (RAOs).

EPA will continue to work with the Upper Basin Project Focus Team (PFT), which was instrumental in developing the actions selected in this ROD Amendment. The PFT is a subgroup of the Basin Commission primarily composed of representatives from EPA, the

State of Idaho, Shoshone and Kootenai Counties, the U.S. Department of the Interior Bureau of Land Management, the U.S. Fish and Wildlife Service, the U.S. Forest Service, the Coeur d'Alene and Spokane Tribes, the State of Washington, and interested citizens. The Basin Commission includes federal, state, Tribal, and local governmental involvement. EPA anticipates working as a member of this commission for implementation of the Selected Remedy and development of the priorities and sequencing of cleanup activities.

Land management agencies may elect to implement cleanup actions on properties within their respective management jurisdictions toward achieving the overall goals of the Selected Remedy. During development of the Selected Remedy, EPA worked with the federal Natural Resource Trustees as required by the NCP (40 CFR 300.430(b)(7)) and will continue to work with the Trustees during implementation of the remedy.

4.1 Scope and Role of the Selected Remedy

Geographic Scope. The SFCDR Watershed occupies about 300 square miles of land surface in the Panhandle of northern Idaho, including 45 river miles along the SFCDR. As noted previously, the Upper Basin geographic area addressed by the Selected Remedy includes areas of mining-related contamination along the SFCDR and its tributaries downstream to one mile west of where the South and North Forks of the Coeur d'Alene River merge, to include the town of Kingston. The Upper Basin is mostly located in Shoshone County, Idaho, and contains OUs 1 and 2 (the Bunker Hill Box) and the eastern upstream portion of OU 3. The Lower Coeur d'Alene Basin, Coeur d'Alene Lake, Spokane River, and other areas within the broader Coeur d'Alene Basin are not within the geographic scope of the Selected Remedy.

Technical Scope. The technical scope of the Selected Remedy is focused on remedial actions that are expected to reduce risks to human health and the environment present in the Upper Basin as a result of historical mining-related contamination. The Selected Remedy addresses contaminant sources (such as mine tailings, waste rock, adit drainage, and contaminated floodplain sediments), surface water quality in the SFCDR and its tributaries, and existing human health remedies that could be vulnerable to the erosion and recontamination of existing clean barriers installed within Upper Basin communities.

The Selected Remedy is expected to result in significant improvements to surface water quality in the Upper Basin and may achieve ambient water quality criteria (AWQC)[5] applicable and relevant or appropriate requirements (ARARs) under the Clean Water Act at many locations; however, it may not achieve these AWQC ARARs at all locations. The Selected Remedy is also expected to greatly reduce both groundwater contamination levels and the contribution of contaminated groundwater to surface water. However, given the pervasive nature of the subsurface contamination, the Selected Remedy is not expected to achieve the groundwater ARARs under the Safe Drinking Water Act at all locations. EPA will evaluate future monitoring data to determine whether additional actions are needed or

[5] The AWQC that apply to the Selected Remedy are a combination of State of Idaho AWQC and site-specific AWQC developed by the State of Idaho for the SFCDR Watershed. For a contaminant of concern (COC) for which a site-specific AWQC exists, the site-specific AWQC is the ARAR. For some COCs, site-specific AWQC were not developed and, in these cases, the AWQC used are the State of Idaho AWQC. The site-specific AWQC were proposed by the State of Idaho and approved by EPA as protective of ecological receptors in the SFCDR.

would be effective in meeting drinking water standards and AWQC. If further actions would not be effective, EPA may evaluate whether a Technical Impracticability (TI) waiver is warranted at specific locations where groundwater and surface water do not achieve drinking water standards and AWQC, respectively.[6]

The actions included in the Selected Remedy will result in the achievement of cleanup levels for soil and sediments where actions are taken.

The Selected Remedy does not include SFCDR and Pine Creek flood control. However, EPA has committed to work with local, state, and federal entities with an interest in SFCDR and Pine Creek flooding issues to help develop solutions. EPA can and will contribute to certain work to understand SFCDR and Pine Creek flooding issues and may select actions, consistent with EPA's authority, that complement broader flood control measures.

The Selected Remedy also does not address contaminated materials beneath paved and unpaved roadways. Because roadways serve as barriers to underlying contamination, EPA and IDEQ are developing an approach under the RODs for OUs 1, 2 and 3 to address this issue collaboratively with local, county, and state entities responsible for providing and maintaining roadways in their communities.

Role of the Selected Remedy within the Overall Site Cleanup Plan. The Selected Remedy is consistent with the overall cleanup strategy for the Bunker Hill Superfund Site. The Selected Remedy is designed to provide significant improvements to soil, sediments, surface water, and groundwater, and to greatly reduce the risks posed to human health and the environment within the Upper Basin. The Selected Remedy represents another essential step in the cleanup of historical mining-related contamination in the broader Bunker Hill Superfund Site.

Although the Lower Basin is not included in the Selected Remedy, actions in the Upper Basin are expected to improve water quality and reduce the movement of contaminated sediments downstream in the Lower Basin. Thus, the Upper Basin cleanup is expected to complement cleanup activities in the Lower Basin by reducing the flow of contaminated materials and minimizing the potential for recontamination from the Upper Basin to the Lower Basin. EPA continues to pursue data collection and analysis efforts in the Lower Basin to support the future development and evaluation of remedial alternatives.

4.2 Remedial Actions

This decision document selects an interim remedy for the Upper Basin. Actions selected in the previous RODs are not modified and continue to be required by those RODs unless expressly modified in Section 4.0 of the Decision Summary in Part 2 of this ROD Amendment. The Selected Remedy includes remedial actions within the Bunker Hill Box and elsewhere along the SFCDR and its primary tributaries. The Selected Remedy defines OU 2 Phase II cleanup actions[7] to address ongoing water quality issues. The Selected

[6] Specific ARARs can be waived if appropriately justified [40 CFR 300.430(f)(1)(ii)(C)].

[7] The OU 2 ROD (EPA, 1992) identified source control actions (referred to in this document as Phase I cleanup actions) for OU 2. This ROD Amendment identifies the Phase II cleanup actions for OU 2, which focus on groundwater collection and treatment.

Remedy replaces the Upper Basin portion of the interim ecological actions selected in the 2002 ROD for OU 3 with a subset of remedial actions from Alternative 3+, as described in this ROD Amendment. As described in more detail in Section 4.0 of the Decision Summary in Part 2, the Selected Remedy does not replace the human health remedy selected in the 2002 ROD for OU 3, nor does it replace previously selected remedial actions for the Lower Basin.

Major components of the remedial actions **within the Bunker Hill Box** (OU 1 and OU 2) are:

- Actions to reduce the flow of contaminated groundwater entering the SFCDR and Government Creek;
- Conveyance of effluent from the Central Treatment Plant (CTP) in Kellogg (i.e., clean, treated water) directly to the SFCDR in a pipeline to prevent recontamination through contact with contaminated subsurface Box soil;
- Collection and treatment of groundwater and water management actions to reduce the flow of contaminated discharges near the Reed and Russell Adits;
- Expansion and upgrade of the CTP to provide treatment of collected water from OU 2, consistently achieve discharge requirements, allow for operation in high-density sludge mode, and reduce the volume of waste sludge generated; and
- Continued implementation of the Institutional Controls Program (ICP, administered by the Panhandle Health District)[8] for protection of human health.

Major components of the remedial actions in the Upper Basin **outside the Box** (in the eastern portion of OU 3) are:

- Extensive excavation and consolidation of waste rock, tailings, and floodplain sediments;
- Capping, regrading, and revegetation of tailings and waste rock areas;
- Collection and treatment of contaminated adjust it discharges, seeps, and groundwater;
- Stream and riparian stabilization actions in watersheds where sediment removal actions are implemented;
- Additional expansions and upgrades of the CTP to provide treatment of collected water from OU 3, consistently achieve discharge requirements, allow for operation in high-density sludge mode, and reduce the volume of waste sludge generated; and
- Continued implementation of the ICP (administered by the Panhandle Health District) for protection of human health.

[8] Idaho Administrative Procedures Act (IDAPA) 41.01.01, Rules of Panhandle Health District 1, is the promulgated rule establishing the ICP. It describes the Panhandle Health District's authority and the ICP's scope and intent.

Key benefits of these remedial actions are expected to include:

- Greater protection of human health and the environment by reducing the risk of exposure through direct contact with contaminated soil and sediments and potential contact with contaminated surface water;
- Significant reduction of the transport of dissolved metals into the Coeur d'Alene River system from the Upper Basin; and
- As the result of cleanup actions at upstream contaminant source areas, the downstream transport of metals-containing sediments will be reduced. This will reduce downstream exposures and minimize the potential for recontamination.
- Implementation of the Selected Remedy is also expected to improve socio-economic conditions in the Upper Basin. These additional benefits are expected to include the following:
- The elements of the remedy focusing on water quality improvements and the subsequent increase in fish populations and diversity will not only improve environmental conditions, but will also expand the recreational use of rivers and streams in the Coeur d'Alene Basin.
- Stabilization of the riverbanks at locations where floodplain and sediment removal actions are conducted will slow erosion and improve the riparian corridor for greater recreational use.
- Cleanup of accessible abandoned mine sites will allow redevelopment of these properties and increase future tax revenues.
- Significant spending will continue on the cleanup actions in the Upper Basin. EPA encourages the hiring of local businesses and workforce for the cleanup work. The relatively long duration of the work should encourage investment in training and development of the local labor force to establish the necessary skills and expertise that can benefit workers and contractors for many years. This should result in growth of the tax base for local economic benefit. The work should also provide opportunities for local supply contractors. Additionally, remediation dollars spent in the Silver Valley are expected to create other opportunities for local businesses, such as new redevelopment possibilities and tourism.

The Selected Remedy includes significant excavation and consolidation of non-Principal-Threat-Waste[9] contaminated materials in either engineered repositories or local waste consolidation areas.[10] Repositories will be large, centrally located areas within the Upper

[9] Includes all wastes not defined as Principal Threat Wastes (PTWs) per the definition provided in Section 11.0 of the Decision Summary in Part 2 of this ROD Amendment.

[10] Waste consolidation areas will serve for consolidation or placement of wastes from specifically identified sources such as mine and mill site remedial actions. The local waste consolidation areas will be located adjacent to or near the waste source areas, which will generally necessitate that they are sited high in the side drainages, away from the SFCDR valley. The local waste consolidation areas will be designed to reliably contain waste materials, prevent releases of contaminants to the air, surface water, and groundwater, and be compliant with ARARs.

Basin where contaminated soil excavated during cleanup actions is transported to, managed, and secured. Repositories constructed under the Selected Remedy will be engineered and constructed to reliably contain waste materials, and will prevent contaminants from being released to surface water, groundwater, or air in concentrations above state and/or federal standards. Waste consolidation areas will be located within tributary watersheds (e.g., Ninemile and Canyon Creeks) at locations where significant volumes of waste are present from historical mine and mill site operations.

EPA, IDEQ, and the Basin Commission have been working and will continue to work together with the local community to identify locations for new repositories in the Upper Basin.

4.3 Remedy Protection Actions

The Selected Remedy includes stormwater control actions to protect the existing human health remedies for OUs 1 and 2 (within the Bunker Hill Box) and the Upper Basin portion of OU 3 against stormwater runoff, tributary flooding, and heavy rain and snowfall. EPA has selected remedy protection actions to reduce the potential for erosion and recontamination of existing clean barriers installed within community areas in the Upper Basin. Major components of the remedy protection actions include:

- Specific remedy protection actions, such as culvert replacements, channel improvements, small diversion structures, and asphalt ditches, identified in the eight primary Upper Basin communities (Pinehurst, Smelterville, Kellogg, Wardner, Osburn, Silverton, Wallace, and Mullan) (see Figure 1-1), and
- Identification of generalized remedy protection actions that are expected to be needed in Upper Basin side gulches.[11]

Key benefits of these remedy protection actions will include:

- Greater long-term protection of human health and the environment in community areas in the Upper Basin, achieved through improvements to existing water conveyance systems (i.e., culvert replacements, asphalt ditches, etc.), and
- A proactive approach to addressing recontamination issues associated with the potential erosion and/or recontamination of existing clean barriers. This is preferred over cleaning up contaminated areas following a storm event because it decreases risks of exposure to contaminated materials.

[11] Side gulches are defined as tributaries of the SFCDR where lower densities of residential populations reside in the Upper Basin and, therefore, fewer of the existing Selected Remedies have been implemented. Section 9.0 of the FFS Report (EPA, 2012) provides a list of the Upper Basin side gulches. Detailed remedy protection projects were not identified for the side gulches because less information is currently available about the side gulch drainage areas. Selection of site-specific remedy protection actions for the side gulches will be accomplished through future Explanations of Significant Differences (ESDs) or other decision documents.

4.4 Principal Threat Wastes

Principal Threat Wastes (PTWs) are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur.[12] The concentrations used to define PTWs in the RODs for OU 2 (EPA, 1992) and OU 3 (EPA, 2002), summarized in Section 11.0 of the Decision Summary in Part 2 of this ROD Amendment, will continue to be used to help delineate PTWs for the Upper Basin.

The 1996 ROD Amendment for OU 2 (EPA, 1996) required that all PTWs from OU 2 be placed in a high-density polyethylene (HDPE) bottom-lined and three-ply copolymer top-lined monocell located in the Smelter Closure Area. Complete containment was selected, rather than treatment, for non-mercury-contaminated PTWs in the 1996 ROD Amendment because containment was significantly (90 percent) less costly than treatment via cement stabilization (the treatment method identified in the 1992 ROD for OU 2); complied with all ARARs; and provided long-term protectiveness and overall protection of human health and the environment. In addition to substantial cost savings, containment was noted to have other advantages over treatment including faster implementation, fewer onsite worker exposures, and preservation of reprocessing potential for the contained materials as technology develops. Mercury-contaminated PTWs were required to be subjected to cement-based stabilization, as previously required in the 1992 ROD, prior to being contained with the non-mercury-contaminated PTWs.

A review of these PTW definitions and the methods chosen to address them indicates that they are still relevant for use in this ROD Amendment. Non-smelter areas addressed since the 2002 ROD for OU 3 have generally been found to be contaminated with large volumes of materials with much lower levels of contaminants of concern (COCs) that pose low-level long-term threats and for which engineering controls such as containment have been protective. For the non-smelter areas addressed by this ROD Amendment, no soil or sediments have been found to contain COCs at PTW levels, and it is not expected that additional PTWs will be encountered when Upper Basin remedial actions are conducted. This is because the smelting and associated processes located in the Bunker Hill Box were designed to concentrate the metals coming from the Upper Basin mills, creating high-concentration wastes. (Smelting activities were not conducted in the Upper Basin outside the Bunker Hill Box.) Tailings from the mills, on the other hand, were less concentrated.

However, if mining concentrates or other materials that meet the site-specific definition of PTWs are encountered during remedy implementation, these materials will be remediated in accordance with the remedies for PTWs selected in earlier RODs, including treatment of mercury PTWs prior to containment. If EPA determines that stabilization and placement of mercury PTWs and/or placement of non-mercury PTWs in a monocell, as required by the 1996 ROD Amendment, is not practicable and they must be disposed of in another manner that is protective of human health and the environment, complies with CERCLA, and is consistent with the NCP, that decision will be documented in an appropriate decision document, such as an ESD.

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[12] Additional information for defining PTWs is provided in EPA, 1991, *A Guide to Principal Threat and Low Level Threat Wastes*.

4.5 Implementation Approach

Given the large geographic area and scope of the required work, the implementation of the Selected Remedy is expected to take about 30 years. EPA will implement the Selected Remedy through an adaptive management approach, which will involve prioritizing activities and identifying and evaluating remedy modifications where necessary based on information gained as this interim remedy is implemented. Remedy modifications may include changes in the priority of certain actions, design modifications, adjustments to the implementation schedule, and/or possibly remedy changes which would be documented in ESDs or additional ROD Amendments, as appropriate. Remedy implementation will be conducted in a prioritized manner to ensure that the actions taken first are the most effective in achieving the overall goals of protection of human health and the environment, and EPA will seek input from stakeholders and community representatives. EPA has already begun the process of planning and prioritizing actions included in the Selected Remedy.

The public will have continuing opportunities to provide input on how the cleanup is being implemented. EPA has committed to implementing remedial actions in the Upper Basin through the Basin Commission process. This includes implementation planning for specific remedial actions associated with the Selected Remedy. EPA will work with the Basin Commission to develop the Implementation Plan, and the public will have opportunities to provide input on this plan. EPA will also work closely with the federal land management agencies during project planning and implementation when remedial activities are to be conducted on federal lands. Modifications to the Selected Remedy implementation schedule, priorities, and/or sequencing will be documented through updates to the Implementation Plan. These modifications are expected to be generally defined as non-significant or minor changes. Implementation of the adaptive management process may reveal the need to make changes to the Selected Remedy that will be defined as significant or fundamental changes. Similarly, an aggregate of non-significant or minor changes could result in a significant or fundamental change. For significant and fundamental changes, EPA will develop an appropriate decision document, such as an ESD or another ROD Amendment, and will solicit public input as required by the decision document.

5.0 Statutory Determinations

The Selected Remedy described in this ROD Amendment will, commensurate with its scope:

- Protect human health and the environment;
- Attain federal, state, and Tribal requirements that are applicable or relevant and appropriate to the remedial actions;
- Be cost-effective;
- Use permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable; and
- Satisfy the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, and volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

The Selected Remedy is expected to result in significant improvements to surface water quality in the Upper Basin and may achieve AWQC ARARs under the Clean Water Act at many locations; however, the remedy may not achieve these ARARs at all locations. The actions included in the Selected Remedy are expected to result in the achievement of cleanup levels for soil and sediments where actions are taken. However, although the Selected Remedy is expected to result in significant improvements to groundwater quality, it is not intended to achieve groundwater maximum contaminant level (MCL) ARARs under the Safe Drinking Water Act throughout the Upper Basin. Similarly, although the Selected Remedy is expected to provide additional safe habitat for special status species and is intended to achieve ARARs under the Migratory Bird Treaty Act and the Endangered Species Act where remedial actions are taken, it will not achieve these ARARs at all locations.

Although this interim remedy is not intended to address fully the statutory mandate for permanence and treatment to the maximum extent practicable, the Selected Remedy satisfies the statutory preference within its scope by utilizing treatment in part to address any PTWs that are found and as a principal element for removal of contaminants in groundwater, adit discharges, and seeps. While groundwater is by definition not a PTW, the contaminants in groundwater are causing significant environmental harm and ecological risk such that they are principal threats in the context of the Upper Basin. The final decision document(s) for the Upper Basin will fully address the statutory preference for treatment.

Consistent with 40 CFR 300.430(a)(ii)(B) and 40 CFR 300.430(f)(1)(ii)(C)(1), this Selected Remedy, an interim remedy, is neither inconsistent with nor precludes implementation of a final remedy that will attain ARARs. The final remedy will be identified in subsequent decision documents.

Because hazardous substances, pollutants, or contaminants will remain in the Upper Basin above levels that allow for unlimited use and unrestricted exposure before completion of the Selected Remedy, statutory CERCLA reviews will continue to be conducted at least every five years after the initiation of remedial actions[13] to ensure that the Selected Remedy is, or will be, protective of human health and the environment.

6.0 Data Certification Checklist

The following information is included in the Decision Summary in Part 2 of this Upper Basin ROD Amendment. Additional information is provided in the Administrative Record supporting this ROD Amendment, which incorporates by reference all Administrative Records developed for the Bunker Hill Superfund Site.

- Chemicals of concern and their respective concentrations (see Section 5.0 and Figures 5-3 through 5-10).
- Baseline risks represented by the chemicals of concern (see Section 7.0 and Tables 7-1 through 7-4).

[13] Cleanup actions are ongoing at the Bunker Hill Superfund Site to implement previous RODs, and several Five-Year Reviews have been completed (EPA, 2000a, 2000b, 2005, and 2010b). The next Five-Year Review for the Site is planned to be completed in 2015.

- Cleanup levels established for the chemicals of concern and the basis for these cleanup levels (see Section 8.0 and Tables 8-1 and 8-2).
- A discussion of source materials constituting principal threats (see Section 11.0).
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater and surface water used in the baseline risk assessment and this ROD Amendment (see Section 6.0).
- Potential land, surface water, and groundwater use that will be available in the Upper Basin as a result of the Selected Remedy (see Sections 12.1.4 and 12.2.4).
- Remedial actions in previously Selected Remedies that are modified by this ROD Amendment (see Tables 4-2, 4-3, and 4-4).
- Estimated capital costs, annual operation and maintenance (O&M) costs, and total present worth costs; the discount rate; and the number of years over which the remedy cost estimates are projected (see Sections 12.1.3 and 12.2.3, Tables 12-1 through 12-9, and Tables 12-11 through 12-14).
- Key factors that led to selecting the remedy (i.e., how the Selected Remedy provides the best balance of tradeoffs with respect to the CERCLA primary balancing and modifying criteria, with an emphasis on those evaluation criteria that were key to the decision) (see Section 10.3).
- Changes to the Selected Remedy from the Preferred Alternative described in the Proposed Plan for the Upper Basin[14] (see Section 14.0).

Authorizing Signature

Daniel D. Opalski
Director, Office of Environmental Cleanup
U.S. Environmental Protection Agency, Region 10

8/27/2012
Date

[14] EPA, July 12, 2010. *Proposed Plan, Upper Basin of the Coeur d'Alene River, Bunker Hill Mining and Metallurgical Complex Superfund Site.*

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

1410 North Hilton • Boise, Idaho 83706 • (208) 373-0502

C.L. "Butch" Otter, Governor
Curt Fransen, Director

August 22, 2012

Daniel Opalski
Director
Office of Environmental Cleanup
USEPA Region X
1200 Sixth Avenue, Suite 900
Seattle, WA 98101

Subject: Letter of Concurrence – Record of Decision Amendment, Upper Basin of the Coeur d'Alene River

Dear Mr. Opalski:

This letter responds to your request for concurrence with the remedy selected by the Environmental Protection Agency (EPA) as outlined in the Record of Decision Amendment (RODA) for the Upper Basin of the Coeur d'Alene River, Bunker Hill Mining and Metallurgical Complex, as of July 12, 2012. The State of Idaho (Idaho) generally concurs with the RODA, subject to the comments provided herein.

I. INTRODUCTION

Idaho has long maintained that a successful cleanup of the Coeur d'Alene Basin (Basin) requires the protection of public health and the support of healthy local communities. Remedial actions must be prioritized to protect human health and ensure the Basin is, and remains, a safe place to live, raise a family, conduct business and invest for the future. As the human health related cleanup of the Basin reaches completion, much of the remedy selected by the RODA is now focused on improving water quality. Idaho agrees that the RODA focus on water quality is important and appropriate at this stage of the cleanup. However, completion and protection of human health related remedial actions remains Idaho's highest and overriding priority and the long-term viability of those actions and water quality improvements is dependent on the support of healthy and sustainable Basin communities.

Idaho appreciates EPA's efforts to collaborate with the Idaho Department of Environmental Quality (DEQ), the Basin Environmental Improvement Project Commission (BEIPC) and local communities during the RODA process and in the overall cleanup to provide remedial actions and policies that support the human health priority. One example is the remedy protection work outlined in the RODA. Another is the commitment of EPA to provide funding which will help local road authorities restore paved roads to ensure they confine underlying contaminants. Ensuring that the roads function as barriers is a common sense means of protecting public health in the Basin and addressing the impact cleanup activities have on community infrastructure. Other measures supported by EPA, including the provision of local repositories and the development of a Community Fill Plan, will also serve to protect the public health remedies and recognize the critical role local communities play in the management of contaminants that remain in place.

Continued focus on public health will also remain relevant as circumstances, knowledge and conditions change. For instance, the recent action by the Centers for Disease Control to establish lower safe blood lead levels for children could raise issues as to the protectiveness of the human health remedial actions implemented in the Basin. While Idaho believes these remedies are protective, as demonstrated by the success of the cleanup in the Box based on observed blood lead levels, any adjustments to those human health remedies could require reprioritization of the environmental improvement remedies selected by the RODA. In implementing the RODA, EPA should continue to prioritize the protection of public health. Idaho recognizes that the adaptive management approach outlined by EPA in the RODA can provide for adjustments as implementation proceeds.

During the RODA process, EPA received extensive and often critical comments from a wide range of individuals, businesses and governmental agencies. Based on Idaho's review of those comments and the final selected remedy and related discussion in the RODA, it is clear that EPA carefully considered the comments, including those provided by Idaho, and made positive modifications to the initial proposed plan. Idaho recognizes the efforts and responsiveness of EPA in this matter. The RODA affirmatively addresses many of the concerns raised by Idaho over the past two years. As a result, Idaho concurs with most but not all aspects of the selected remedy of the RODA.

II. COMMENTS

Provided below are the State's comments regarding major components of the RODA.

Remedy Protection Measures

Idaho supports the Remedy Protection Actions outlined in the RODA. These actions will help protect communities from side drainage flooding and serve as examples of work which protects public health and strengthens the ability of local communities to maintain those protections in the future.

Mine and Mill Sites Cleanup

Idaho has supported source control work at mine and mill and other sites but requested that individual sites initially listed by the proposed plan be reviewed and potentially eliminated if such sites are active mining facilities, pose no threat to human health or the environment, or if there was simply little or no information to support their inclusion. In response, EPA has reduced the number of mine and mills sites listed for remediation in the RODA. Idaho recognizes this outcome which was based on EPA's consultation with community stakeholders, the DEQ and other government agencies, and the review of known or obtainable information regarding sites to be included in the RODA. Idaho agrees that continuation of this consultation process should guide future decisions regarding the exclusion or addition of sites to the list of those to be remediated.

Idaho specifically supports EPA's exclusion of active mining operations from the scope of the RODA. These active operations are governed by existing environmental requirements and the selection of remedial actions for areas of active operations is premature and inappropriate.

In implementing the RODA, mine and mill site cleanups should be prioritized to address the most impacted watersheds first. Idaho continues to support source control measures as the foundation of permanent water quality improvement.

<u>Repositories</u>

Idaho agrees that the use of Waste Consolidation Areas (WCAs) is a practical, cost-effective means for managing wastes from mine and mill site cleanup. The WCAs will reduce transportation costs and reduce the need for additional repositories.

Although not part of the RODA, completion and implementation of the Community Fill Plan (CFP) currently being developed by EPA, the Panhandle Health District (PHD) and DEQ is a common sense approach to managing contaminated soils. The CFP can provide for the safe disposition of contaminated soils and support economic development within the Basin. The CFP can be implemented through the Institutional Control Program administered by the PHD. The CFP will benefit local communities and the Basin cleanup by allowing for safe, cost-effective disposition of contaminated soils in a manner that facilitates development. Practical solutions of this type increase efficiencies and are critical to the future and long-term success of the cleanup.

<u>Collection and Treatment of Water from the Upper Basin</u>

There is no dispute that water quality in the South Fork of the Coeur d'Alene River (SFCDR) and several of its tributaries do not meet Idaho water quality standards. The information developed in the RODA process demonstrates uncertainty, however, as to whether current water quality standards can ever be achieved despite the expenditure of tens of millions of dollars, decades of work and perpetual treatment. Idaho continues to assert that implementation of active water treatment by collecting and conveying water via pipes from Upper Basin areas to the Central Treatment Plant (CTP) in Kellogg is premature at this time and is a low priority in comparison to other cleanup work. Available cleanup funds should be applied to higher priority actions selected in past RODs, the RODA and, potentially, any future ROD addressing the Lower Basin. Idaho requests that EPA delay implementation of RODA activities concerning the collection and conveyance of Upper Basin waters for active treatment at the CTP until other higher priority cleanup actions are completed.

As stated in Idaho's previous comments, any collection and conveyance of Idaho water must comply with the requirements of Idaho water law.

Idaho supports EPA's actions toward establishing interim achievable water quality goals based on biological benchmarks to guide cleanup actions and gauge water quality improvements.

Collection and Treatment of Water from the "Box"

The collection of groundwater in the vicinity of the Central Impoundment Area (CIA) for active treatment at the CTP could significantly reduce metals loading to the SFCDR. Unlike other areas of the Basin, source control work in the Box has largely been completed. Idaho continues to conditionally support the collection and active treatment of groundwater within the Box dependent on the availability of long-term funding and the completion of appropriate studies to determine the feasibility and practicality of such treatment. Settlement funds have been identified to support the Box water treatment activities identified in the RODA and both Idaho and EPA are exploring mechanisms to assure the continued availability of such funding over the long-term. EPA's pending optimization study regarding the CTP is expected to provide valuable information concerning operational improvements, cost savings and overall feasibility of long-term treatment.

Future Mining

Idaho agrees with the exclusion of active mining areas from remedial actions selected by the RODA. Idaho believes the "Protocol" developed by EPA, DEQ and Hecla Mining Company can serve as a model for accommodating both mining and cleanup activities in the Basin. The agencies should continue to support the economic viability of the Basin, of which mining is a crucial component, to help ensure the long-term success of completed and pending remedial activities.

Flood Control

The RODA does not select flood control measures for the SFCDR and Pine Creek. The probability of major flooding events in these drainages poses a clear and serious threat to the long-term effectiveness of remedial actions which protect human health in the Basin. Idaho appreciates EPA's commitment in the RODA to continue working with other government agencies to address these risks. Idaho also recognizes that flood control is necessary for the general protection of human health and property in the Basin. Idaho will continue to work with EPA to engage federal flood control agencies to remedy these risks. These efforts to date have produced modest progress. Should these efforts not succeed, Idaho believes the selection of additional remedy protection measures will be necessary to assure the long-term protectiveness of the human health remedies.

<u>Scope of the RODA</u>

Idaho recognizes that the scope of the RODA has been significantly reduced in terms of both cost and time required to implement. This reduction is responsive to serious concerns expressed by Idaho and many other commenters. Though reduced, the scope of remedial action selected by the RODA remains formidable and EPA has accordingly committed to collaborative processes, including adaptive management techniques, to implement the RODA. These processes are intended to, and must, provide for meaningful input by the public, local communities and other governmental entities. It is apparent that remedy modifications will be necessary as implementation proceeds and, therefore, public input and acceptance will be critical to making such modifications. Given the scope of the RODA, Idaho's concurrence depends on EPA's implementation commitments. EPA has also committed to implement the RODA through the Basin Environmental Improvement Project Commission (BEIPC) process. The BEIPC is a focal point for engagement with local elected officials and the community. Idaho supports this approach and recognizes EPA's active participation in the BEIPC.

Implementation through an adaptive management approach can be beneficial, but such approach should not be utilized to return to a significantly larger scope of action. Within the bounds of reasonableness, Idaho's general concurrence is directly tied to the reduced scope of the RODA.

<u>Use of Typical Conceptual Designs</u>

EPA used Typical Conceptual Designs (TCDs) as a tool to develop costs and conceptual remedial designs for the large number of actions called for in the RODA. The footnote on Page 9-2 indicates that "the constructed remedies at specific source sites may differ from the TCDs based on future site- and waste-specific characterization assessments and other pre-design activities." Idaho notes that the TCDs serve largely as placeholders and in some instances may be misleading. For example, TCD C08a assumes a flexible membrane cap and bottom liner will be utilized at future repositories. None of the several existing repositories have required a bottom liner and there is no indication or reasoning for inclusion of such a feature in future repositories. DEQ has been assured by EPA that TCDs do not limit or restrain the actual planning and design of remedies selected for implementation. The use of site specific information and adaptive management as well as agency and public input will be critical to the design and construction of remedial actions which are protective and cost-effective.

III. CONCLUSION

The State of Idaho expressed significant concerns in response to the plan proposed by EPA in 2010. The remedy described by the RODA demonstrates that EPA has carefully considered and responded to the concerns of Idaho and others. The RODA also describes EPA's commitment to implement the RODA in a manner that will be responsive to ongoing and future concerns. As stated previously, Idaho's general concurrence is contingent upon these central tenants remaining EPA's primary focus for the duration of the RODA implementation.

Moreover, Idaho's concurrence with the RODA in no way binds the State to future EPA decisions. Idaho reserves the right to review, independently assess and address all future issues and decisions regarding cleanup of the Basin.

In closing, Idaho remains committed to continue working with EPA to protect human health and improve environmental conditions within the Basin. Finally, EPA staff deserves recognition for their professionalism and hard work over the past years in developing the RODA.

Sincerely,

Curt A. Fransen
Director
Idaho Department of Environmental Quality

CAF: ra

c: The Honorable C.L. "Butch" Otter,
Governor of the State of Idaho

REFERENCE:

COEUR D'ALENE TRIBE

850 A STREET
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August 24, 2012

Mr. Daniel Opalski
Director, Office of Environmental Cleanup
EPA Region 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

Re: Response to EPA's request for the Coeur d'Alene Tribe's concurrence on the selected remedy for the Bunker Hill Mining and Metallurgical Site Upper Basin Record of Decision ("ROD") Amendment.

Dear Mr. Opalski:

The Coeur d'Alene Tribe has reviewed the ROD #3 Amendment, dated July 12, 2012. As you know the Tribe has been supportive of EPA's Superfund activities since they began in the mid-1980s and has always sought permanent and comprehensive cleanup strategies to address the mining contamination that has come to be located in the Tribe's homeland and current Reservation. Throughout this timeframe we have supported the implementation of RODs 1, 2, and 3. Although these RODs and this current Amendment do not focus on the massive pollution problem in the Lower Basin and Coeur d'Alene Lake, we understand the logic of cleaning up the Upper Basin to "shut off the spigot," thus reducing the potential of recontamination of the Lower Basin. We also acknowledge that due to the geographic magnitude of the contamination and the time frame it will take to comprehensively address the pollution throughout the Basin, it is wise to implement work in stages, learn from that work and adaptively plan for future remediation in geographic sections, progressing from upstream to downstream. It is also the Tribes view that adaptive management may mean additional remedial efforts may be undertaken if the data proves it necessary.

Given this preface, the Coeur d'Alene Tribe generally concurs with the Amendment as written. The Tribe provides this concurrence with the understanding that EPA will continue to support the Tribe in their participation of all future detailed planning efforts necessary to implement this amendment and strive to address the overarching issues we have raised during our government to government consultations. These overarching issues of concern continue to include:

Funding: The need to expend Asarco Trust funds in a manner consistent with the probability that effective remediation of the Basin may cost several billions of dollars. Therefore, to the extent practicable, EPA should plan yearly work within available funds generated from interest earned on the account. By maintaining flexibility with yearly expenses through spending interest earned, EPA can assure sufficient funding for additional Upper Basin work and the significant funding needs to implement a future Lower Basin remedy.

- Education, Training and Jobs: The Tribe provides a unique value system and traditional knowledge that is rooted in natural resource protection. We wish to use this knowledge gained over thousands of years and with the support of EPA secure funding for scholarships to educate Tribal members in the fields of science and engineering, and workforce training to develop immediate expertise necessary to become an integral part of the local workforce that implements the remediation work. The Tribe spearheaded the lawsuits that have provided the funding to enable this work and believe it deserves the opportunity to raise the standard of living of Tribal members through the long-term high paying jobs that this cleanup will offer.

- Tribal Monitoring: Monitoring the effects of work conducted on the ground will be the key to understanding whether expenditures are improving conditions. This continuous and long-term monitoring (the Basin Environmental Monitoring Plan, or BEMP) will provide the information necessary to adaptively manage the many work elements outlined in the Plan. As such, the Tribe has been monitoring Lake conditions with their own funds and seeks EPA's support to expand our monitoring efforts into the Lower Basin.

- Lower Basin Projects: The EPA recognizes that the Lower Basin and Lake is a priority concern of the Tribe. Although we recognize the need to work from upstream to downstream, we also recognize the need to begin understanding the types of remedial designs necessary to improve downstream conditions. To that end we want EPA to begin implementing "demonstration projects" as outlined in the original ROD #3 that address: floodplain, stream bank, and riverine contamination.

- Coeur d'Alene Lake: Recognizing that the Lake is part of the Superfund site and that a remedy has been deferred pending the successful management of metals through the implementation of the Lake Management Plan (LMP), the Tribe remains guardedly optimistic. To better understand what "successful" means, we have asked EPA to work with the Tribe to define the criteria in which to measure whether the LMP is providing the protection necessary to continue to defer a Lake remedy. We look forward to defining these criteria so we all have a bench mark in which to evaluate the efficacy of the LMP. In addition, a critical component of criteria development is approval of the Tribe's water quality standards. The process of approval of our standards has been fraught with delays and endless red

> tape and as a result we still have no standards governing Tribal TAS waters. Swift actions that lead to the approval of our standards are essential to finalize any LMP success criterion.

The Coeur d'Alene Tribe is a patient people and recognizes that it took 100 years to pollute the natural resources of the Basin – it will probably take 100 years to complete the remediation efforts. It is with the idea of making good decisions today that will positively affect the next seven generations that the Tribe will continue to support EPA's efforts. Therefore, the Tribe offers their support as we jointly advance cleanup efforts. Now that this Plan is completed, the Tribe hopes that its implementation can be conducted in a scientifically sound, economically prudent, and expeditious manner.

Sincerely,

Mr. Phillip J. Cernera
Director of Lake Management

cc Mr. Chief Allan, Tribal Chairman
Mr. Robert Matt, Admin. Director
Mr. Howard Funke, Tribal Attorney

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
4601 N Monroe Street • Spokane, Washington 99205-1295 • (509)329-3400

July 27, 2012

Mr. Daniel Opalski, Director
Office of Environmental Cleanup
U.S. Environmental Protection Agency
1200 Sixth Avenue, Suite 900 (MS ECL-117)
Seattle, WA 98101

RE: Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River—Bunker Hill Mining and Metallurgical Complex Superfund Site

Dear Mr. Opalski:

This letter communicates the State of Washington's expectations and position regarding the ROD Amendment for the Upper Basin of the Coeur d'Alene River.

Washington has been, and continues to be, engaged as a participating member in the Basin Environmental Improvement Project Commission. Our participation has been focused on providing input and support to insure that timely and effective remedial actions are implemented at the Bunker Hill Mining and Metallurgical Complex Superfund Site (Site). The selection of a cleanup approach that addresses the metals-impacted surface water in the Upper Coeur d'Alene Basin is of particular importance to Washington. The remedial actions taken in Idaho to manage dissolved and particulate metals loading to the south fork of the Coeur d'Alene River directly affect the water quality of the Spokane River within Washington. The success of Washington's metals Total Maximum Daily Loads (TMDL) largely relies on controlling the upstream contaminant sources in Idaho so that the toxicity criteria of Washington's Water Quality Standards for surface water are met at the Washington/Idaho border.

In addition, the long-term integrity of Washington and EPA's joint riverbank and beach cleanup remedies are dependent upon the implementation of a timely and effective cleanup plan.

Given the time and funding limitations to enact an overall remedy for the Site, it is imperative that remedial actions providing the greatest reduction in metals loading to surface water be pursued as soon as possible. Construction of the pipeline to convey Canyon Creek groundwater for active treatment and hydraulic isolation of tailings in The Box will help address a large component of identified loading. Without such prioritization, the Lower Basin, Coeur d'Alene Lake, and Washington State will continue to be heavily impacted for decades.

The remedial action approach described in the ROD Amendment is primarily focused on achieving improvements in surface water quality by addressing the major contributing sources to the South Fork of the Coeur d'Alene River. The time frames provided are realistic, given the level of effort needed to implement the remedial actions. The approach also reflects adjustments based on current site data, stakeholder input, and recognition of fiscal limitations. The judicious application of available funding in the Upper Basin over a reasonable time frame will also allow for a timelier, effective, and funded future ecological remedy for the Lower Basin.

For these reasons, the State of Washington offers its concurrence on the ROD Amendment for the Upper Basin of the Coeur d'Alene River. We look forward to seeing measurable progress in the cleanup of the Upper Basin in the near future that will result in significant reductions of metals loading to the south fork of the Coeur d'Alene River.

Sincerely,

Grant D. Pfeifer

Grant Pfeifer
Regional Director and Agency Small Business Liaison
(509) 329-3516 desk / (509) 570-8607 cell
Grant.Pfeifer@ecy.wa.gov

GP:eh

cc: Dave George, Department of Ecology
Michael Hibbler, Department of Ecology

Spokane Tribe of Indians

P.O. Box 100 • Wellpinit, WA 99040 • (509) 458-6500 • Fax (509) 458-6575

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AUG - 3 2012

OFFICE OF
ENVIRONMENTAL CLEANUP

July 30, 2012

Daniel D. Opalski
Director, Environmental Cleanup
U.S.E.P.A. Region 10
1200 Sixth Avenue
Seattle, WA 98101

Re: Spokane Tribe of Indians' support on the selected remedy for the Bunker Hill Mining and Metallurgical Site Upper Basin Record of Decision Amendment

Dear Mr. Opalski:

We are in receipt of your letter dated July 12, 2010, requesting the Spokane Tribe of Indians' support on the selected remedy for the Bunker Hill Mining and Metallurgical Site Upper Basin ROD Amendment. We appreciate the opportunity for this government-to-government exchange, and hope for continued positive relations with your agency on future matters of mutual concern.

Because implementing any cleanup action carries obvious benefits, the Spokane Tribe generally concurs with and supports the cleanup activities included in the selected remedy. But as you know, the Spokane Tribe has expressed concerns that the selected remedy may not maximize the protection of human health and the environment in the lower Spokane River area, and that additional measures should be implemented.

More specifically, we are concerned that the selected remedy, as amended, does not provide adequate protection of current and future subsistence users who reside and/or practice subsistence lifestyles downstream of the Coeur d'Alene Basin. Protecting these users, which include the people of our Reservation, requires a more integrated consideration of impacts on the lower Spokane River. We know that heavy metals will continue to flow from Lake Coeur d'Alene, and continue to believe that the outflow must be managed with a view toward protecting not just recreationists on the Lake, but our people practicing our traditional ways as well.

It is for this reason in particular that our Tribe's technical staff have worked so hard with Region 10 to develop and implement under the Clean Water Act, surface water quality standards that are intended to protect those uses. And it is for this reason that our Tribe requested throughout the Coeur d'Alene Basin cleanup process, and continues to request, monitoring on the lower Spokane River. Such monitoring would provide critical data during annual spring runoff, and would additionally serve to warn our Tribe and membership should a catastrophic or other event result in hazardous substance releases or re-releases.

When the Coeur d'Alene Basin ROD was initially released, the Spokane Tribe expressed its appreciation for the remedy's commitment to perform additional work on our Reservation related to mining contamination from Idaho. The additional testing and studies to evaluate the potential exposures to tribal subsistence users to contaminated resources in and along the Spokane River on the Spokane Indian Reservation were considered by the Tribe both necessary and welcome. It is concerning to us that so little has been done to date in satisfaction of those downstream commitments. Indeed the ROD Amendment is, to us, deafening in its silence at page 1, where it defines OU 3 as extending from the Montana-Idaho border "down to the depositional areas of the Spokane River, which flows from Coeur d'Alene Lake into Washington State." If, as the ROD Amendment states, OU 3 "includes all areas of the Coeur d'Alene Basin outside the Bunker Hill Box where mining-related contamination is located," then the evidence shows that the Spokane Indian Reservation must also be included.

But despite our ongoing concerns, the work to be accomplished under the selected remedy is viewed as a positive step forward. It is in that spirit, and in the spirit of future cooperation between our governments to address this enormous problem, that the Spokane Tribe sends this letter supporting EPA's actions. Again, we appreciate the work performed by Region 10 to date on this difficult cleanup, and look forward to continued coordination and cooperation between our governments on future activities to address Silver Valley contamination and other matters.

Sincerely,

Rudy B. Peone

Rudy Peone
Chairman

cc: Shannon Work
Randy Connolly
Fred Kirschner

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
620 SW Main Street, Suite 201
Portland, Oregon 97205-3026

August 8, 2012

Dennis McLerran, Regional Administrator
C/O Coeur d'Alene Basin Team
Environmental Protection Agency, Region 10
1200 6th Avenue, Suite 900, ECL-113
Seattle, WA 98101

Dear Mr. McLerran,

The Department of the Interior (Department) has completed a review of the Record of Decision Amendment for the Upper Basin of the Coeur d'Alene River, Bunker Hill Mining and Metallurgical Complex Superfund Site dated July 12, 2012 (RODA). The Department, through the Bureau of Land Management (BLM) and U.S. Fish and Wildlife Service (Service), has worked cooperatively with staff from the Environmental Protection Agency (EPA) to provide input, technical information, and advice on the RODA. We appreciate the opportunity to collaborate with EPA staff members on this very important cleanup and would like to thank you for your responsiveness to our comments throughout the planning process.

We support the RODA's expansion of the cleanup in the Upper Coeur d'Alene Basin (Basin) beyond that presented in the 2002 Record of Decision (ROD). Consistent with the Department's goals, we commend EPA's steps towards reducing or eliminating hazardous substances from entering pathways that affect human health, and the productivity of the natural resources and the services they provide within the Basin. The primary goals of the Department within the Basin include cleanup and restoration of impacted federal lands and other impacted lands so that they can support healthy populations of aquatic and terrestrial species (including aquatic invertebrates, native fish, and migratory birds), and contributing to the recovery of threatened and endangered species such as bull trout, Canada lynx, and water howellia. To meet these goals will require significant source control of releases to surface and ground waters and wildlife habitats of the Basin. Based on the available information, it appears that the actions outlined in the RODA will substantially contribute to source control and to meeting these human health and natural resource goals. In addition, integration of the RODA's cleanup actions with the restoration actions currently being planned by the Coeur d'Alene Basin Natural Resource Trustees will further enhance the overall conditions within the Basin.

Numerous secondary source mine and mill sites in the Upper South Fork Coeur d'Alene watershed have been identified within the Proposed RODA, many of which are on BLM lands. In addition, a potential repository site exists partially on BLM lands. We realize that before site-specific actions are designed, additional characterization will, in many cases, be needed to determine the final course of action at these sites. The Department looks forward to participating with EPA staff and it's contractors to develop and implement cleanup actions within the Basin, especially those actions that are on or affect BLM lands. Additionally, once the mine and mill sites are investigated in more detail, new sites that require action will undoubtedly be discovered and will need to be included in the Selected Remedy. We support the flexibility in the Selected Remedy to add or drop mine and mill sites or to substantially change initial site plans. We see this flexibility as important to the overall success of source control in the upper Basin and look forward to engaging with EPA to implement this critical aspect of the Selected Remedy.

In response to the 2002 ROD, the Department expressed concerns that remediation would not be focused enough on the Lower Coeur d'Alene Basin. Because the current RODA does not include additional actions in the Lower Basin, the Department continues to have this concern. The selected 2002 remedy targeted 4,500 acres of the more than 18,000 acres contaminated wetlands in the Lower Basin. The Lower Basin holds the highest bird diversity in the Coeur d'Alene Basin, providing habitat for 30 species of waterfowl that either stop during migration or breed there, as well as numerous other waterbirds, raptors, and songbirds. Left to naturally recover, most of the wetland acreage on the Lower Basin would continue to pose risks to many of these species for decades to come. Remediating the Lower Basin will result in improving the services provided by the natural resources within the area; for example, sediments high in lead are regularly deposited in areas where the public engages in swimming, fishing, and boating. This affects both the safety and the quality of these recreational experiences. The Department recommends that EPA reserve adequate resources for remediation in the Lower Basin, which is not addressed in the current RODA.

We look forward to continued coordination with EPA in the future and appreciate the opportunity to comment. If you have any questions please, contact the Department's Natural Resource Damage Assessment Case Manager, Ms. Kathleen Moynan, at (503) 231-2228. Questions regarding resources managed by the Service may be directed to Mr. Sergio Pierluissi at (509) 893-8032. Questions related to BLM-administered resources should be directed to Mr. Jeff Johnson at (208) 769-5030.

Sincerely,

Allison O'Brien

Allison O'Brien
Regional Environmental Officer

USDA United States Department of Agriculture | Forest Service | Region One | Northern Region
200 East Broadway
Missoula, MT 59802

File Code: 2160
Date: August 8, 2012

Dennis McLerran
Regional AdminstratorAdministrator
U.S. Environmental Protection Agency, Region 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

Dear Mr. McLerran,

We have completed a review of the Record of Decision Amendment (RODA) for the Upper Basin of the Coeur d'Alene River, Bunker Hill Mining and Metallurgical Complex Superfund Site dated July 12, 2012. We appreciate the efforts U.S. Environmental Protection Agency (USEPA), Region-10, has made to coordinate with the public, the Forest Service (FS), and other stakeholders in the basin. We value working with the USEPA staff members and consultants in an open forum.

Overall, we support additional cleanup actions in the Upper Basin. We support the actions in the RODA that move towards improvements for both human and ecological health. An important objective for the FS in the Coeur d'Alene Basin has and continues to be restoration and maintenance of healthy watersheds and diverse habitats. We feel the results of the actions described in the Selected Remedy will trend conditions in the Upper Basin towards this objective.

The improvement of water quality is a key objective as the Coeur d'Alene Basin Natural Resource Trustee Council develops its restoration plan, which will further enhance restoration in the Basin as a whole. We continue to encourage USEPA to emphasize improvement of water quality.

There are numerous upper watershed secondary source mine and mill sites that were identified within the original response plan, many of which are on National Forest (NF) lands. The flexibility to address these mines and mill sites is important to the FS. We appreciate USEPA having added language to that effect to the last paragraph, in Part 1-Declaration, Section 4.0 Description of the Selected Remedy. In our experience, many of these secondary source sites can contain unique and /or acute contamination sources that are not always easy to remedy.

In responses to the 2002 ROD, the Natural Resource Trustees expressed concerns that remediation was not focused enough on the Lower Coeur d'Alene Basin as the current RODA does not fully address the Lower Basin. We continue to have the same concerns as the 2002 selected remedy targeted 4,500 acres out of 18,300 contaminated wetland acres in the Lower Basin. If the Lower Basin is primarily left to naturally recover under that scenario, most of the wetland acreage in the Lower Basin would continue to pose risks to many bird species. Increased remediation in the Lower Basin would also provide opportunities for safe recreational activities, such as fishing, camping, and boating. We request that EPA reserve adequate resources for increased remediation in the Lower Basin.

We look forward to continued coordination with USEPA in the future and appreciate the opportunity to comment. If you have any questions please contact Kevin Knesek at (208) 765-7442 or ksknesek@fs.fed.us, or Bob Kirkpatrick at (406) 329-3307 or bkirkpatrick@fs.fed.us.

Sincerely,

/s/ Jane L. Cottrell (for)
FAYE L. KRUEGER
Regional Forester

cc: Kevin S Knesek
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Part 2
Decision Summary

Contents

List of Figures

List of Tables

List of Abbreviations and Acronyms

μg/dL	microgram(s) per deciliter
μg/L	microgram(s) per liter
AC	acre(s)
AMD	acid mine drainage
AOC	Administrative Order on Consent
ARAR	applicable or relevant and appropriate requirement
AWQC	ambient water quality criterion/criteria
BEMP	Basin Environmental Monitoring Plan/Program
bgs	below ground surface
BLM	U.S. Department of the Interior Bureau of Land Management
BLP	Bunker Limited Partnership
CCC	Citizens' Coordinating Council
CDC	Centers for Disease Control and Prevention
CDR	Coeur d'Alene River
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	*Code of Federal Regulations*
cfs	cubic foot/feet per second
CIA	Central Impoundment Area
CLP	Contract Laboratory Program
COC	contaminant of concern
COPC	contaminant of potential concern
COPEC	contaminant of potential ecological concern
CSM	conceptual site model
CTP	Central Treatment Plant
cy	cubic yard(s)

DOA	U.S. Department of Agriculture
DOI	U.S. Department of the Interior
EcoRA	Ecological Risk Assessment
EE/CA	engineering evaluation/cost analysis
EMP	Environmental Monitoring Plan/Program
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ESA	Endangered Species Act
ESD	Explanation of Significant Differences
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FFS	Focused Feasibility Study
FR	*Federal Register*
FS	Feasibility Study
GI/FS	General Investigation/Feasibility Study
gpm	gallon(s) per minute
HDPE	high-density polyethylene
HDS	high-density sludge
HHRA	Human Health Risk Assessment
I-90	Interstate 90
ICP	Institutional Controls Program
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Department of Environmental Quality
IDHW	Idaho Department of Health and Welfare
IDWR	Idaho Department of Water Resources
INL	Idaho National Laboratory
lb.	pound(s)
lb/day	pound(s) per day
lf	linear foot/feet
LIDAR	Light Detecting and Ranging

LOAEL	lowest observed adverse effects level
MAP	Mapping, Assessment, and Planning
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
mg	milligram(s)
MGD	million gallons per day
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
MOA	Mine Operations Area
NA	not applicable or not available
NAS	National Academy of Sciences
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPV	net present value
NRC	National Research Council
NRD	natural resource damage
NRDA	Natural Resource Damage Assessment
O&M	operation and maintenance
OU	Operable Unit
PA	Predictive Analysis
PFT	Project Focus Team
ppm	parts per million
PRB	permeable reactive barrier
PRG	preliminary remediation goal
PRP	potentially responsible party
PTM	Principal Threat Materials
PTW	Principal Threat Waste
RADER	Risk Assessment Data Evaluation Report

RAO	remedial action objective
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RM	River Mile
RME	reasonable maximum exposure
ROD	Record of Decision
ROW	right of way
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act
SCA	Smelter Closure Area
SFCDR	South Fork of the Coeur d'Alene River
SRB	sulfate-reducing bioreactor
SR-PRB	sulfate-reducing permeable reactive barrier
SSC	State Superfund Contract
SVNRT	Silver Valley Natural Resource Trust/Trustees
TBC	to be considered
TBD	to be determined
TCD	typical conceptual design
TI	Technical Impracticability
TLG	Technical Leadership Group
TMDL	Total Maximum Daily Load(s)
UCL	upper confidence limit
UECA	Uniform Environmental Covenants Act
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WWTP	wastewater treatment plant

SECTION 1.0

Site Name, Location, and Description

The Bunker Hill Mining and Metallurgical Complex Superfund Site ("the Bunker Hill Superfund Site", or "the Site") is located primarily in northern Idaho (Figure 1-1). The Site includes mining-contaminated areas in the Coeur d'Alene River corridor, adjacent floodplains, downstream water bodies,[1] tributaries, and fill areas, as well as the 21-square-mile Bunker Hill "Box" where historical ore-processing and smelting operations occurred. The Site was listed on the National Priorities List (NPL) in 1983 and, under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), is assigned CERCLIS identification number IDD048340921.

The U.S. Environmental Protection Agency (EPA) has divided the Bunker Hill Superfund Site into three Operable Units (OUs): the populated areas of the Bunker Hill Box (OU 1), the non-populated areas of the Box (OU 2), and all areas of mining-related contamination in the broader Coeur d'Alene Basin (OU 3) outside the Box. The three OUs are summarized below.

Bunker Hill Superfund Site Operable Units (OUs)

OU 1	OU 1 is defined as the populated areas of the Bunker Hill Box because it is home to more than 7,000 residents of the towns of Pinehurst, Smelterville, Kellogg, and Wardner, as well as the unincorporated communities of Page, Ross Ranch, Elizabeth Park, and Montgomery Gulch. Residences also extend up side gulches and adjacent hillside areas. Populated-area issues of concern include residential yards, house dust, commercial properties, public use areas, and street rights of way (ROWs).
OU 2	OU 2 comprises the non-populated areas of the Bunker Hill Box. These areas include former industrial areas such as the Mine Operations Area (MOA) in Kellogg; the zinc plant, acid/fertilizer plant, and other processing facilities located in Government Gulch; Smelterville Flats (the floodplain of the South Fork of the Coeur d'Alene River [SFCDR] in the western half of the Bunker Hill Box); hillsides, creeks, and gulches; the Central Impoundment Area (CIA) in Kellogg; the Central Treatment Plant (CTP), a water treatment facility in Kellogg for acid mine drainage (AMD) and other metals-contaminated water; and the Bunker Hill Mine with its associated AMD.
OU 3	OU 3 includes all areas of the Coeur d'Alene Basin outside the Bunker Hill Box where mining-related contamination is located. OU 3 extends from the Idaho-Montana border into the State of Washington and contains floodplains, populated areas, lakes, rivers, and tributaries. OU 3 includes areas surrounding and including the SFCDR and its tributaries, and areas surrounding and including the main stem of the Coeur d'Alene River down to the depositional areas of the Spokane River, which flows from Coeur d'Alene Lake[2] into Washington State.[3]

This Record of Decision (ROD) Amendment is focused on the Upper Basin of the Coeur d'Alene River, which is the main area of historical mining and industrial activities and the

[1] Downstream water bodies extend to portions of the Spokane River, located in eastern Washington.

[2] Coeur d'Alene Lake is being managed by state, Tribal, federal, and local governments outside the Superfund process through revision and implementation of the *Coeur d'Alene Lake Management Plan* (Idaho Department of Environmental Quality [IDEQ] and Coeur d'Alene Tribe, 2009).

[3] Note that the river corridor portions of the SFCDR and Pine Creek located within the Bunker Hill Box are considered to be part of OU 3.

primary source of downstream metals contamination. The Upper Basin is mostly located in Shoshone County, Idaho, and contains OUs 1 and 2 (the Bunker Hill Box) and the eastern portion of OU 3 (Figure 1-1). The 300-square-mile Upper Basin includes areas of mining-related contamination along the SFCDR and its tributaries downstream to the confluence of the South and North Forks of the Coeur d'Alene River. The Selected Remedy for the Upper Basin, which is an interim remedy as described in this ROD Amendment, includes actions within the Upper Basin and extending downstream one mile to the west to include the town of Kingston. The Selected Remedy includes remedial actions in portions of OU 1, OU 2, and OU 3. The North Fork is being addressed under CERCLA by other (non-EPA) agencies, primarily the U.S. Forest Service (USFS).

EPA is selecting this interim remedy in accordance with CERCLA, the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (known as the NCP). This decision is based on the Administrative Record supporting this ROD Amendment, which incorporates by reference all Administrative Records developed for the Bunker Hill Superfund Site. EPA is the lead agency for this decision document. The support agencies for those remedial actions selected within the boundaries of the respective state or Tribal jurisdictions are IDEQ and the Coeur d'Alene Tribe.

SECTION 2.0

Site History and Enforcement Activities

This section summarizes the history of the Bunker Hill Superfund Site and the Upper Basin (Section 2.1), previous cleanup actions at the Site (Section 2.2), Site investigation activities and studies since the ROD for OU 3 was issued in 2002 (Section 2.3), and the history of CERCLA enforcement activities at the Site (Section 2.4).

The CERCLA process for the Upper Basin is summarized in Figure 2-1, which shows how the past Remedial Investigations (RIs), Feasibility Studies (FSs), and RODs for the OUs at the Bunker Hill Superfund Site are related to this Upper Basin ROD Amendment.

2.1 Site History

Mining within the Coeur d'Alene Basin began more than 100 years ago, and the region became one of the leading silver, lead, and zinc producing areas in the world. Mining activities were concentrated in the Upper Basin, where the U.S. Department of the Interior Bureau of Land Management (BLM), USFS, and EPA have identified more than 1,000 historical mining or milling-related features. As a result of past mining, milling, and smelting practices, substantial portions of the Basin contain elevated concentrations of lead, zinc, cadmium, arsenic, and other metals that are potentially hazardous to human health and the environment.

Within the Upper Basin, elevated concentrations of metals resulted primarily from the discharge or erosion of mill tailings and other mine-generated wastes into rivers and streams. These water bodies, in turn, deposited millions of tons of mine tailings into stream beds, floodplains, and shorelines throughout the Site. Acid mine drainage (AMD, which is metals-affected drainage water from mine portals) also impacts surface water and groundwater. Tailings were also frequently used as fill materials to build communities upon and for commercial and infrastructure construction projects. Particulates released to the air from smelting operations contained high concentrations of metals and were transported as airborne dust and deposited over a large area.

Because of these historical factors, high concentrations of metals are pervasive in the soil, sediments, surface water, and groundwater throughout the Site, posing risks to people, plants, and animals. Although blood lead levels in children living within the Site are declining, elevated levels have been documented for more than 20 years. Migratory birds and mammals die following ingestion of lead-contaminated soil and sediments, while contaminated surface water, soil, and sediments have increased mortality and decreased the growth and reproduction of various plants and animals, especially fish and waterfowl.

As noted previously, the Bunker Hill Superfund Site was placed on the NPL in 1983. Following initial investigation of OU 1 and OU 2, cleanup actions began in the late 1980s. Investigation of OU 3 began in 1998. Cleanup actions have continued to the present time. These actions have been conducted by EPA, the mining companies, IDEQ, the Washington State Department of Ecology, BLM, USFS, the Coeur d'Alene Tribe, the Silver Valley Natural

Resource Trustees (SVNRT), and the federal Coeur d'Alene Basin Natural Resource Trustees, in cooperation with other stakeholders and the public.

2.2 Previous Cleanup Actions

The original RODs for the three OUs at the Site were signed on the dates indicated below. Summaries of the cleanup actions included in each ROD (and in subsequent decision document modifications in the case of OU 2) are included in Tables 2-1 through 2-3.

- **ROD for OU 1** (EPA Superfund Record of Decision, Bunker Hill Mining and Metallurgical Complex Residential Soils Operable Unit, Shoshone County, Idaho): August 30, 1991.
- **ROD for OU 2** (EPA Superfund Record of Decision: Bunker Hill Mining & Metallurgical Complex, EPA ID: IDD048340921, OU 02, Smelterville, ID): September 22, 1992.

  In addition, Amendments to the ROD for OU 2 and Explanations of Significant Difference (ESDs) were signed on the following dates:

  - **First ROD Amendment for OU 2** (*EPA Superfund Record of Decision Amendment: Bunker Hill Mining & Metallurgical Complex, EPA ID: IDD048340921, OU 02, Smelterville, ID*): September 9, 1996.
  - **Second ROD Amendment for OU 2** (*EPA Superfund Record of Decision Amendment: Bunker Hill Mining & Metallurgical Complex, EPA ID: IDD048340921, OU 02, Smelterville, ID*): December 10, 2001.
  - **First ESD for the OU 2 ROD** *(Explanation of Significant Differences for Revised Remedial Actions at the Bunker Hill Superfund Site, Shoshone County, Idaho)*: January 1996.
  - **Second ESD for the OU 2 ROD** *(Explanation of Significant Differences for Revised Remedial Actions at the Bunker Hill Superfund Site OU 2, Shoshone County, Idaho)*: April 1998.
- **ROD for OU 3** (Record of Decision, The Bunker Hill Mining and Metallurgical Complex Operable Unit 3): September 12, 2002.

Substantial progress has been made implementing the remedies selected in the RODs and other previous decision documents for the three OUs, primarily the remedies that focused on reducing the risks posed to human health by exposure to mining-related contamination. The portions of the existing Selected Remedies focusing on human health for OUs 1, 2, and 3 have functioned as designed and are protective of human health. In particular, the cleanup actions have resulted in significant and well-documented declines in children's blood lead levels. An Institutional Controls Program (ICP),[1] administered by the Panhandle Health District, provides a locally enforced set of rules and regulations established to maintain the

[1] Idaho Administrative Procedures Act (IDAPA) 41.01.01, Rules of Panhandle Health District 1, is the promulgated rule establishing the ICP. It describes the Panhandle Health District's authority and the ICP's scope and intent.

integrity of installed barriers,[2] prevent exposure to remaining contamination, and ensure that new barriers are installed during redevelopment that may occur within the administrative boundary of the ICP.[3] The following summarizes these cleanup actions:[4]

- **OU 1:** Cleanup activities first began in OU 1, the populated areas surrounding the historical mineral processing and smelting area of the Bunker Hill Box, because of the risks posed to human health from exposure to mine and smelter wastes. The ROD for OU 1 (EPA, 1991a) focused on remediation of lead-contaminated soil in residential areas primarily through excavation of contaminated soil and the installation of protective soil/vegetation barriers. Approximately 2,500 residential properties and 300 commercial properties were remediated as part of this program. The human health remedy for OU 1, which was implemented by potentially responsible parties (PRPs), was certified complete in 2008.
- **OU 2:** Phased cleanup activities in OU 2 began in the early 1990s. The ROD for OU 2 (EPA, 1992) included actions to protect human health in the non-populated areas and common-use areas in the Bunker Hill Box through removals, source control, capping, and other measures. This ROD also included actions that complemented some of the OU 1 remedial activities (cleanup of rights of way [ROWs],[5] cleanup of commercial properties, and removal of house dust). The 1996 ROD Amendment for OU 2 (EPA, 1996b) changed the remedy for Principal Threat Materials (PTM)[6] from chemical stabilization to containment; the 2001 ROD Amendment for OU 2 (EPA, 2001d) addressed AMD issues. The two ESDs (EPA, 1996a, 1998b) clarified portions of the Selected Remedy for OU 2.
- Phase I source control actions in OU 2, as detailed in earlier decision documents, are largely complete. Phase I has included removal, containment, and consolidation of extensive contamination from various areas, capping of source areas, demolition of structures, and corresponding public health response actions. An evaluation of the effectiveness of the Phase I actions has been conducted along with studies to provide the basis for selecting, as part of this Upper Basin ROD Amendment, appropriate Phase II remedial actions to address long-term water quality issues.
- **OU 3:** Cleanup activities since the ROD for OU 3 was issued (EPA, 2002) have primarily focused on implementation of the Selected Human Health Remedy in community[7] and residential[8] areas. Prior to the 2002 ROD, limited removal actions in OU 3 were

[2] Barriers are used as components of the human health remedies selected for OUs 1, 2, and 3 to prevent human contact with contaminated materials.

[3] The ICP also provides education, sampling assistance, clean soil for small projects that need less than one cubic yard of material, pick-up of soil removed from small projects, and a permanent disposal location for contaminated soil generated Site-wide.

[4] A comprehensive list of the remedial and removal actions conducted specifically in the Upper Basin is provided in Table 2-1 in the Focused Feasibility Study (FFS) Report for the Upper Basin (EPA, 2012).

[5] ROWs are defined in the existing RODs as all state, county, local, and private roads.

[6] PTM are referred to in subsequent documents, including this Upper Basin ROD Amendment, as “Principal Threat Wastes” (PTWs).

[7] Community areas refer to public places, such as recreational areas, parks, town centers, and businesses.

[8] Residential areas refer to privately owned or occupied homes and property.

conducted by EPA and other entities including the SVNRT, USFS, IDEQ, and BLM. Implementation of the Selected Human Health Remedy for community, residential, and recreational areas in the Coeur d'Alene Basin outside the Box, presented in the ROD for OU 3, is ongoing. EPA received additional funding through the American Recovery and Reinvestment Act of 2009 to accelerate the implementation of remaining human health cleanup activities in OU 3. By the end of 2009 (as documented in the most recent Five-Year Review Report [EPA, 2010b]), nearly 2,600 residential properties and ROWs in OU 3 had been remediated and approximately 560,000 cubic yards of contaminated material had been removed as part of the Selected Human Health Remedy for OU 3. In addition, remedial actions were completed under the ROD for OU 3 at Upper Basin mine and mill sites with recreational use areas.

In addition to selecting a human health remedy for community, residential, and recreational areas within OU 3, the ROD for OU 3 selected an interim remedy for protection of the environment that focused on improving water quality, minimizing downstream migration of metal contaminants, and improving conditions for fish and wildlife populations. Because a conscious decision to prioritize human health actions was made, such actions were taken first and, consequently, most of the actions to protect the environment have not yet been implemented. However, EPA conducted actions at four mine and mill sites[9] that addressed recreational human health as well as ecological exposures. In addition, EPA worked with a willing private property owner, along with the U.S. Fish and Wildlife Service (USFWS) and Ducks Unlimited, Inc., to establish a clean wetland feeding habitat in the Lower Basin.

2.3 Site Investigation Activities and Studies Since 2002

Since the RODs for OUs 1, 2, and 3 were issued (and the ROD for OU 2 was last amended in 2001), data collection and pre-remediation studies have continued. Table 2-4 provides a summary of studies conducted in the Upper Basin from 2001 through 2011. The resulting information indicates that it is necessary to augment the established remedies to ensure continued protection of human health and the environment in the Upper Basin. In addition, information is now available with which to evaluate alternatives to protect and maintain the existing selected human health and ecological remedies for OUs 1 and 2 and the Upper Basin portion of OU 3. Key studies from Table 2-4 that have contributed to this body of information include:

- Additional investigation of surface water and groundwater quality and flow and the related fate and transport of dissolved metals in the Upper Basin, including monitoring (a) under the OU 3 Basin Environmental Monitoring Program (BEMP; EPA, 2004), (b) under the OU 2 Environmental Monitoring Program (EMP; CH2M HILL, 2006b), and (c) by the U.S. Geological Survey (USGS; Donato, 2006);
- The National Academy of Sciences' review of the ROD for OU 3 (NAS, 2005);

[9]The Sisters Mine Site on Canyon Creek, the Rex Mine and Mill Site on Ninemile Creek, the Constitution Mine and Mill Site on Pine Creek, and the Golconda Mine and Mill Site near Wallace.

- Detailed assessment of the effectiveness of Phase I remedial actions conducted in OU 2 (CH2M HILL, 2007c, 2008; TerraGraphics and Ralston Hydrologic Services, 2006);
- Post-remediation monitoring at the Golconda, Rex, Woodland Park, Success, and Constitution sites (all located within OU 3) as part of the Coeur d'Alene Basin Remedial Action Monitoring Program (CH2M HILL, 2009l);
- Development of a numerical groundwater flow model for the SFCDR Watershed (CH2M HILL, 2009d);
- Detailed assessments of the Bunker Hill Box and focused study of Bunker Creek, the Woodland Park area in the Canyon Creek Watershed, and the Osburn Flats area, including studies of groundwater-surface water interactions and characterization of aquifer properties (CH2M HILL, 2007b, 2009a through 2009c, 2009e, and 2009g through 2009k);
- Assessment of surface water and groundwater data collected under both high-flow and low-flow conditions in the SFCDR watershed (CH2M HILL, 2009f);
- Treatability testing of both active and passive treatment technologies in Canyon Creek and evaluation of passive technologies at the Success and Nevada Stewart mines (CH2M HILL, 2006b; McCloskey, 2005);
- Bench-scale experiments conducted by Idaho National Laboratory (INL) that have contributed to an improved understanding of the fate and transport of dissolved metals in the Upper Basin (INL, 2007, 2009); and
- Hydrologic and hydraulic modeling completed to define the portions of the protective barriers that are potentially at risk during storm events (see Appendix G in the Focused Feasibility Study [FFS] Report for the Upper Basin [EPA, 2012]).

In addition, the following investigations were conducted between the time EPA issued the Upper Basin Proposed Plan in 2010 (EPA, 2010a) and this ROD Amendment in 2012:

- During the summer of 2011, EPA conducted a Focused Characterization Sampling Program in the Upper Basin. The findings of this Program are documented in the FFS Report (EPA, 2012). The objective of the Program was to obtain characterization information on selected mine and mill sites in the Upper Basin to evaluate whether the sites should be retained in or removed from the Selected Remedy presented in this ROD Amendment.
- In keeping with EPA's adaptive management approach, pre-design investigation work was conducted in the Ninemile Creek drainage in the summer of 2011. Data collected during the investigation provided refined estimates of contaminated waste volumes at specific sites and helped to identify a location where a local waste consolidation area could be constructed. Site data and associated costs have been updated based on this new information. The FFS Report (EPA, 2012) documents and explains these changes.

2.4 History of CERCLA Enforcement Activities

The following is a brief history of the extensive CERCLA-related regulatory actions within the Bunker Hill Superfund Site.

- 1983—The Bunker Hill Mining and Metallurgical Complex is placed on the NPL.
- 1986—The State of Idaho settles a natural resource damage (NRD) claim against the mining companies for $4.5 million.
- 1991—The Bunker Hill Mining Company files for Chapter 11 bankruptcy. EPA subsequently resolved its claims against the Bunker Hill Mining Company as part of the bankruptcy proceedings.
- 1991—The Coeur d'Alene Tribe files an NRD lawsuit against Gulf Resources & Chemical Corporation, Pintlar Corporation, ASARCO, Inc. (ASARCO), Government Gulch Mining Company, Ltd, Federal Mining and Smelting Company, Hecla Mining Company (Hecla), Sunshine Mining Company (Sunshine Mining), Callahan Mining Corporation (Callahan), and Union Pacific Railroad Company (UPRR). That year, the Tribe settles with Callahan (prior to its merger with Coeur d'Alene Mines Corporation).
- July 1992—The Bunker Limited Partnership (BLP) files for Chapter 11 bankruptcy. EPA subsequently resolved its claims against BLP as part of the bankruptcy proceedings.
- 1994—Gulf Resources files for Chapter 11 bankruptcy. EPA subsequently resolved its claims against Gulf Resources as part of the bankruptcy proceedings.
- May 1994—EPA and the State of Idaho enter into a consent decree with the Upstream Mining Group (ASARCO, Coeur d'Alene Mines Corporation, Callahan, Hecla, Sunshine Precious Metals, and Sunshine Mining) for remedial work within the Bunker Hill Box.
- 1995—PRPs including UPRR and Stauffer Chemical sign a consent decree to implement remedial actions in OU 2, including:
  - Remediation of UPRR right of way through the Box (UPRR), and
  - Closure of A-4 gypsum pond (Stauffer Chemical).
- March 1996—The U.S. Department of Justice, on behalf of EPA, the U.S. Department of Agriculture, and the U.S. Department of the Interior, files a complaint in U.S. District Court for the District of Idaho against ASARCO, Hecla, Sunshine Mining, and Coeur d'Alene Mines Corporation, seeking:
  - Declaration of mining company liability for response costs outside the Bunker Hill Box, and
  - Payment of natural resource damages within and outside the Bunker Hill Box.

  The case filed by the United States is consolidated with a pending claim by Coeur d'Alene Tribe.

- September 1997—EPA and ASARCO sign an Administrative Order on Consent (AOC) for an engineering evaluation/cost analysis (EE/CA) to examine the use of wetland treatment systems to address mine adit discharge in Canyon Creek.
- 1998—EPA initiates a Remedial Investigation and Feasibility Study (RI/FS) for the Coeur d'Alene Basin outside the Bunker Hill Box.
- August 1999—EPA issues a Unilateral Administrative Order for removal action to address spillage of metal concentrates along the UPRR right of way.
- March 2000—EPA, USFS, and ASARCO sign an AOC for an EE/CA at the Jack Waite Mine Site in the watershed of the North Fork of Coeur d'Alene River.
- June 2000—The Ninth Circuit Court of Appeals vacates the decision by U.S. District Court that limited the scope of the NPL facility to the 21-square-mile Bunker Hill Box. The mining companies are given the opportunity to appeal, but do not do so. The decision confirms that the NPL facility includes all areas of the Coeur d'Alene Basin where mining contamination has come to be located.
- August 2000—U.S. District Court approves the consent decree between UPRR, the State of Idaho, the Coeur d'Alene Tribe, and the United States concerning the railroad right of way. A $30 million settlement provides for cleanup of mining contamination within the right of way and conversion of the right of way for use as a recreational trail, consistent with the federal Rails-To-Trails Act. The trail is operated by the State and the Tribe, and the cleanup will be maintained in perpetuity by funding from UPRR.
- January 2001—U.S. District Court approves the consent decree between Sunshine Mining, the United States, and the Coeur d'Alene Tribe. This consent decree resolved claims between Sunshine Mining and the United States and the Coeur d'Alene Tribe.
- May 2001—U.S. District Court approves the Consent Decree between the United States and defendants Coeur d'Alene Mines Corporation and Callahan. The settlement requires the defendants to submit payment of $3.9 million, conduct a removal action on Coeur's property, and transfer property to the United States.
- Between January and July 2001, the first phase of a trial regarding liability with ASARCO and Hecla as principal defendants is conducted in U.S. District Court in Boise, Idaho. In September 2003, the Court found the parties liable for U.S. response costs under CERCLA.
- 2008—A settlement for the Bunker Hill Box (OUs 1 and 2) is negotiated with ASARCO and approved and provided $6.8 million ($8.0 million with interest), resolving its outstanding liability within the Box under the 1994 consent decree.
- 2009—On March 13, the U.S. Department of Justice and ASARCO files the settlement agreement with the United States Bankruptcy Court for the Southern District of Texas Corpus Christi Division. On June 5, the Court approves the settlement agreement. The trust agreement associated with the Bunker Hill Superfund Site is filed with the Bankruptcy Court on December 9. As part of the bankruptcy settlement, over $573 million has been paid by ASARCO for further work at the Site: $494 million will be used for Superfund cleanup response actions, while $79.4 million will fund natural resource

restoration projects. An independent Work Trust has been established to manage the ASARCO settlement funds and complete cleanup approved by EPA. The funds will help EPA to complete additional cleanup within OU 3.

- 2010 through 2011—The United States settles CERCLA claims with 16 of 17 "de minimis" parties. These settlements will provide $7.6 million in cash payments that will be used for response actions and restoration activities in OU 3. These settlements also provide injunctive relief in the form of access, institutional controls, net smelter return payments, and/or cleanup work where appropriate.
- September 8, 2011—A consent decree is entered that resolves the claims against Hecla Mining Company. Under this settlement, Hecla will pay $263.4 million plus interest over a three-year period to the United States, the Coeur d'Alene Tribe, and the State of Idaho to resolve claims stemming from releases of wastes from its mining operations. $197 million of the recovery funds will be used for response actions at the Bunker Hill Superfund Site. The remaining amount will fund natural resource restoration projects and Coeur d'Alene Lake Management Plan activities.

SECTION 3.0

Community Participation

Community participation played an essential part in selection of the interim Selected Remedy for the Upper Basin. The Upper Basin spans a large geographic area that includes unique communities with diverse interests and points of view. Recognizing this, EPA provided a wide range of opportunities for people in the Upper Basin to learn about and participate in the remedy selection process. In its community participation activities, EPA complied with the specific CERCLA requirements for public participation in the ROD Amendment process.

3.1 Involving the Community

EPA's goals for the community involvement activities included ensuring the meaningful participation of interested and affected members of the community. The outreach activities were intended to provide timely, accurate information and opportunities for the local community to be involved in development of the Upper Basin Proposed Plan (EPA, 2010a) and FFS Report (EPA, 2012) and, ultimately, this ROD Amendment. Public interest in EPA's activities is high, and members of the public were actively involved in providing input.

From 2008 through 2012, EPA Project Managers attended approximately 75 meetings with local organizations, community leaders, and elected officials to provide information, discuss this ROD Amendment and the documents that preceded it, and encourage involvement in the decision-making process. Public workshops, meetings, open houses and site tours were hosted by EPA to provide a range of community involvement opportunities. The agency prepared fact sheets, news articles, responses to "Frequently Asked Questions", and other materials to help the public stay informed and involved. Materials were provided via regular mail, email, paid newspaper advertisements, and the Internet. EPA also created a ROD Amendment webpage where the public can find fact sheets, technical memoranda, meeting handouts and presentations, community involvement materials, draft documents, and other items related to the remedy selection process. This ROD Amendment and any subsequent decision documents will be posted on the webpage. In addition, EPA worked with the media to share updates and publicize opportunities for involvement in the ROD Amendment process. Community input helped shape the process and the content of technical documents and, ultimately, the Selected Remedy for the Upper Basin.

To encourage community participation in activities related to the Bunker Hill Superfund Site, EPA has collaborated with the Coeur d'Alene Basin Environmental Improvement Project Commission ("the Basin Commission") since its formation in 2001. The public is welcome to attend meetings held by the Basin Commission and its subgroups. EPA has provided updates about this ROD Amendment and the remedy selection process at each Basin Commission meeting beginning in October 2008. EPA has also worked with the Basin Commission's Citizens' Coordinating Council (CCC) and Technical Leadership Group (TLG) to share information and increase stakeholder involvement.

During the FFS for the Upper Basin (2008-2012), EPA met regularly with the Upper Basin Project Focus Team (PFT), a group focusing on technical issues related to cleanup. The PFT is a subgroup of the Basin Commission primarily composed of representatives from EPA, the State of Idaho, Shoshone and Kootenai Counties, BLM, USFWS, USFS, the Coeur d'Alene and Spokane Tribes, the State of Washington, and interested citizens. Participants changed from meeting to meeting and on occasion, representatives from the mining industry participated. EPA considered input from the Upper Basin PFT when remedial action alternatives were developed and evaluated during the FFS (as documented in the FFS Report [EPA, 2012]).

EPA continued to work with the PFT during development of this ROD Amendment and associated implementation planning. The PFT provided input that helped EPA evaluate individual site information and issues related to community and stakeholder interest. The PFT continues to work with EPA on implementation planning of remedial activities associated with the CERCLA cleanup of the Upper Basin.

3.2 Proposed Plan and Comment Period

The Proposed Plan for the Upper Basin was published for public comment in July 2010 (EPA, 2010a), and the public comment period ran from July 12 to November 23, 2010. The public was encouraged to review and comment on EPA's Preferred Alternative and on all the alternatives presented in the Proposed Plan, the Draft Final FFS Report for the Upper Basin (CH2M HILL, 2010), and documents available in the Administrative Record supporting this ROD Amendment, which incorporates by reference all Administrative Records developed for the Bunker Hill Superfund Site. An initial public comment period of 30 days is required by CERCLA for Proposed Plans; anticipating high public interest, EPA set the initial public comment period for the Upper Basin Proposed Plan at 45 days. In response to requests from the public for an extension, EPA extended the comment period an additional 90 days, for a total of 135 days. A fact sheet summarizing the Proposed Plan was mailed to about 1,000 Coeur d'Alene Basin residents. EPA also published newspaper advertisements in the *Coeur d'Alene Press*, the *Spokesman Review*, and the *Shoshone News Press* announcing the availability of the Proposed Plan, the comment period, and the associated public meeting (see below). In addition, EPA ran a series of display advertisements in local newspapers informing the communities about EPA's rationale for the Upper Basin Proposed Plan. EPA held a public meeting on August 4, 2010 at the Shoshone Medical Center Health and Education Center in Smelterville, Idaho, where EPA Project Managers gave a presentation about the Proposed Plan. Members of the public provided oral comments for the record. An open house was held just before the public meeting at the same location. Written comments were also accepted at the meeting and the open house. Transcripts are available for public review in local information repositories.

During the extended public comment period, EPA held two additional open-house workshops, attended numerous community meetings, and hosted a public bus tour of some of the sites addressed by the Proposed Plan. Throughout the comment period, EPA received comments via email, regular mail, and oral testimony. EPA also accepted oral comments that were submitted at two separate public meetings organized by Idaho elected representatives. (These meetings were in addition to those held by EPA and discussed above.) EPA's responses to all the comments received during this period are provided in Section 4.0 in Part 3 of this ROD Amendment, the Responsiveness Summary.

3.3 Administrative Record

As required by Section 300.825(a)(2) of the NCP, this ROD Amendment will become part of the Administrative Record supporting the Upper Basin Selected Remedy, which incorporates by reference all Administrative Records developed for the Bunker Hill Superfund Site, and will be available for public review at the following locations:

Molstead Library, North Idaho College
1000 Garden Avenue
Coeur d'Alene, Idaho 83814
Tel. 208-769-3355

Superfund Records Center, U.S. Environmental Protection Agency (EPA) Region 10
1200 6th Avenue (Suite 900)
Seattle, Washington 98101
Tel. 206-553-4494 or 800-424-4372

Kellogg Public Library
16 West Market Avenue
Kellogg, Idaho 83837
208-786-7231

Wallace Public Library
415 River Street
Wallace, Idaho 83873
208-752-4571

St. Maries Library
822 W. College Avenue
St. Maries, Idaho 83861
208-245-3732

Spokane Public Library
906 West Main Avenue
Spokane, Washington 99201-0976
509-444-5336

EPA's Coeur d'Alene Field Office
1910 Northwest Boulevard, Suite 208
Coeur d'Alene, Idaho 83814
208-664-4588

EPA's Website:
http://yosemite.epa.gov/r10/cleanup.nsf/sites/bh+rod+amendment
(or, http://go.usa.gov/igD)

SECTION 4.0

Scope and Role of the Selected Remedy

4.1 Overall Site Cleanup Plan

The Upper Basin Selected Remedy described in this ROD Amendment is consistent with the overall cleanup strategy for the Bunker Hill Superfund Site. The Selected Remedy is designed to provide significant improvements to soil, sediments, surface water, and groundwater, and to greatly reduce the risks posed to human health and the environment within the Upper Basin. These are essential steps in the cleanup of historical mining-related contamination in the broader Coeur d'Alene Basin and in the Bunker Hill Box.

The following is a summary of the overall cleanup strategy for the Bunker Hill Superfund Site. Specific activities included in the Upper Basin Selected Remedy are highlighted in **bold**:

- Residential, commercial, and gravel-right-of-way cleanup activities have been conducted in OU 1, the area of the most imminent public health threats when cleanup at the Site began, and were certified complete in 2008.
- Cleanup actions in OU 2 are being implemented in two phases. Phase I is mostly complete and has included removal, containment, and consolidation of extensive contamination from various areas, capping of source areas, demolition of structures, and corresponding public health response actions. **Phase II actions are included in the Selected Remedy and address long-term water quality.**
- Human health cleanup actions in OU 3 (both the Upper and Lower Basins), as selected in the 2002 ROD, are ongoing.
- **The Selected Remedy includes stormwater control actions to protect the existing portions of Selected Remedies focusing on human health in the Upper Basin (i.e., in OUs 1 and 2 and the Upper Basin portion of OU 3).**
- **The Selected Remedy selects specific cleanup actions for the Upper Basin, including the Bunker Hill Box. The Selected Remedy focuses on cleanup of the most significant[1] sources of contamination in the Upper Basin.**
- **The Selected Remedy will be implemented using an adaptive management approach in which new information will be evaluated and considered during the implementation of the Selected Remedy for ongoing optimization of remedial approaches—at both the site-specific and Upper Basin-wide levels.**
- **The actions included in the Selected Remedy are expected to result in the achievement of cleanup levels for soil and sediments where actions are taken. While**

[1] Section 14.0 of this Decision Summary discusses how actions were prioritized for inclusion in the Selected Remedy.

significant improvements are also anticipated for surface water and groundwater quality, the Selected Remedy is not expected to fully address surface water or groundwater contamination at all locations in the Upper Basin. Thus, the Selected Remedy is an interim rather than a final remedy. However, the Selected Remedy will address many significant sources of contamination in the Upper Basin and will attain a level of protection of human health and the environment that is commensurate with the scope of the Selected Remedy.

- The North Fork of the Coeur d'Alene River is being addressed under CERCLA by other (non-EPA) agencies, primarily USFS and IDEQ.
- The Lower Coeur d'Alene Basin is not within the scope of the Selected Remedy. However, the Upper Basin cleanup is expected to result in improved surface water quality and decreased contaminated sediment transport downstream in the Lower Basin. Thus, the Upper Basin cleanup is expected to complement cleanup activities in the Lower Basin by reducing the flow of contaminated materials and minimizing the potential for recontamination from the Upper Basin to the Lower Basin. Work in the Lower Basin is continuing with additional characterization and refinement of the conceptual site model and will likely include pilot projects. EPA continues to pursue data collection and analysis efforts in the Lower Basin to support the future development and evaluation of remedial alternatives. After these studies have been completed, EPA expects to select additional cleanup actions, subject to public comment, to address contamination issues in the Lower Basin.
- Because hazardous substances released upstream have flowed downstream and come to be located in Coeur d'Alene Lake, the Lake is part of the Bunker Hill Superfund Site, and specifically part of OU 3. However, a remedy for lake bed contamination has been deferred contingent on successful contaminant management through the State/Tribal Lake Management Plan (LMP).[2] The LMP's goal is to manage metals in contaminated lake bed sediments through a nutrient management plan as well as outreach and education with property owners related to the potential impacts of contaminated sediments on water quality in the Lake. The LMP has been written and adopted by the State of Idaho and the Coeur d'Alene Tribe but its implementation is in the initial phase. Continued water quality monitoring, especially with the implementation of remedial actions described in this Upper Basin ROD Amendment, will provide EPA, the State, and the Tribe with data to demonstrate the effectiveness of the LMP. EPA may re-evaluate its deferral of a remedy selection for the Lake considering these data and other relevant information. Although the Lake is outside the scope of this Upper Basin ROD Amendment, EPA continues to recognize the importance of protecting Coeur d'Alene Lake and as such is committed to working with interested parties to clarify metrics for determining the effectiveness and sufficiency of the LMP. EPA anticipates that these metrics for the LMP will be more fully defined in the context of assessing the overall protectiveness of selected remedies at the Bunker Hill Superfund Site as part of the next CERCLA-required Five-Year Review scheduled for 2015.

[2] Coeur d'Alene Lake is being managed by state, Tribal, federal, and local governments outside the Superfund process through revision and implementation of the *Coeur d'Alene Lake Management Plan* (Idaho Department of Environmental Quality [IDEQ] and Coeur d'Alene Tribe, 2009).

Figure 4-1 provides an overview of how the Selected Remedy for the Upper Basin relates to the overall cleanup strategy for the broader Bunker Hill Superfund Site.

4.2 Basis for this ROD Amendment

This ROD Amendment presents the Selected Remedy for the Upper Basin, an interim remedy that will protect human health and the environment in the Upper Basin within the context of its scope. The Selected Remedy also includes actions to protect portions of the existing Selected Remedies focusing on human health described in previous RODs.

Since the issuance of the previous RODs, ROD Amendments, and ESDs, considerably more knowledge about the Upper Basin has been gained from investigations and studies, groundwater modeling, research into groundwater-surface water interactions, and ecological studies (these efforts are summarized in Section 2.3). The Selected Remedy also addresses recommendations made by the NAS following its review of the ROD for OU 3 (NAS, 2005). The Selected Remedy provides a remedy for the Upper Basin that will:

- Aggressively address contaminant sources such as mine tailings, waste rock, and contaminated floodplain sediments;
- Improve surface water quality in the SFCDR and its tributaries; and
- Protect portions of existing Selected Remedies focusing on human health that are vulnerable to erosion and recontamination.

Development of the cleanup plan for the Upper Basin followed a systematic process, in accordance with the NCP, for the analysis of potential remedial actions and remedy protection measures and ultimate identification of a Selected Remedy. Sections 4.2.1 and 4.2.2 describe the current status of the existing Selected Human Health and Ecological Remedies, respectively, for OUs 1, 2, and 3 and why modification of these remedies is appropriate.

4.2.1 Status of the Existing Human Health Remedies

The Selected Remedy for OU 1, which focused on protection of human health and was implemented by PRPs, was certified complete in 2008. Implementation of Phase I of the portion of the Selected Remedy for OU 2 that is focused on protection of human health is largely complete. Implementation of the Selected Human Health Remedy for OU 3 in community and residential areas in the Coeur d'Alene Basin (exclusive of the Bunker Hill Box) is ongoing. EPA and IDEQ are developing an approach under the existing RODs to address paved roads as barriers for protection of human health collaboratively with local, county, and state entities responsible for providing and maintaining roadways in their communities.

Periodic reviews conducted to date show that the portions of the existing remedies focusing on protection of human health for OUs 1, 2, and 3 have functioned as designed and are protective of human health. In particular, Superfund cleanup actions have resulted in significant and well-documented declines in children's blood lead levels, as measured by blood lead concentrations within the communities where cleanup actions have been implemented (EPA, 2000a, 2000b, 2005, and 2010b). As noted previously, an Institutional

Controls Program (ICP) has been established to provide a locally enforced set of rules and regulations to maintain the integrity of installed barriers and to ensure that new barriers are installed during redevelopment that may occur within the administrative boundary of the ICP.

At the same time, EPA is aware of certain circumstances that have the potential to adversely affect the successful long-term protection of the portions of existing Selected Remedies focusing on human health (as well as the portions of existing Selected Remedies focusing on ecological receptors) for the OUs. In general, the circumstances of concern are associated with overland water flow from high-precipitation events and tributary flooding that erode clean barriers and/or deposit contaminated sediments in clean areas. Clean barriers have been installed to prevent exposure to mining- and smelting-related contaminants through direct contact, and long-term maintenance of these barriers is a key component of the portions of existing Selected Remedies focusing on human health. Some components of the existing surface water conveyance infrastructure in Upper Basin communities serve to protect the clean barriers. Although some communities have sought resources to improve their water conveyance systems, available resources often are not sufficient to safeguard the remedies that have been implemented for protection of human health and the environment.

Protection of human health continues to be a vital part of EPA's work at the Bunker Hill Superfund Site. EPA has therefore evaluated drainage issues in Upper Basin communities and circumstances that may erode or degrade clean barriers and/or recontaminate clean areas. This evaluation led to actions included in the Selected Remedy that will ensure long-term protectiveness of the portions of the existing Selected Remedies focusing on human health for OUs 1 and 2 and the Upper Basin portion of OU 3.

This approach to remedy protection is consistent with EPA's adaptive management approach to the Bunker Hill Superfund Site, which involves identifying and evaluating remedy modifications where necessary and making adjustments to the cleanup approach (through design, implementation, or decision documents, as appropriate) when needed based on new information.

4.2.2 Status of the Existing Ecological Remedies

There is no ecological remedy for OU 1 because the focus of the Selected Remedy for OU 1 was on human health. The Selected Ecological Remedy for OU 2 is being implemented by EPA and IDEQ using a phased approach, which was developed by these agencies following the bankruptcy of the major PRP for the Bunker Hill Box in 1994. A Comprehensive Cleanup Plan developed as part of the 1995 State Superfund Contract (SSC) for OU 2 (EPA and Idaho Department of Health and Welfare [IDHW], 1995) defined the phased path forward for remedy implementation at OU 2. Since then, two ROD Amendments (EPA, 1996b, 2001d) and two ESDs (EPA, 1996a, 1998b) have been issued for OU 2. The 1996 ROD Amendment changed the remedy for Principal Threat Materials (PTM)[3] from chemical stabilization to containment. The 2001 ROD Amendment addressed AMD issues within OU 2. To date, EPA and the State of Idaho have not concluded negotiations on an SSC amendment that would

[3] PTM are referred to in subsequent documents, and in this Upper Basin ROD Amendment, as "Principal Threat Wastes" (PTWs).

allow for full implementation of the 2001 ROD Amendment. The two ESDs clarified portions of the Selected Remedy for OU 2.

Phase I work at OU 2 is largely complete. The focus was on remedial actions aimed at removal and consolidation of extensive contamination from various areas, demolition of structures, and development and implementation of an ICP for OUs 1 and 2 guiding future land use development and public health response actions. Phase I work also included support of studies for long-term water quality improvement and evaluation of the effectiveness of the source removal, containment, and surface capping completed as part of Phase I remedial actions in OU 2. The latter evaluation is documented in the *Phase I Remedial Action Assessment Report, Operable Unit 2* (CH2M HILL, 2007c), the *Final Phase I Remedial Action Characterization Report for the Bunker Hill Mining and Metallurgical Complex Superfund Site OU2* (TerraGraphics and Ralston Hydrologic Services, 2006), and the *Source Areas of Concern Report, Operable Unit 2* (CH2M HILL, 2008). The evaluation set the stage for the Phase II activities at OU 2 that will be conducted as part of the implementation of the Upper Basin Selected Remedy. Phase II is generally intended to augment Phase I and will specifically address long-term water quality.

For OU 3, the Selected Ecological Remedy presented in the 2002 ROD was an interim remedy based upon a prioritized subset of the numerous actions included in Ecological Alternative 3 in the *Final (Revision 2) Feasibility Study Report, Coeur d'Alene Basin Remedial Investigation/Feasibility Study* (2001 FS Report; EPA, 2001c). Both Ecological Alternatives 3 and 4 in that FS Report included NCP-compliant remedial actions and provided a foundation upon which to develop the Selected Remedy for this ROD Amendment. The 2002 interim remedy for protection of the environment in OU 3 focused on improving water quality, minimizing downstream migration of metal contaminants, and improving conditions for fish and wildlife populations. Because a decision to prioritize human health actions resulted in implementation of those actions first, most of the actions to protect the environment have not yet been implemented. However, to the extent that funding was available, EPA has conducted actions at mine and mill sites that addressed recreational human health as well as ecological exposures. The remedial actions in OU 3 included in the Upper Basin Selected Remedy supersede those that were included in the 2002 interim remedy for protection of the environment.

The Upper Basin Selected Remedy, as presented in this ROD Amendment, includes actions that will update, modify, and add to the previous cleanup plans for the Upper Basin described in the RODs for OUs 1, 2, and 3 and related decision documents.

4.3 Scope of the Selected Remedy

The following sections describe the geographic and technical scope of the Selected Remedy for the Upper Basin.

4.3.1 Geographic Scope

The SFCDR Watershed occupies about 300 square miles of land surface in the Panhandle of northern Idaho, including 45 river miles along the SFCDR. As noted previously, the Upper Basin geographic area addressed by the Selected Remedy in this ROD Amendment includes areas of mining-related contamination along the SFCDR and its tributaries downstream to one mile west of the confluence of the South and North Forks of the river, to include the town of Kingston. The Upper Basin is primarily located in Shoshone County, Idaho, and contains OUs 1 and 2 (the Bunker Hill Box) and the eastern portion of OU 3. The decision to include the Bunker Hill Box in the Upper Basin Selected Remedy was consistent with NAS recommendations (NAS, 2005) to reduce technical issues regarding the implementation of remedies for protecting ecologic health downstream of the Box.

The Upper Basin is the primary source area for most of the mining-related waste materials present in the Coeur d'Alene Basin; therefore, within the Upper Basin, elevated concentrations of metals are present in waste piles, stream beds, and floodplains primarily from the discharge or erosion of mill tailings and other mine-generated wastes into rivers and streams. The SFCDR and many of its tributaries have undergone extensive channelization and additional alterations as a result of mining-related activities and other anthropogenic activities, including the construction of Interstate 90 (I-90).

As previously noted, the Lower Coeur d'Alene Basin (also within OU 3) is not included in this Selected Remedy, although water quality improvements resulting from Upper Basin cleanup actions will improve surface water quality in the Lower Basin and result in reduced transport of metals there. The primary focus of remedial actions implemented to date in the Lower Basin has been human health-focused cleanup actions (in residences, recreational areas, and other common-use areas) and a clean waterfowl feeding area project. Work in the Lower Basin is continuing with additional characterization and refinement of the conceptual site model and will likely include pilot projects. EPA continues to pursue data collection and analysis efforts in the Lower Basin to support the future development and evaluation of remedial alternatives. After these studies have been completed, EPA expects to select additional cleanup actions, subject to public comment, to address contamination issues in the Lower Basin.

In addition to the Lower Basin, other areas not within the geographic scope of the Selected Remedy are:

- The North Fork of the Coeur d'Alene River is being addressed under CERCLA by other (non-EPA) agencies, primarily USFS and IDEQ;
- Coeur d'Alene Lake, which is being addressed outside the Superfund process by state, Tribal, federal, and local governments through revision and implementation of the Coeur d'Alene Lake Management Plan (IDEQ and the Coeur d'Alene Tribe, 2009); and
- Dispersed recreational areas along the Spokane River, where the State of Washington is implementing remedial actions under the 2002 ROD for OU 3 (EPA, 2002).

4.3.2 Technical Scope

The Selected Remedy is focused on remedial actions that will reduce risks to human health and the environment that are present in the Upper Basin as a result of mining-related contamination. This decision document selects an interim remedy for the Upper Basin. Actions selected in the previous RODs are not modified and continue to be required by those RODs unless expressly modified herein. The Selected Remedy includes remedial actions within the Bunker Hill Box and elsewhere along the SFCDR and its primary tributaries. The Selected Remedy defines OU 2 Phase II cleanup actions[4] to address ongoing water quality issues. The Selected Remedy replaces the Upper Basin portion of the interim ecological actions selected in the ROD for OU 3 (EPA, 2002) with a subset of remedial actions from Alternative 3+, as described in this ROD Amendment. The Selected Remedy does not replace human health remedies selected in the 2002 ROD for OU 3, nor does it replace previously selected remedial actions for the Lower Basin. The Selected Remedy also includes remedy protection actions to protect existing human health remedies that have been implemented in OUs 1, 2 and 3.

Many complex and interwoven factors contribute to the overall risks in the Upper Basin, and not all of these factors are directly addressed by the alternatives described and evaluated in the FFS Report (EPA, 2012). As described in detail in Section 12.0 of this Decision Summary, following public and stakeholder comments on EPA's Preferred Alternative presented in the Upper Basin Proposed Plan (EPA, 2010a), EPA has reduced the scope of the Selected Remedy.

Factors that are beyond the technical scope of the Selected Remedy include achievement of surface water and groundwater cleanup levels throughout the Upper Basin; SFCDR and Pine Creek flood control; and contaminated materials beneath paved roadways and communities. Each of these factors is discussed below.

- The remedial actions included in the Selected Remedy address risks from contaminated soil, sediments, surface water, and groundwater. The actions included in the Selected Remedy are expected to result in the achievement of cleanup levels for soil and sediments where actions are taken. The Selected Remedy is also expected to result in significant improvements to surface water quality in the Upper Basin and is expected to achieve ambient water quality criteria (AWQC) applicable or relevant and appropriate requirements (ARARs) under the Clean Water Act at many locations; however, the Selected Remedy may not achieve these AWQC ARARs at all locations. Furthermore, the Selected Remedy is expected to result in significant improvements to groundwater quality; however, given the extensive subsurface contamination that will remain in place, the remedy is not intended to achieve groundwater maximum contaminant level (MCL) (ARARs under the Safe Drinking Water Act) throughout the Upper Basin. EPA will evaluate future monitoring data to determine whether additional actions are needed or would be effective in meeting drinking water standards and AWQC. If further actions would not be effective, EPA may evaluate whether a Technical Impracticability (TI) waiver is warranted at specific locations where groundwater and surface water do not achieve drinking water standards and AWQC, respectively.[5]
- Upper Basin residents are justifiably concerned about the potential for SFCDR or Pine Creek flood damage in their communities. EPA and IDEQ have incorporated localized drainage control projects into the Selected Remedy to enhance the long-term

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[4] The OU 2 ROD (EPA, 1992) identified source control actions (referred to in this document as Phase I cleanup actions) for OU 2. This ROD Amendment identifies the Phase II cleanup actions for OU 2, which focus on groundwater collection and treatment.

[5] Specific ARARs can be waived if appropriately justified [40 CFR 300.430(f)(1)(ii)(C)].

protectiveness of the existing remedies, but potential damage to portions of the remedy from major flooding of the SFCDR or Pine Creek has not been addressed at this time. EPA has the responsibility to ensure the long-term protectiveness of CERCLA remedies. However, comprehensive flood control is a complex multi-jurisdictional issue that is beyond the regulatory authority of EPA's cleanup program. EPA understands that local communities are concerned about flooding issues. EPA has, therefore, committed to work with local, state, and federal entities with an interest in SFCDR and Pine Creek flooding issues to help develop solutions. EPA can and will contribute to certain work to understand SFCDR and Pine Creek flooding issues and may select actions, consistent with EPA's authority, that complement broader flood control measures.

- The RODs for OUs 1, 2, and 3 address cleanup of rights of way (ROWs) in the Bunker Hill Box and the Coeur d'Alene Basin, as appropriate, to respond to risks to human health. The RODs allow ROWs to be cleaned up such that they provide barriers to underlying metals contamination. Many ROWs have been cleaned up as residential and commercial properties have been remediated in Box and Basin communities. However, EPA recognizes that some pre-existing paved roadways may not provide adequate long-term barriers to underlying contaminated materials, and that local and state entities are responsible for the long-term road development and maintenance efforts. As a result, EPA and IDEQ are developing an approach under the existing RODs to address this issue collaboratively with local, county, and state entities responsible for providing and maintaining roadways in their communities. The objective of this effort is to develop and implement a strategy that ensures the long-term effectiveness of barriers installed in ROWs, and also aligns with the transportation and maintenance needs of the Box and Basin communities. These actions are not part of the Selected Remedy described in this ROD Amendment.

4.4 Significant Differences Between the Existing Selected Remedies and the Upper Basin Selected Remedy

Table 4-1 provides a summary of the Selected Remedy for the Upper Basin as it applies to each OU. Tables 4-2 through 4-4 summarize the existing remedies selected in the 1991 ROD for OU 1 (EPA, 1991a), the 1992 ROD for OU 2 (EPA, 1992, as amended in 1996 [EPA, 1996b] and 2001 [EPA, 2001d]), and the 2002 ROD for OU 3 (EPA, 2002). These tables also indicate whether each previously selected action (1) has been completed or is in process; (2) will be or potentially will be completed in the future; or (3) is replaced by actions included in the Upper Basin Selected Remedy. The following sections summarize the differences between the existing selected remedies for the three OUs and the Selected Remedy for the Upper Basin.

4.4.1 Operable Unit 1

The existing Selected Remedy for OU 1 (EPA, 1991), which focused on protection of human health, was certified complete in 2008. The Upper Basin Selected Remedy (the remedy selected in this ROD Amendment) supplements the existing Selected Remedy for OU 1 by including localized drainage improvement actions that will protect those portions of the existing remedy that are in areas at risk from localized tributary flooding and heavy precipitation. As noted previously, there is no existing ecological remedy for OU 1.

4.4.2 Operable Unit 2

The existing Selected Remedy for OU 2 (EPA, 1992) identified OU 2 Phase I source control actions that have largely been completed. Implementation of the remainder of the existing Selected Remedy will continue in accordance with previous decision documents. Implementation of the portions of the existing Selected Remedy for OU 2 focusing on protection of human health is also largely complete. The Upper Basin Selected Remedy selected in this ROD Amendment supplements the existing Selected Remedy for OU 2 by including localized drainage improvement actions that will protect those portions of the existing remedy that are in areas of risk from localized tributary flooding and heavy precipitation.

The Upper Basin Selected Remedy selects cleanup actions to address ongoing water quality issues in OU 2. These actions include managing the contaminated discharge from the Reed and Russell Adits, reducing the flow of contaminated groundwater to the SFCDR, and collecting and treating contaminated groundwater.

Some remedial actions included in previous decision documents for OU 2 have not yet been implemented and are not modified by the Selected Remedy described in this Upper Basin ROD Amendment. These actions are identified in Table 4-3.

4.4.3 Operable Unit 3

As indicated in Table 4-4, implementation of the existing Selected Human Health Remedy for OU 3 is ongoing and will be completed in accordance with previous decision documents. The Upper Basin Selected Remedy described in this ROD Amendment supplements the existing Selected Human Health Remedy for OU 3 by including actions that will protect the existing remedy.

In contrast to the existing Selected Human Health Remedy for OU 3, relatively few elements of the existing Selected (interim) Ecological Remedy have been implemented (see Table 4-4). The existing Selected Ecological Remedy for OU 3 is based on a prioritized subset of the actions included in Alternative 3 in the 2001 FS Report (EPA, 2001c). These actions were intended to constitute a first, albeit significant, step towards cleanup of the broader Coeur d'Alene Basin outside the Bunker Hill Box (OUs 1 and 2). The Selected Remedy described in this ROD Amendment replaces the Upper Basin portion of the interim ecological actions selected in the ROD for OU 3 (EPA, 2002) with a subset of remedial actions from Alternative 3+, as described in this ROD Amendment. The Selected Remedy does not replace the human health remedy selected in the 2002 ROD for OU 3, nor does it replace previously selected remedial actions for the Lower Basin.

SECTION 5.0

Site Characteristics

This section discusses the nature and extent of contamination and contaminant fate and transport in the Upper Basin. Information provided in this section is based on the work documented in the 2001 RI and FS Reports (EPA, 2001b, 2001c), the 2002 ROD for OU 3 (EPA, 2002), the Upper Basin Proposed Plan (EPA, 2010a), and the FFS Report for the Upper Basin (EPA, 2012), and incorporates additional investigation/study information and monitoring data obtained since the 2002 ROD for OU 3 was issued. Specific sources of data used in the analysis of nature and extent of contamination include the BEMP for OU 3 (EPA, 2004), the EMP for OU 2 (CH2M HILL, 2006a), the Coeur d'Alene Basin Remedial Action Monitoring Program (CH2M HILL, 2009l), USGS gauging station data as reported on the USGS website, and the results of discrete sampling events.

In January 2002, EPA began working with Coeur d'Alene Basin stakeholders to collaboratively develop a long-term environmental monitoring program. Organizations initially involved with EPA in development of the monitoring program included IDEQ, the Washington Department of Ecology, the Coeur d'Alene and Spokane Tribes, USFWS, USGS, and BLM. Media-specific workgroups were also established to focus on the specific monitoring needs regarding surface water, soil/sediments, biota, and Coeur d'Alene Lake. The larger group and the smaller working groups have participated in numerous discussions, teleconferences, and meetings to discuss the formulation of the environmental monitoring program. Monitoring and site characterization will continue and will be used to inform the implementation of the Selected Remedy. Monitoring and additional data needs are described in Section 12.4 of this Decision Summary.

5.1 Conceptual Site Model

A comprehensive conceptual site model (CSM) of the Coeur d'Alene Basin was developed as part of the RI/FS for the Basin to convey a summary of the sources of contamination, mechanisms of contaminant release, pathways of contaminant release and transport, and the ways in which humans and ecological receptors are exposed to contaminants (CH2M HILL, 2000). A summary of the CSM for the Coeur d'Alene Basin was included in the 2001 RI Report (EPA, 2001b). Even with the amount of cleanup activities that have occurred at the Bunker Hill Superfund Site, as documented in Section 2.2 of this Decision Summary, there is little to no change to the original CSM developed in 2000 because of the magnitude of remaining waste sources that still require cleanup.

However, EPA's understanding of the CSM for the Upper Basin has evolved by synthesizing results from previous studies, data collection, and assessment of ongoing remedial actions (see Section 2.3 and Table 2-4 of this Decision Summary for details). Elements of the updated CSM for OU 2 that was developed in 2006 (CH2M HILL, 2006e) have also been incorporated into the CSM for the Upper Basin. A simplified sketch of the CSM for the Upper Basin is presented in Figure 5-1.

The following sections provide current information related to the nature and extent of contamination and the fate and transport of contaminants in the Upper Basin.

5.2 Nature and Extent of Contamination

The long history of mining activities within the Upper Basin, combined with the dynamic and complex hydrologic system and anthropogenic modifications to that system, have resulted in widespread and commingled sources of contamination. Mine waste sources and locations, as well as the distribution and character of related contaminants, are discussed below.

5.2.1 Sources and Locations of Mining Wastes

Contaminant sources, as identified by BLM and others, are widespread in the Upper Basin, extending up nearly every drainage area (EPA, 2001b, 2001c). Many of these sources are not discrete locations, but rather diffuse areas where sources extend along river and creek segments. This is due in part to historical mining practices that resulted in direct discharge of tailings from mining operations to the SFCDR and its tributaries, which did not completely cease until 1968.

Contaminated media that potentially affect human health and the environment include surface water, soil, sediments, and groundwater. During development of the 2001 FS Report (EPA, 2001c), the contaminated media were grouped by *source type* to help characterize the nature and extent of contamination and develop remedial alternatives. These contaminant source types, based on the mining-related primary sources and secondary sources, with estimated volumes (for the Upper Basin portion of OU 3), are as follows.

- Primary sources:
  - Tailings: 11 million cubic yards
  - Waste rock: 11.7 million cubic yards
  - Adit drainage: 101 pounds of zinc per day
- Secondary sources:
  - Contaminated shallow floodplain sediments: 7.1 million cubic yards
  - Deeper floodplain sediments, road and railroad fill and embankments: 4 to 20 million cubic yards

A significant amount of remediation work has been conducted in the Bunker Hill Box since OU 2 Phase I remedial actions began in 1995. More than 3.3 million cubic yards of contaminated wastes have been removed from the Box and consolidated onsite in engineered closure areas (the Smelter Closure Area [SCA] and Central Impoundment Area [CIA]). The use of geomembrane cover systems in these closure areas effectively prevents the exposure of human and ecological receptors to the contaminated wastes. Consolidating these wastes in engineered closure areas has also substantially reduced the exposure pathways to surface water and groundwater compared to pre-remediation conditions. However, because of EPA's commitment not to displace local communities, a significant amount of contamination still remains beneath the surface in the Bunker Hill Box that is not accessible for removal.

Known source areas and approximate volumes of tailings produced within the different areas of the Upper Basin are summarized in Table 5-1. Significant contamination is present beneath developed areas within and outside the Box. For the same reason as for developed areas within the Box, these materials are not readily accessible for removal.

Since at least the 1920s, a number of actions have been taken to control the movement of tailings in the SFCDR and its tributaries. The historical construction and subsequent breaching of dams in these local rivers and streams have played a significant role in the placement of mining wastes in the Upper Basin and the creation of secondary sources (e.g., floodplain and riverbed sediments). Under the auspices of the Mine Owners Association, the largest mining companies built dams of wood pilings and planks in the early 1900s; the intent was to impound tailings along Canyon Creek and the SFCDR. The Canyon Creek dam near Woodland Park, the Osburn dam on the SFCDR near Osburn, and the Pinehurst dam on the SFCDR near Pinehurst were manmade structures that created large deposits of tailings, especially coarse tailings. Subsequent floods, especially in late 1917, damaged the wood plank dams at Woodland Park and Osburn, and the Mine Owners Association did not make necessary repairs. Meanwhile, millions of tons of tailings had built up on the floodplains above the dams. The dams were breached by flooding and high flows multiple times, resulting in large quantities of contaminated mine wastes being transported downstream to other parts of the Upper Basin and, more significantly, to the Lower Basin. These dams remained in place for decades and, while the dams are now gone, large quantities of tailings remain that continue to be transported downstream during flood events.

Methods used by mining companies to process and store tailings evolved over time as follows:

- During the 1920s, portions of the jig tailings[1] in some of the impoundments were recovered and processed using the flotation method.
- From the 1940s to the 1960s, significant quantities of metals were recovered from the old tailings deposits using a modified "sink-float" method. Despite these reprocessing activities, many tailings with high metals content were left in place along the streams.
- Between 1933 and 1967, approximately 34.5 million tons of mixed alluvium and tailings were dredged from the lower Coeur d'Alene River (not within the Upper Basin) and deposited on floodplains in an area covering more than 2,000 acres.
- Beginning in 1926, some permanent impoundments were created to store mining wastes. The largest of these was the CIA, which began operation in 1928 as an unlined repository for flotation tailings from the Bunker Hill ore concentration mills. Over time,

[1] The first mills used large stamps that pulverized the ore and jig tables that separated the heavier silver- and lead-rich portions from the "worthless" portion called jig tailings. Jig tailings were coarse-grained (up to 3 inches in diameter), and were typically disposed of in floodplains or stream channels. This process was not efficient, and the tailings contained high quantities of recoverable metals by today's standards. In particular, the jig processing method did not allow for economically viable separation of zinc, which jig tailings contained in abundance.

the CIA developed into an approximately 200-acre impoundment for tailings, mine wastes, gypsum, slag, other process wastes, and water and AMD from the Bunker Hill Mine.

- As part of the OU 2 Phase I remedial actions, approximately 2 million cubic yards of mine wastes were placed and graded in the CIA. The top of the CIA was capped with a low-permeability geomembrane cover system except for the CTP sludge disposal cell. The cap substantially reduces infiltration of water into underlying tailings, thereby reducing metals migration to underlying groundwater and nearby surface water.
- Other large impoundments include the Page Impoundment in the western portion of OU 2 (approximately 85 acres), the Osburn Tailings Impoundment (approximately 60 acres), the Sunshine Impoundment in Big Creek (approximately 55 acres), and the Hecla-Star Tailings Impoundment in Woodland Park (approximately 62 acres).

Despite the methods described above to re-process and control tailings and other mine wastes, these materials continue to be widespread in the Basin and contribute to metals loading in the SFCDR, its tributaries, and the Lower Basin of the Coeur d'Alene River.

5.2.2 Types of Contamination and Affected Media

The contaminants of concern (COCs[2]) for the Upper Basin include arsenic, cadmium, lead, mercury, and zinc, with cadmium, lead, and zinc affecting environmental media in the Upper Basin (soil, sediments, surface water, and groundwater). Contaminant releases within the Upper Basin are driven primarily by the movement of surface water and groundwater within the environmental system. Dissolved zinc in surface water and groundwater and total (or particulate) lead in surface water are used as indicators to identify potential contaminant sources having negative effects on water quality in the SFCDR and its tributaries; other COCs have been discussed in detail in previous documents (EPA, 2001b, 2001c).

EPA conducted extensive analyses and evaluations of background conditions as part of the RI/FS for the Coeur d'Alene Basin (EPA, 2001b, 2001c). These analyses and evaluations conclusively demonstrated that the dominant source of metals is mining-related activities, not natural sources. A comprehensive analysis of background concentrations, representing more than 10,000 samples, can be found in the *Final Technical Memorandum (Rev. 3): Estimation of Background Concentrations in Soil, Sediment, and Surface Water in the Coeur d'Alene and Spokane River Basins* (URS Greiner, 2001). Because metal concentrations are naturally variable, the analysis quantified the range of background concentrations for each metal and selected the 90th percentile for soil and sediment and the 95th percentile for surface water as the representative background concentrations. The background concentrations identified for the Upper Basin represent the most mineralized conditions. The background soil/sediment and surface water metal concentrations are far below (small fractions of) the existing concentrations in the mining-impacted media targeted for cleanup.

[2] COCs are those chemicals that are identified as threats to human health or the environment based on risk assessment results, and which need to be addressed by the remedial actions included in the Upper Basin Selected Remedy.

Dissolved zinc is considered an appropriate indicator for dissolved metals in surface water and groundwater because it occurs at the highest concentrations; it is relatively mobile compared to other metals; and dissolved metals (particularly cadmium) appear well correlated with dissolved zinc throughout the Upper Basin (EPA, 2001c). Zinc is widely distributed in the environment, and SFCDR site-specific AWQC for zinc are exceeded throughout the Upper Basin, generally at levels toxic to aquatic organisms. The sulfide mineral sphalerite is the primary mineral form of zinc. As one of the most mobile of the heavy metals, zinc is readily transported in most natural waters and can occur in both suspended and dissolved forms in surface water.

Lead is used as an indicator for total metals for the Upper Basin because it is found in nature as a component of various minerals (for example, galena, cerussite, and anglesite). Lead is a stable metal in most environments and generally shows a very limited solubility; therefore, a significant fraction of the lead that is present in the SFCDR and its tributaries is expected to be in an undissolved form, as particulate lead. Total lead is considered representative of suspended metals in surface water.

5.3 Contaminant Fate and Transport

Contaminant fate and transport information provided in this section for Upper Basin surface water and groundwater is based on the additional studies conducted and data collected since the RI/FS for the Coeur d'Alene Basin was completed (EPA, 2001b, 2001c) and the ROD for OU 3 was issued (EPA, 2002). Surface water monitoring has shown that the SFCDR and its tributaries are the source of the majority of the dissolved zinc in the Coeur d'Alene River at Harrison, the downstream point in the Lower Basin where the Coeur d'Alene River enters Coeur d'Alene Lake. While the OU 2 Phase I cleanup actions have reduced the contribution of dissolved metals, there continues to be substantial metals loading via groundwater-surface water interaction as the SFCDR passes through the Bunker Hill Box. In the Upper Basin, contaminant fate and transport are affected by the following:

- The physical setting, which dictates the movement and interaction of surface water and groundwater;
- The physical and chemical properties of the COCs present; and
- Sources and mechanisms for releases of contaminants to surface water and groundwater.

The following sections discuss surface water and groundwater quality and trends and the impact of groundwater on surface water in the key alluvial areas in the Upper Basin (Woodland Park, Osburn Flats, and the Bunker Hill Box).

5.3.1 Surface Water Quality

For the FFS analyses (EPA, 2012), Upper Basin surface water quality was evaluated with data gathered from multiple surface water monitoring locations, shown in Figure 5-2.

Extensive monitoring of the Upper Basin has been conducted, beginning in the late 1980s and continuing to the present time. This has included data collection for the RI/FSs for OUs 1 and 2 (in the Bunker Hill Box) and OU 3. Additional monitoring data have been collected as part of the OU 2 EMP (CH2M HILL, 2006a) and the OU 3 BEMP (EPA, 2004) (focused on evaluating long-term trends), the Coeur d'Alene Basin Remedial Action Monitoring Program (CH2M HILL, 2009l) (assessing the effects of remedial actions in specific areas), and site-specific studies (such as evaluating water quality during high-flow and low-flow conditions, groundwater-surface water interactions, and daily changes in stream chemistry).

Site-specific AWQC for cadmium, lead, and zinc for ecological protection of the SFCDR Watershed were developed by the State of Idaho (Idaho Administrative Procedures Act [IDAPA] 58.01.02.284) and have been adopted by EPA. Reference to AWQC in this ROD Amendment refers to these standards. For evaluating dissolved zinc as an indicator of surface water quality, site monitoring data were used to calculate site-specific AWQC ratios.

The AWQC ratio is the concentration of a chemical in surface water divided by the AWQC for that chemical. An AWQC ratio of one or less indicates that the water quality criteria are met. The AWQC ratios are less variable than measured concentrations or calculated loads, and are not correlated with surface water flow rates except at very high rates, such as during peak runoff in the spring (EPA, 2004). AWQC are based on measured or calculated hardness, which varies by location and sampling event.[3] Because hardness varies by sampling location and the conditions during sampling, calculated AWQC for dissolved zinc are sample-specific.[4]

Figure 5-3 shows the distribution of zinc AWQC ratios at selected locations for different key time periods. The locations were selected because they enable a focused analysis of Upper Basin conditions and provide the most robust datasets for evaluating long-term trends. The different time periods are defined as 1987-1995, 1995-2002 (during which time several significant remedial actions were undertaken), and from 2002 to 2008. Figure 5-3 uses box plots (in the upper portion of the figure) to group the data by each time period for each location, and scatter plots (below the box plots) to show the general trends over time. Both the box plots and the scatter plots generally show decreasing zinc AWQC ratio trends over time. These results are consistent with previous studies, such as those conducted by USGS (Donato, 2006). The improvements are due to remedial actions completed in the Upper Basin, including OU 2 Phase I remedial actions (which comprised the majority of remedial actions completed during 1995-2002), work conducted in Canyon and Ninemile Creeks by BLM and the SVNRT, and some degree of natural recovery.

The box plots and scatter plots also show the variability in the zinc data between locations and over time, which is consistent with the complexity of the interactions between upland sources, floodplain contaminated sediments, groundwater, and surface water, and how remedial actions affect those interactions.

Figure 5-4 shows the maximum zinc AWQC ratios for surface water data collected from October 2002 to 2008 (following the time when several significant remedial actions were undertaken), and includes locations throughout the Upper Basin. The intent of this figure is

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[3] The site-specific chronic AWQC for zinc is a function of water hardness and is calculated using the following formula: $AWQC = e^{(0.6624 * \ln(hardness) + 2.2235)}$.

[4] For evaluating AWQC and AWQC ratios, surface water grab samples that have been analyzed for dissolved metals, including calcium and magnesium, are used to calculate sample-specific hardness values.

to provide a conservative "snapshot" of current conditions. Maximum AWQC ratios often coincide with low-flow conditions, when contaminated groundwater has the greatest adverse impact on surface water quality. Figure 5-4 also displays the discrete source areas located within the Upper Basin. Figure 5-5 shows the maximum AWQC ratios for data collected in the Bunker Hill Box.

The most contaminated areas upstream of the Box include Canyon Creek, Ninemile Creek, and the Mainstem SFCDR downstream of Mullan, the location of significant past mining activities. AWQC ratios have historically been and continue to be lowest in the SFCDR upstream of Mullan. The most contaminated streams within the Bunker Hill Box include Government Creek, tributaries to Bunker Creek (including Portal, Railroad, Deadwood, and Magnet Creeks), and Milo Creek. AMD is being discharged directly to Milo Creek because the Bunker Hill Mine owner is not in compliance with an order from EPA to capture and treat all discharges from the mine. Because the AMD release began after OU 2 Phase I remedial actions were implemented, Milo Creek is the only surface water body in the Box where surface water quality declined following the Phase I remedial actions.

There are several drainages with numerous discrete source areas where (1) very few data are available (except where the tributary drainages meet the SFCDR), and (2) zinc AWQC ratios are relatively moderate (e.g., in Big Creek and Pine Creek) as compared to the most contaminated areas discussed above. It is important to note that given the numerous source areas in the Upper Basin, there is considerable uncertainty regarding future water quality impacts from these sources, stemming from the complexity of chemical, biological, and environmental factors that influence metal release rates from the variety of source types.

In addition to dissolved zinc, total lead is used as an indicator of surface water quality. Sources, as well as fate and transport mechanisms, are different for total lead than for dissolved zinc. Lead is primarily transported in water in particulate or colloid form, and is measured from unfiltered water samples as total lead (or particulate lead) that also includes any dissolved lead. Particulate lead is typically mobilized during high-energy, high-flow conditions as increased sediments become entrained in stream flow. Unfortunately, stream discharge is difficult to measure during high flows, and depth- and width-integrated sampling regimes are challenging to follow. Thus, data collected during high-flow conditions are generally subject to greater uncertainty than those collected under low-energy, low-flow conditions when fewer lead-bearing particulates are typically transported.

Figure 5-6 shows data from Station SF-271 at Pinehurst (near the confluence of the North and South Forks of the Coeur d'Alene River) from 2000 to 2009. These data are typical for the Upper Basin because total lead concentrations are usually greatest on the rising limb of the hydrograph and decrease with time as sediment sources are depleted and flows decrease, and as stream energy dissipates. During first-flush and/or rain-on-snow events, sediments are mobilized by overland flow and from the near-channel floodway, channel banks, and channel beds by elevated instream flows. As a result, the eroded sediments are frequently sources of lead to Upper Basin surface water.

Figure 5-7 shows a map view of total lead concentrations in Upper Basin surface water during high-flow conditions in May 2008.[5] Total lead concentrations upstream of OU 2 are highest in Canyon Creek and Ninemile Creek (consistent with dissolved zinc), but are highly erratic along the SFCDR below Wallace. Widely variable total lead concentrations during high-flow conditions in irregularly shaped, high-gradient streams, common to the Upper Basin, are typical. This is because the ability of the water to transport suspended material varies as a function of flow and velocity, which in turn can vary significantly over short distances due to changes in channel cross section and shape.

In summary, improvements in surface water quality have been made in recent decades as efforts to address the most obvious sources of contamination were implemented. However, surface water quality remains seriously impaired in many areas of the Upper Basin.

5.3.2 Groundwater Quality and Impact on Surface Water

Alluvial aquifers within the Upper Basin occur in the valley fill sediments and are typically shallow, unconfined, and long and narrow in dimension. Alluvium and floodplain deposit sources are widespread contaminant sources in the Upper Basin, spreading across the floodplains and valleys of the SFCDR and Canyon Creek, Ninemile Creek, and other SFCDR tributaries. These sediment deposits also underlie developed and/or capped areas in some areas of the Upper Basin, and impact the groundwater quality and eventually the surface water quality in these areas.

The City of Kingston maintains a municipal production well in the lower aquifer, downstream from the confluence of the SFCDR and the North Fork, and the City of Pinehurst maintains a municipal production well in the lower portion of the aquifer located beneath Pinehurst. Water quality in these areas has historically been of high quality and free of contamination and, while these areas are technically hydraulically connected to the lower aquifer in the Bunker Hill Box, they are not considered threatened by conditions within the Box. There are no municipal supply wells in the Box itself. With the exception of the area immediately surrounding Pinehurst in the Pine Creek Watershed, groundwater quality in the shallow (or upper) aquifer of the Upper Basin has been affected to the point that it is not suitable for domestic or municipal use in many areas.

A high degree of hydraulic interaction exists between the shallow groundwater aquifer and surface water. In general, the following characteristics are important to the interaction of groundwater and surface water in the Upper Basin:

- Groundwater quality in the shallow aquifer is impacted by floodplain deposit sediment sources and, in some cases, contaminated material impoundment areas.
- Streams tend to be gaining (groundwater discharging to surface water) in areas where the alluvial valley narrows, and losing (surface water discharging to groundwater) in areas where the alluvial valley widens.

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[5] Total lead concentration data represent the maximum values reporting for samples collected in May 2008 as part of the High-Flow and Low-Flow Surface Water Study (CH2M HILL, 2009f) and the Coeur d'Alene Basin Remedial Action Monitoring Program (CH2M HILL, 2009l).

- During low-flow conditions (late summer/early fall), surface water flow is dominated by groundwater discharge.

The following sections focus on three areas of the shallow aquifer in the Upper Basin in which groundwater plays a significant role in metals loading to surface water: Woodland Park, Osburn Flats, and the Bunker Hill Box. Various studies, including groundwater modeling, have been conducted in these areas to assess the impact of groundwater on surface water quality.

5.3.2.1 Woodland Park

Woodland Park is located along Canyon Creek near Wallace (Figure 5-2). Dissolved zinc concentrations in groundwater in October 2008 at Woodland Park are shown in Figure 5-8. The highest concentrations in groundwater within Woodland Park were located near gaining sections of Canyon Creek.

A September 2006 study of groundwater-surface water interactions in Woodland Park indicated that groundwater discharge to Canyon Creek in Woodland Park significantly increased the surface water load of dissolved zinc during low-flow conditions (CH2M HILL, 2007b). Data from the study show the largest zinc load increases in surface water occurring in the reaches between Stations A1 and A1.2 (these stations are shown in Figure 5-8). Additional dissolved zinc load was entering Canyon Creek between Stations A4E and A6, primarily due to seeps from the SVNRT repository located in Woodland Park.

5.3.2.2 Osburn Flats

Osburn Flats is located along the SFCDR in Osburn. Concentrations of dissolved zinc in Osburn Flats groundwater in October 2008 are shown in Figure 5-9. In general, higher dissolved zinc concentrations were found in the area upstream (or east) of McFarren Gulch, which is near the historical location of the Osburn Plank Dam. The lowest concentrations of zinc in groundwater were detected along the south side of Osburn Flats, away from the SFCDR and near the hillsides south of Osburn.

A study of metals loading to the SFCDR in Osburn Flats under low-flow conditions in September 2008 indicated that the surface water load of dissolved zinc increased due to groundwater discharge from the area under the former Osburn Plank Dam, resulting in an increase in dissolved zinc concentrations in the SFCDR (CH2M HILL, 2009g). In other gaining reaches in Osburn Flats, stream flow increased without concurrent increases in dissolved zinc concentrations in surface water because concentrations in groundwater were roughly equal to concentrations in the SFCDR, resulting in an increased load of dissolved zinc to the stream by virtue of increasing discharge (CH2M HILL, 2009d). The largest increases in dissolved zinc concentrations in surface water occurred in the primarily gaining reach from Station B3 (also known as SF-249) to Station B5-ALT (these stations are shown in Figure 5-9).

5.3.2.3 Bunker Hill Box

In most of the Upper Basin there is a single aquifer beneath the SFCDR and its tributaries, but in the Bunker Hill Box and downstream both upper and lower alluvial aquifers are present. The upper aquifer is present in alluvial materials in the SFCDR valley and a lower, confined aquifer is present downstream from the eastern end of the Box. The shallow upper aquifer in the Box has more contamination than the lower aquifer because of the surface water and groundwater interaction with the SFCDR.

Dissolved zinc concentrations in upper-aquifer groundwater in the Bunker Hill Box under low-flow conditions in October 2008 are presented in Figure 5-10. In general, the highest concentrations of dissolved zinc in groundwater in the Box were in the shallow aquifer near the CIA and Government Creek. Some monitoring locations north of Smelterville and the Page Wastewater Treatment Plant had elevated zinc concentrations in groundwater but relatively lower concentrations than in groundwater near the CIA.

The groundwater-surface water interaction within the Box is significant in terms of the volume exchanged and its impact on the water quality of the SFCDR. The eastern (upstream) gaining reach in the Box (see Figure 5-10) is located near the CIA, which results in a major negative impact on water quality due to highly contaminated groundwater entering the SFCDR. Furthermore, the CTP currently discharges treated water to Bunker Creek, and much of this treated water enters the groundwater system through losing reaches of Bunker Creek. This results in additional discharge of high-concentration groundwater to the SFCDR. There are also areas of high dissolved zinc concentrations in groundwater in Government Gulch that negatively impact surface water quality in Government Creek and then the SFCDR. In the western (downstream) gaining reach of the SFCDR in the Box, dissolved zinc loads in surface water increase (Figure 5-10). This increase is driven by the large volumes of contaminated groundwater discharging to surface water. Dissolved zinc concentrations in the western portion of the Bunker Hill Box are considerably lower than those in the eastern portion of the Box (CH2M HILL, 2007c).

5.3.3 Surface Water Quality Trends

Since the Upper Basin Proposed Plan was issued (EPA, 2010a), EPA has conducted a statistical evaluation of surface water data collected from selected monitoring stations in the Upper and Lower Basins. The methodology and results of this evaluation are documented in the *Draft BEMP/EMP Surface Water Statistical Evaluation* (CH2M HILL, 2011). The evaluation sought to determine whether statistically significant trends in surface water quality are occurring. The evaluation examined station-specific trends over both the full period of the sampling record and the sampling period subsequent to 2002, following the time when several significant remedial actions were undertaken in the Upper Basin. Both measured variables (metals and nutrient concentrations) and calculated variables (AWQC, AWQC ratios, and loads) were included in the evaluation.

Results from the evaluation indicate that metals concentrations, AWQC ratios, and metals loads show generally decreasing trends at most stations over the full period of the sampling record. However, results from the evaluation of post-2002 trends indicated the following:

- The majority of stations exhibit no significant post-2002 trends, suggesting that conditions are unchanging, based on what the post-2002 data can detect.
- The majority of stations have median post-2002 AWQC ratios that exceed 1, with five stations exceeding the dissolved zinc AWQC by more than 20 times and eight stations exceeding the dissolved cadmium AWQC by more than 20 times.

The evaluation concluded that unchanging trends in the post-remediation period (i.e., since 2002), coupled with AWQC ratios exceeding 1, suggest that conditions at the stations with the AWQC exceedances will likely continue to exceed AWQC without additional cleanup actions that target improvements in water quality.

5.4 Summary of Site Conditions

The Bunker Hill Superfund Site is located within one of the largest historical mining districts in the world, and mining-related hazardous substances have been dispersed in nearly every aspect of the environment including air (historically), soil, sediments, surface water, and groundwater. Dozens of relatively extensive remedial actions have been conducted to date in the Upper Basin, and improvements to human health and the environment have been achieved. Despite this, contaminant levels in affected streams, soil, sediments, and groundwater remain at levels that present unacceptable risks to human health and the environment.

Dissolved zinc concentrations in groundwater have generally decreased within the Box as a result of Phase I remedial actions completed in OU 2. However, significant quantities of tailings and other mine wastes are located beneath communities and infrastructure and cannot be removed without significant disruption to the populated communities. These contaminant sources continue to negatively impact water quality and could potentially negatively impact human health if in-place barriers are damaged and underlying contaminants are exposed. Contaminant contributions from groundwater to the SFCDR within OU 2 remain relatively large and have a significant negative impact on SFCDR water quality.

Conditions in the Upper Basin, specifically the nature and extent of contamination, can be summarized as follows:

- COCs for media in the Upper Basin include arsenic, cadmium, lead, mercury, and zinc.
- Surface water meets, or is close to, AWQC upgradient from mine waste sources but degrades significantly upon contact with mine wastes.
- Surface water quality in terms of dissolved zinc concentrations has generally been improving in the Upper Basin (including the Bunker Hill Box), but remains severely impaired in the SFCDR and several tributaries.
- Large loads of particulate lead are transported through the Upper Basin primarily during high-water events, creating toxic sediment deposits along the SFCDR and its tributaries.
- Groundwater is severely affected and contributes to surface water contamination.
- Status and trend testing using post-2002 surface water data from BEMP and EMP stations in OU 3 and OU 2, respectively (following the time when several significant remedial actions were undertaken in the Upper Basin) has indicated that (1) the majority of stations exceed AWQC ratios of 1 for dissolved zinc and dissolved cadmium; (2) the majority of stations show unchanging trends; and (3) areas exceeding AWQC are not expected to change without additional action (CH2M HILL, 2011a).

SECTION 6.0

Current and Potential Future Land and Resource Uses

6.1 Current Land Uses

The Upper Basin of the Coeur d'Alene River is located primarily in Shoshone County in the Panhandle of northern Idaho (Figure 1-1). A small area in the Pine Creek headwaters is located in Kootenai and Benewah Counties. Much of the land is under federal management as National Forest (including the Clearwater, Coeur d'Alene, and St. Joe National Forests). Land uses are a mix of residential, commercial, agriculture, mining, forestry, and recreation. All of the communities in the Upper Basin are located within Shoshone County (pop. 12,913 [U.S. Census Bureau, 2009]). The majority of the population in the Upper Basin consists of residents of communities located along the SFCDR, including Kingston, Pinehurst, Smelterville, Kellogg, Wardner, Osburn, Silverton, Wallace, and Mullan.

The undeveloped areas of the Upper Basin include upland forests and lowland floodplains with riverine and riparian areas and wetlands. The SFCDR has been channelized along much of this reach to accommodate railroads and roads (Stratus, 2000; EPA, 2001b, 2001c), but its numerous tributary streams still provide abundant recreational opportunities. In 2002, a CERCLA removal action was completed by UPRR as part of the conversion of a contaminated railroad ROW to a recreational trail system. As a result, the Trail of the Coeur d'Alenes now follows UPRR's 72-mile ROW from Mullan to Plummer near the border with the State of Washington.

In the headwater and tributary areas of the SFCDR, predominant land uses include mining, mineral processing, and forestry with some urban and residential development. The narrow tributary canyons are populated by small communities, dispersed residences, and roads that cross or border streams. The quality of habitat in these areas, and its ability to support natural populations of flora and fauna, have been impacted to varying degrees by historical mining activity in the Upper Basin.

6.2 Potential Future Land Uses

Future land uses in the Upper Basin are anticipated to be similar to the current land uses. Although population levels in the Upper Basin have declined in recent years, the City of Coeur d'Alene has experienced substantial population growth, and it is possible that this population could expand into the Upper Basin. Communities within the Upper Basin, Kellogg in particular, are working to attract tourists for recreational activities such as skiing and biking and historical activities like mining museums and mine tours. A recent development is the residential community of Galena Ridge, which is composed of home sites, condominiums, and other multi-family units built around an 18-hole golf course and recreational walking and biking trails, including the Trail of the Coeur d'Alenes.

The Institutional Controls Plan (ICP) allows for development of remediated and unremediated properties within the boundaries of the ICP through a locally enforced set of rules and regulations. The ICP was established to maintain the integrity of installed barriers and to ensure that new barriers are installed as appropriate during development. Through the ICP, a local, free-of-charge repository for disposal of contaminated materials encountered during development is provided. This disposal is currently conducted at one of the operating repositories that serve the cleanup. Cleanup is not expected to restrict future mining and exploration in the Silver Valley. Where cleanup of historical contamination from past mining activities is planned in areas that are being currently mined, developed, or expanded, EPA will coordinate investigation, design, and cleanup work with the property owners. This approach will minimize disruption to any active facilities. EPA recognizes that mining has been an important part of the history of the Silver Valley and will continue to be in the future. EPA also understands that mining companies need certainty for planning and investing, and is committed to completing cleanup actions in ways that allow responsible mining operations to continue in compliance with environmental regulations.

6.3 Surface Water and Groundwater Uses

The State of Idaho has identified domestic water supply as a designated beneficial use for certain surface waters of the Idaho portion of the Coeur d'Alene Basin. All surface waters are designated by the State of Idaho for agricultural and industrial water supply, wildlife habitat, and aesthetics. In addition, all surface waters in the Upper Basin are either designated for or presumed to support cold water aquatic life and secondary contact recreation.

A deep groundwater aquifer and clean surface water tributaries are used as drinking water sources in the Upper Basin. Within the Coeur d'Alene Basin as a whole, approximately 57 percent of residences obtain water from public sources and 43 percent obtain water from private sources. In 1989, the Idaho Department of Water Resources (IDWR) established an Area of Drilling Concern for groundwater within the 21-square-mile Bunker Hill Box to protect public health in recognition of the existing groundwater contamination. (An area designated as an "Area of Drilling Concern" has special well construction requirements and prohibitions.)

Future use of groundwater as drinking water from shallow, unconfined aquifers within the area of mining impacts in the Upper Basin may be limited by concentrations of cadmium, lead, and zinc that exceed MCLs until cleanup is implemented. Although the Selected Remedy is expected to result in improvements to groundwater quality, it is not intended to satisfy the groundwater protection expectation of returning groundwater to beneficial use (as drinking water), as outlined in the NCP.

SECTION 7.0

Summary of Site Risks

The Bunker Hill Superfund Site was listed on the NPL in 1983 based upon high levels of lead, arsenic, cadmium, and zinc in the local environment and high blood lead levels in children living in communities near the smelter complex and related mining facilities. In the 1970s lead poisoning was widespread, with 75 percent of local children having an unsafe blood lead level higher than 40 micrograms per deciliter (µg/dL), which was the acceptable allowable blood lead level until 1985, when the level dropped to 25 µg/dL (Centers for Disease Control and Prevention [CDC], 1985; TerraGraphics, 1990). The CDC further lowered the acceptable blood lead level to 10 µg/dL in 1991 (CDC, 1991). In May2012, in response to recommendations from its external Advisory Committee on Childhood Lead Poisoning Prevention, the CDC lowered the blood lead level to 5 µg/dL with future reductions linked to the upper 97.5th percentile of national pediatric blood lead levels of children aged 1 to 5 (CDC Advisory Committee on Childhood Lead Poisoning Prevention, 2012). EPA is reviewing these recommendations. At this time, EPA will continue to base its work on existing definitions of blood lead levels as it carefully examines whether changes to approaches or policies are needed based on this new information.

The health response has been ongoing for decades. EPA's blood lead monitoring program is an annual voluntary program, and participation fluctuates from year to year. Based on results for those children whose families have opted to participate, children's blood lead levels are close to the national average of 1 µg/dL (EPA, 2008; NAS, 2005; Idaho Department of Health and Welfare [IDHW] et al., 2011).

Historical mining wastes have created a legacy of pervasive elevated metals concentrations that present significant risks to people as well as to many animal, aquatic organism, and plant species throughout the Upper Basin. The risks are neither hypothetical nor potential future risks—the risks persist and necessitate remedial action. The following sections provide an overview of the human health and ecological risks in the Upper Basin.

7.1 Summary of Human Health Risks

Lead in soil and house dust is the primary concern for risks to people. Human health risk assessments (HHRAs) were conducted to support the previous RODs for the three OUs (EPA, 1991; 1992; 2002). Since that time, a significant amount of human health cleanup work has been implemented, including the majority of the remedies within the Bunker Hill Box (OUs 1 and 2) and the Upper Basin portion of OU 3. Because of the extensive cleanup work that has been done in residential and recreational areas for protection of human health, the findings of the prior HHRAs are most important in areas where high levels of lead remain available for exposure. In areas where the remedies focused on human health have been implemented, the protectiveness of those actions is evaluated through the Five-Year Review Process. The 2010 Five-Year Review Report (EPA, 2010b) concluded that the remedies focused on human health that have been implemented to date are protective and are functioning as designed. However, additional actions are needed to fully protect human and environmental receptors (see Section 6 of the 2010 Five-Year Review Report).

Some risk from exposure to lead will persist because it is not possible to eliminate all lead-contaminated soil and sediments. This ROD Amendment describes additional actions that will be taken in the Upper Basin to further reduce risks to human health and the environment. Lead risks will be managed by additional cleanups and maintenance of the Lead Health Intervention Program and other controls in perpetuity.

A summary of previous HHRAs is provided in the following section for context and historical background. Current and potential future human health risks are also discussed, in the context of the 2010 Five-Year Review of the existing Human Health Remedies.

7.1.1 Previous Risk Assessments and Studies

Several key HHRAs have been conducted for the Upper Basin, including the following:

- **The 1990 Risk Assessment Data Evaluation Report ("RADER")** for the populated areas of the Bunker Hill Box (OU 1) (EPA, 1990).
- **The 1992 HHRA for OU 2,** the non-populated areas of the Box (Science Applications International Corporation [SAIC], 1992).
- **The 2001 HHRA for the Coeur d'Alene Basin outside the Box** (OU 3) (IDHW, 2001).

EPA determined in the RADER that excessive lead in the blood of young children and pregnant women was the primary human health concern in the Coeur d'Alene Basin. This was confirmed by subsequent risk evaluations and remains true today (NAS, 2005). Extensive site-specific analysis of blood lead data paired with environmental lead data quantified exposure pathways and was used to develop lead action levels and monitor the effectiveness of soil remediation (Sheldrake and Stifelman, 2003; von Lindern et al., 2003). Blood lead levels appeared to be most closely related to lead in house dust, followed by the independent effects of lead in yard soil and soil from the surrounding community, the condition of interior lead-based paint, and the lead content of exterior paint (TerraGraphics and URS Greiner, 2000).

Human health risks were further evaluated in the 2001 HHRA (IDHW, 2001), which included both the Upper and Lower Basin portions of OU 3 but excluded the Bunker Hill Box (in consideration of the prior HHRAs conducted in 1990 and 1992). Eight metals (antimony, arsenic, cadmium, iron, lead, manganese, mercury, and zinc) were initially selected as contaminants of potential concern and evaluated in depth in the 2001 HHRA. However, two metals—lead and arsenic—emerged as the primary COCs for human health in the ROD for OU 3. As noted previously, lead is the primary human health COC in the Upper Basin because lead exposures exceeded target health goals at the largest number of locations during the 2001 HHRA. Arsenic was identified as a COC for OU 3 because its concentrations also exceeded target health goals, but less frequently than lead. Other metals that exceeded health goals, such as cadmium and iron, were limited to isolated locations or were co-located with lead and arsenic; therefore, they were not identified as a primary human health concern by the HHRA. In addition, the 2001 HHRA noted that significant lead exposure may also result from participation in common recreational activities in areas in the Upper and Lower Basins with high lead concentrations, especially in side canyons and near the Coeur d'Alene River. EPA's Integrated Exposure Uptake Biokinetic Model was used to evaluate the lead risks and to develop soil action levels as target health goals for reducing lead exposure pathways for children. These goals are described in EPA national guidance (1998a), which recommends that a "soil lead concentration be determined so that a typical child would have an estimated risk of no more than 5 percent of exceeding a blood lead of 10 µg/dL." Site-specific analyses of alternative risk reduction scenarios at the Bunker Hill Superfund Site indicated that reduction of soil lead concentrations to less than 700 milligrams per kilogram (mg/kg) is necessary to achieve the 5 percent risk criterion.

7.1.2 Current and Potential Future Human Health Risks

EPA has prioritized cleanup actions to reduce human health exposures, primarily to lead, and has conducted analyses of remedy effectiveness to support the Basin-wide Five-Year Reviews. In the summer, annual blood lead screening is provided free of charge throughout the Panhandle Health District. At other times of the year, blood lead screening can be arranged by contacting the Panhandle Health District. The ICP, which is also managed by the Panhandle Health District, was established to ensure that cleanup actions retain their integrity and effectiveness and are not compromised by future actions and events. The 2010 Five-Year Review concluded that additional actions are needed to fully protect human and environmental receptors. Specific findings in EPA's 2010 Five-Year Review Report (EPA, 2010b) include the following:

- Community mean lead concentrations in soil throughout both the Upper Basin and the Box were below 400 mg/kg for all geographic areas as of 2009. In the Box, mean lead concentrations in soil ranged from 70 to 270 mg/kg for the communities evaluated in 2008 following implementation of the Selected Remedy for OU 1. Prior to remediation in the early 1980s, mean lead concentrations had been as high as between 2,500 mg/kg and 5,000 mg/kg. In the Upper Basin, significant reductions in community mean lead concentrations occurred between 2004 and 2009. Community mean lead concentrations in the Upper Basin ranged from approximately 200 mg/kg to approximately 375 mg/kg as of 2009, down from a maximum of approximately 900 mg/kg prior to 2004.
- The blood lead remedial action objective (RAO) in the Box has been achieved by reducing soil and dust lead concentrations to levels that limit estimated mean soil and dust lead intakes for children.
- Sediments contaminated by mine waste continue to be transported throughout the SFCDR, including some of its tributaries, and the mainstem of the Coeur d'Alene River. Exposure to these contaminated sediments poses health risks to people recreating in the Lower Basin as well as waterfowl in the Lower Basin.

The existing Human Health Remedies are focused on populated and designated recreation areas and have been shown to be protective where they have been implemented. However, concentrations of COCs, primarily lead, remain above cleanup levels at mine and mill sites in unpopulated areas throughout the Upper Basin. These areas are also used for recreation by residents of the Upper Basin as well as tourists. Significant risks to human health posed by these sites will remain until the mining-contaminated materials are cleaned up and the direct contact exposure pathway is eliminated.

7.2 Summary of Ecological Risks

EPA made a conscious decision to prioritize and implement human health actions first; consequently, most of the actions to protect the environment have not yet been implemented. Therefore, the findings of previous Ecological Risk Assessments (EcoRAs) are generally considered to reflect current conditions in the Upper Basin.

An EcoRA (CH2M HILL and URS Greiner, 2001a) was prepared as part of the RI/FS for the Coeur d'Alene Basin. The EcoRA characterized risks to aquatic and terrestrial organisms exposed to hazardous substances associated with mining activities. Because that EcoRA and the ROD for OU 3 (EPA, 2002) identified a lack of site-specific riparian songbird data, a focused EcoRA was completed in 2006 to evaluate the effects of lead-contaminated soil on ground-feeding songbirds in the riparian area of the Basin (CH2M HILL, 2006d), and a site-specific songbird study was conducted by USFWS in 2007 (Hansen, 2007). The results of the USFWS study documenting the exposure of ground-feeding songbirds to lead and its effects on them throughout the Basin (Hansen et al., 2011) and the focused EcoRA for songbirds (Sample et al., 2011) have now been published as peer-reviewed journal articles.

The 2001 EcoRA, following consultation with the many stakeholders who participated in the EcoRA Work Group, established ecological management goals, assessment endpoints, and measures that are consistent with the NCP and EPA guidance. The goals include the need to reduce the toxicity and/or toxic effects of hazardous substances released by mining activities to ecological receptors within the Coeur d'Alene Basin, and the need to provide habitat conducive to the recovery of special-status species. By protecting the integrity of the food chain, water, and other natural resources, as well as habitat structure, it is expected that significant progress will be made towards the achievement of ecological management goals.

7.2.1 Identification of Contaminants of Potential Ecological Concern and Possible Routes of Exposure

Media evaluated in the 2001 EcoRA included soil, sediments, and surface water. Groundwater, although contaminated in the Coeur d'Alene Basin, was not evaluated directly but was considered indirectly by evaluation of contaminants of potential ecological concern (COPECs) in the soil and in surface water (to which groundwater discharges in the Basin). Table 7-1 presents the range of concentrations detected, the frequency of detection, and the 95 percent upper confidence limit (UCL) on the mean for each COPEC by medium. The following COPECs were carried forward in the EcoRA:

- Soil: Arsenic, cadmium, copper, lead, and zinc
- Sediments: Arsenic, cadmium, copper, lead, mercury, silver, and zinc
- Surface water: Cadmium, copper, lead, and zinc

The routes by which ecological receptors may be exposed to the COPECs in the Coeur d'Alene Basin are summarized in Table 7-2 and include the following:

- Birds and mammals: Ingestion of soil, sediments, surface water, and food

- Fish: Ingestion of and direct contact with sediments and surface water
- Benthic invertebrates: Ingestion of and direct contact with sediments or surface water
- Aquatic plants: Root uptake and direct contact with sediments and surface water
- Amphibians: Direct contact with surface water, soil, and sediments
- Terrestrial plants: Root uptake from soil and sediments
- Terrestrial invertebrates: Ingestion of and direct contact with soil and sediments
- Soil processes: Direct contact of microbes with soil and sediments

7.2.2 Ecological Risk Summary

The results of the 2001 EcoRA indicated that most watersheds in which mining has occurred and a large portion of the Coeur d'Alene Basin downgradient from mining areas are ecologically degraded as a direct or secondary effect of the presence of mining-related hazardous substances. This ecological degradation has resulted in demonstrated, observable effects in the Coeur d'Alene Basin. The results of the EcoRA also showed that if remediation is not conducted in the Basin, effects can be expected to continue for the foreseeable future. High concentrations of metals are pervasive in soil, sediments, and surface water, and these metals pose substantial risks to the wildlife, fish, and plants that inhabit the Basin. Impacts were evaluated for more than 80 different species, representing numerous trophic levels and hundreds of exposed species. Species evaluated included "special-status species" such as those listed by USFWS as endangered or threatened under the Endangered Species Act (ESA). Species-specific information can be found in the 2001 EcoRA (CH2M HILL and URS Greiner, 2001a).

The EcoRA concluded that heavy metals, primarily lead, zinc, and cadmium, present significant risks to most ecological receptors throughout the Coeur d'Alene Basin, including fish, birds, mammals, amphibians, terrestrial and aquatic plants, soil and aquatic invertebrates, and microbial soil processes. Receptor classes with close association with aquatic environments and associated soil and/or sediments, such as amphibians, benthic macroinvertebrates, and small ground-dwelling mammals, are particularly susceptible because fish and birds are among the more vulnerable receptor classes and are closely connected with the human environment (through recreation). Key observations from the 2001 EcoRA and updated information from studies and environmental monitoring programs conducted since 2001 are summarized below.

7.2.2.1 Fish and Aquatic Organisms

- Based on historical information, approximately 20 miles of the SFCDR and 46 miles of its tributaries have limited and impacted fish populations. Some areas with high metals concentrations have been observed to be essentially devoid of fish and other aquatic life.
- In addition to elevated concentrations of metals in waters of the Upper Basin, fish, invertebrate, and plant tissue has elevated metals concentrations.
- Impacted species include the native bull trout, which is listed as "threatened" under the ESA.

- Some expected fish species (e.g., sculpin) are absent from certain areas due to relatively high metals concentrations.
- Exposure of aquatic organisms to metals was confirmed by the presence of elevated concentrations of metals in fish tissue.
- Toxicity testing using water from heavily contaminated portions of Canyon Creek and the SFCDR indicated that substantial dilution with clean water (10-fold or more) is required to eliminate acute toxicity.
- Based upon comparison of metals concentrations in surface waters to chronic AWQC, growth and reproduction of surviving aquatic life would be substantially reduced in several areas.
- Site-specific toxicity testing and/or biological surveys have indicated lethal effects of waters and/or reduced populations of aquatic life.
- Toxic effects of contaminated sediments are believed to contribute to adverse effects on aquatic life.

7.2.2.2 Birds

- Risks to health and survival from at least one metal in at least one area were identified for 21 of 24 representative avian species.
- Potential risks to fish-eating birds were noted in the Upper Basin.
- Lead and zinc present the greatest risks to birds in the Coeur d'Alene Basin.
- In the Lower Basin, lead poisoning (primarily due to ingestion of contaminated sediments) is responsible for 96 percent of the total tundra swan mortality, compared to 20 to 30 percent (primarily due to ingestion of lead shot) at the Pacific flyway and national levels.
- The Upper Basin is a significant source of contaminated sediments that are deposited in the Lower Basin. Waterfowl carcasses found in 1997 and 2009 represented some of the largest documented "die-offs" since 1924. Deaths by lead poisoning from the ingestion of contaminated soil and sediments are expected to continue.
- Risks to health and survival from at least one metal in at least one area were identified for 21 of 24 avian receptor species (CH2M HILL and URS Greiner, 2001a).
- The USFWS songbird study (Hansen, 2007; Hansen et al., 2011; USFWS, 2008b), and focused EcoRAs (CH2M HILL, 2006d; Sample et al., 2011) confirmed that ground-feeding songbirds in the Coeur d'Alene Basin are accumulating lead in blood and liver tissue from ingesting lead-contaminated soil at levels that show injury to songbirds.

7.2.2.3 Ecosystem and Receptor Characteristics

In addition to direct toxic effects on ecological receptors that were evaluated using measures of exposure and ecological effects described above, mining-related hazardous substances also can have secondary effects on ecological structures and processes (expressed by the physical and biological characteristics) that can result in adverse effects on ecological receptors. These secondary effects were evaluated using measures of ecosystem and receptor characteristics, which are particularly important in the Coeur d'Alene Basin because of the extensive habitat changes attributable to the effects of mining and mining-related activities. The measures of ecosystem and receptor characteristics used in the EcoRA for the Upper Basin are listed in Table 7-3 by habitat type and assessment endpoint affected. A brief linkage statement is provided for each measure to describe how the measure is associated with mining-related hazardous substances and the assessment endpoints. Measures of ecosystem and receptor characteristics were applied to habitats within each CSM unit for which data were available, and preliminary evaluation showed that the measures could be potentially affected.

7.2.2.4 Protective Levels and Monitoring

Concentrations of contaminants of ecological concern that are expected to be protective of ecological receptors are presented in Table 7-4. Concentrations of lead in soil or sediments that are expected to be protective for birds were developed through a series of field and laboratory studies. The 2001 EcoRA benefitted from the numerous site-specific studies that were completed as part of the Natural Resource Damage Assessment (NRDA) of the Coeur d'Alene Basin. Under the BEMP for OU 3 (EPA, 2004) and the EMP for OU 2 (CH2M HILL, 2006a), biological monitoring work conducted in the Upper Basin and the Bunker Hill Box since the EcoRA has demonstrated that ecological receptors exposed to surface water, sediments, and soil within the Upper Basin and Box continue to be exposed to elevated metals above thresholds shown to cause harm (EPA, 2010b).

7.2.3 Summary of EcoRA Uncertainties

Even though much is known about the ecological risks in the Upper Basin, four primary categories of uncertainty are associated with assessing risks posed to ecological receptors by chemicals occurring in the environment (problem formulation, exposure assessment, ecological effects assessment, and risk characterization). The uncertainties associated with problem formulation include data availability and the use of historical data; however, these uncertainties were reduced because data that were found to be questionable through the general review and evaluation were not used.

The uncertainties associated with the exposure assessment include exposure pathways not retained for quantitative evaluation, identification of ecological receptors, selection of representative species, exposure route assumptions, bioaccumulation models, and speciation of metals. Uncertainties associated with the ecological effects assessment include evaluation of chemical toxicity (selection and use of toxicity reference values), interspecies extrapolations (use of allometric scaling factors), regression modeling, assumptions regarding the use of toxicity (bioassay) test organisms or test results, and chemical interactions.

Uncertainties and limitations associated with the risk characterization include the use of hazard quotients as an indicator of potential ecological risk, lack of data for some multi-pathway risk estimates, joint multi-chemical toxicity, lack of multiple lines of evidence for certain receptor groups, the treatment of estimated exposures that exceeded no observed adverse effect levels but not lowest observed adverse effect levels, and the use of risk estimates for representative species to characterize risks to other plants and wildlife.

7.3 Basis for Remedial Actions

Based on the continuing risks posed to human health and the environment by elevated concentrations of metals, particularly lead, arsenic, cadmium, and zinc, appropriate remedial actions are necessary to protect humans and ecological receptors including special-status species and natural resources that contribute to ecosystem functioning in the Upper Basin. The response actions selected in this ROD Amendment are necessary to protect human health and the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health or welfare or the environment.

SECTION 8.0

Remedial Action Objectives

8.1 Upper Basin Remedial Action Objectives

RAOs are general descriptions of what a cleanup under CERCLA is expected to accomplish in order to achieve compliance with potential ARARs or an intended level of risk protection. EPA has worked closely with IDEQ; the Basin Commission; the Coeur d'Alene Tribe; other federal, state, and local agencies; and local community members on this complex cleanup effort and the development of RAOs. The Selected Remedy—an interim remedy, not a final remedy—will take significant steps towards achieving the RAOs for the Upper Basin.

The RAOs for the Upper Basin are listed below. These are RAOs specific to the Upper Basin Selected Remedy documented in this ROD Amendment only. A comparison of these RAOs to the RAOs included in previous RODs is provided in Section 8.2. The RAOs for the Selected Remedy include:

Human Health	Remedial Action Objective(s)
Soil/Sediments/Source Materials	Reduce human exposure to soil, sediments, and source materials, including residential yard soil, that have concentrations of COCs greater than selected risk-based levels for soil.
Surface Water	Restore surface water designated as beneficial use for drinking water to meet drinking water and water quality standards.
	Prevent ingestion of surface water used as drinking water and containing COCs exceeding drinking water standards and associated risk-based levels for drinking water.
	Prevent discharge of seeps, springs, and leachate that would cause surface water to exceed drinking water and water quality standards.
Aquatic Food Sources	Prevent human exposure to unacceptable levels of COCs via ingestion of aquatic food sources (e.g., fish and water potatoes).
Ecological Receptors	**Remedial Action Objective(s)**
Ecosystem Physical Structure and Function	Reduce COCs in soil, sediments, and surface water to support a functional ecosystem for aquatic and terrestrial plant and animal populations (including, but not limited to, waterfowl, riparian songbirds, and other species protected under the Endangered Species Act, the Fish and Wildlife Conservation Act, and the Migratory Bird Treaty Act) in the Upper Basin.
Soil/Sediments/Source Materials	Reduce risks from COCs in soil, sediments, and source materials to acceptable exposure levels that are protective of ecological receptors.
	Reduce transport and deposition into surface water and groundwater of COCs from soil, sediments, and source materials at concentrations above levels that are protective of ecological receptors.
Surface Water	Reduce risks from COCs in surface water in the Upper Basin to acceptable exposure levels that are protective of ecological receptors.

Ecological Receptors	Remedial Action Objective(s)
Mine Water, including Adits, Seeps, Springs, and Leachate	Reduce discharge to surface water of mine water, including adits, seeps, springs and leachate, containing COCs at concentrations that cause surface water to exceed levels protective of ecological receptors.
Groundwater	Reduce discharge to surface water of groundwater containing COCs at concentrations that cause surface water to exceed levels protective of ecological receptors.

In conjunction with RAOs, which provide a general statement of what the cleanup will accomplish, cleanup levels are specific measurable criteria that are developed to provide protection of human health and the environment. Cleanup levels are based on federal and state standards (e.g., ARARs) and, when such standards are not available, site-specific levels are developed based on risk, toxicity, and exposure information. The establishment of cleanup levels is preceded by the development of preliminary remediation goals (PRGs). PRGs were developed during the FFS for the Upper Basin and were subsequently used to evaluate alternatives presented in the Proposed Plan (EPA, 2010a). The PRGs are extensive and are presented in the FFS Report (EPA, 2012). This ROD Amendment reflects consideration of those PRGs in the context of the Selected Remedy, and establishes the cleanup levels discussed below.

As described above and in Section 12.0 of this Decision Summary, although the Selected Remedy will address many significant sources of contamination in the Upper Basin, it is an interim, not a final, remedy. Consequently, achieving certain ARARs, including AWQC, MCLs, and the requirements of the MBTA and the ESA, in all areas of the Upper Basin is outside the scope of the Selected Remedy. Future decision documents will determine the basis for additional cleanup actions and cleanup levels that may need to be established for the Upper Basin. EPA may later determine that certain ARARs may not be achievable, and issue a Technical Impracticability (TI) waiver in a future decision document.

The primary COCs for human health are lead and arsenic, as discussed in Section 7.1.1 of this Decision Summary. The COCs for ecological receptors and their protective levels in soil, sediments, and surface water are discussed in Section 7.2 and summarized in Table 7-4.

The cleanup level for lead in soil, sediments, and source materials in the Upper Basin for protection of human health and ecological receptors is 530 mg/kg. Lead is considered an indicator metal and is generally co-located with other COCs when they are present. This single cleanup level for lead is a risk-based protective value that provides operational clarity and efficiency for remedial design and cleanup decisions. It applies only to the remedial actions described in this ROD Amendment and does not replace cleanup levels for lead selected in previous decision documents.

Cleanup levels for COCs in surface water for protection of human health and ecological receptors are provided in Table 8-1. For surface water, AWQC are the cleanup levels for protection of the aquatic environment. AWQC, adjusted for hardness for specific metals, were identified as the PRGs for surface water in the 2001 EcoRA (CH2M HILL and URS Greiner, 2001a) and have been updated based on current regulations and guidance. The 2001 EcoRA also presented a water-borne concentration that represents the lowest chronic effects level of metals that may affect aquatic plants. However, this effects level for plants is a screening-level benchmark that is not as robust as the AWQC, which also take into account the protection of aquatic plants. Therefore, the AWQC are considered adequately protective for aquatic organisms and plants. The cleanup levels for surface water are the lower concentrations of AWQC and MCLs, and thus are considered protective of aquatic organisms, plants and human health.

Table 8-2 contains cleanup levels for protection of human health for COCs in groundwater used as drinking water.

8.2 Differences in Remedial Action Objectives and Cleanup Levels from Existing Selected Remedies

There are some subtle differences between the RAOs developed for the Selected Remedy for the Upper Basin and the RAOs identified in the RODs for OUs 1, 2, and 3 (EPA, 1991a, 1992, and 2002, respectively) and the ROD Amendments for OU 2 (EPA, 1996b, 2001d). Most of the differences result from the different scopes and roles of the prior RODs and associated documents in comparison to the scope and role of this ROD Amendment. In some other cases, clarifying language has been added to the existing RAOs, although the intent is retained. Table 8-3 summarizes the similarities and differences between the RAOs identified in the previous decision documents and the new RAOs for the Upper Basin, provides the rationale for the differences, and identifies the RAOs that will be carried forward and used for the Upper Basin cleanup.

The primary differences in cleanup levels from the existing Selected Remedies include the AWQC for the SFCDR Watershed and the cleanup level for lead in soil and sediments for the protection of songbirds. AWQC were not changed outside the SFCDR, and thus the state-wide AWQC still apply to portions of OU 3 outside the Upper Basin. The primary differences in cleanup levels from the existing Selected Remedies are described below.

- **Site-specific AWQC**: Updated AWQC cleanup levels resulted from site-specific research in the SFCDR conducted by the State of Idaho after the ROD for OU 3 was issued in 2002 (IDAPA 58.01.02.284). This led to substantially higher AWQC for the SFCDR than are applied elsewhere in Idaho for lead and zinc. For each of these metals, AWQC are calculated as a function of hardness. The equations used to calculate the State of Idaho AWQC and the SFCDR-specific AWQC are different: the SFCDR-specific AWQC equation yields higher values for a given hardness. For example, the site-specific AWQC for dissolved zinc at 30 milligrams per liter (mg/L) hardness is 88 micrograms per liter (µg/L).[1] This value is approximately twice as high as the state-wide AWQC for

[1] Calculated using the SFCDR-specific chronic AWQC for zinc = $e^{(0.664*\ln(\text{hardness})+2.2235)}$, as specified in IDAPA 58.01.02.284. The SFCDR-specific criteria were developed using EPA's "resident species" approach that involved testing the toxicity of cadmium, lead, and zinc in actual site water near the headwaters of the SFCDR (upstream of pollution from mining activities) using native species that occur in the subbasin. The studies included toxicity tests with 14 species, including westslope cutthroat trout, shorthead sculpin, mayflies, stoneflies, caddisflies, other insects, and snails. The SFCDR-specific criteria were developed by the State of Idaho and reviewed and approved by EPA in 2002.

dissolved zinc in surface water that was specified in the 2002 ROD for OU 3 at the same hardness level (43 µg/L).[2]

- **Lead cleanup level for songbirds**: The site-specific cleanup level for lead in soil and sediments for songbirds in the Upper Basin is identified in Attachment 4-1 in the FFS Report (EPA, 2012) and is also discussed in Section 7.2.2 of this Decision Summary. A lead cleanup level that was specifically protective of songbirds was not included in the 2002 ROD for OU 3 due to lack of site-specific data. Since that time, additional data have been collected to support the identification of a site-specific lead cleanup level for songbirds of 530 mg/kg in soil and sediments.

Other cleanup levels have been established for protection of human health in previous decision documents and are not changed by the identification of this lead cleanup level for actions selected in this ROD Amendment.

[2] Calculated using the State of Idaho chronic AWQC for zinc = $0.986 * e^{(0.8473*\ln(\text{hardness})+0.884)}$.

SECTION 9.0

Description of Alternatives

Two sets of alternatives for the Upper Basin were developed and evaluated in the FFS Report (EPA, 2012):

- Remedial alternatives intended to address the widespread mining-related contamination in the Upper Basin; and
- Remedy protection alternatives intended to enhance the protectiveness of portions of the existing Selected Remedies focusing on human health for OUs 1 and 2 and the Upper Basin portion of OU 3.

Sections 9.1 and 9.2 describe the Upper Basin remedial alternatives and remedy protection alternatives, respectively.

9.1 Remedial Alternatives

Remedial alternatives were first developed separately for the Upper Basin portion of OU 3 (outside the Bunker Hill Box) and for OU 2 (within the Box) (Figure 9-1). These separate alternatives and the factors that led to their development are described in Sections 9.1.1 and 9.1.2. The separate alternatives were then combined to produce 10 remedial alternatives that address all of the Upper Basin. The combined remedial alternatives are presented in Section 9.1.3 and listed in Figure 9-1.

9.1.1 Remedial Alternatives for the Upper Basin Portion of OU 3 (Outside the Bunker Hill Box)

The remedial alternatives presented for the Upper Basin portion of OU 3 in the FFS Report (EPA, 2012) were developed based on ecological remedial alternatives included in the 2001 FS Report for the broader Coeur d'Alene Basin (EPA, 2001c). In both cases, because of the size and complexity of the area, a typical conceptual design (TCD) approach was applied to source sites to develop the remedial alternatives.

Source sites are discrete areas that have been identified as potential sources of metals contamination to surface water. Many source sites also pose a human health exposure risk through direct contact with or ingestion of contaminated soil, sediments, and/or water. A source site often contains multiple waste types such as tailings, contaminated floodplain sediments, waste rock, and/or adit discharges. A TCD is a conceptual design for an element of a remedial action, such as excavation, capping, or water treatment, that can be applied based on the waste type(s) present at a given source site. The development of remedial alternatives in both the 2001 FS Report and the 2012 FFS Report included applying specific TCDs to the source sites based on the waste type(s) and the overall remedial approach for each source site. Using available information and data, waste type(s) and quantities were estimated at each source site. Unit costs were developed for each TCD, and costs were calculated for the assumed remedial approach on a source-site basis. The waste quantities and costs were then compiled for all the source sites to create an aggregate estimate of the actions to be completed under each alternative, along with the associated cost.[1]

TCDs were assigned to waste types in the following three broad categories:

- **Tailings and tailings-impacted floodplain sediments**. Tailings are present in both floodplain and upland areas. They are present within impoundments, in unimpounded piles, and intermixed with floodplain sediments and waste rock. The tailings and impacted sediments typically contain high concentrations of metals, pose significant risks to human health and the environment, and are potentially significant sources of metals loading to surface water and groundwater.
- **Waste rock.** Waste rock typically contains lower concentrations of metals than tailings. The TCDs assigned to source sites where this waste type is present are less aggressive and less costly than those assigned to sites with tailings and tailings-impacted sediments.
- **Adit drainages, seeps, and groundwater.** These are water sources that have the potential to contribute metals loading to surface water depending on the discharge quantities, the metals concentrations, and the specific locations.

In the 2001 FS Report, six ecological alternatives were developed and evaluated using the TCD approach. The six alternatives are listed below and provided a range of remedial alternatives from no action to maximum removal:

- Alternative 1 – No Action
- Alternative 2 – Contain and Stabilize With Limited Removal, Disposal, 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

Of these alternatives, only Ecological Alternatives 3 and 4 were determined by EPA to meet the threshold criteria of overall protection of human health and the environment and compliance with ARARs and be in compliance with the NCP (EPA, 2001c). Therefore, during the planning of the FFS for the Upper Basin, EPA carried forward the Upper Basin components of Ecological Alternatives 3 and 4 as the basis for remedial alternatives to be developed and considered in the FFS.

In the FFS, EPA used new data and study results obtained since the 2002 ROD for OU 3 to update the TCDs and expand Ecological Alternatives 3 and 4. The new information is summarized in Section 2.3 of this Decision Summary, and included studies related to the fate and transport of metals in source materials, groundwater, and surface water; the nature

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[1] It is important to note that TCDs are only conceptual designs, and the constructed remedies at specific source sites may differ from the TCDs based on future site- and waste-specific characterization assessments and other pre-design activities.

and extent of contamination; treatability testing; and the effectiveness of implemented remedial actions. New or substantially revised TCDs were developed for remedial actions not covered by TCDs derived from the 2001 FS Report, and the TCDs for water treatment were updated based on pilot-scale treatability studies and further analyses performed since 2002. The updated water treatment TCDs included changes in the location of the centralized, active treatment plant,[2] the method of treatment for specific sites (active or semi-passive),[3] and the manner of providing onsite semi-passive treatment. Table 9-1 lists all the TCDs that were used in the FFS as the basis for development of the remedial alternatives for the Upper Basin portion of OU 3.

The updated and expanded remedial alternatives are referred to in the FFS Report as Alternatives 3+ and 4+ for the Upper Basin portion of OU 3. Alternatives 3+ and 4+ consider the same source sites for potential remedies as were considered in Ecological Alternatives 3 and 4 in the 2001 FS Report. A total of 761 sites were included.

In terms of the number of source sites that have changed from no proposed action(s) to proposed action(s), the differences between Ecological Alternative 3 and Alternative 3+ and between Ecological Alternative 4 and Alternative 4+ are relatively minor. Figure 9-2 shows the difference in the numbers of source sites addressed specifically by Alternatives 3+ and 4+.

Groups of source sites and associated remedial actions in OU 3 that were modified for the FFS evaluation based on the application of new information included the following (additional details of the comparison between Ecological Alternatives 3 and 4 and Alternatives 3+ and 4+ are provided in the FFS Report [EPA, 2012]):

- **Sites added on the basis of relatively high estimated dissolved metals loading to surface water.** Based on analyses of site data that were not available at the time of the 2001 FS Report, 11 sites were added to Alternative 3+ in the FFS Report on the basis of relatively high estimated dissolved metals loading to surface water. None of these sites were included in Ecological Alternative 3 in the 2001 FS Report, and four were not included in Ecological Alternative 4 in that report.

- **Formerly and currently operating sites.** Actions at four former or currently operating sites were changed from hydraulic isolation[4] to hydraulic isolation and capping in both Alternatives 3+ and 4+.

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[2] The 2001 FS Report proposed constructing a new high-density sludge plant for water treatment in Pinehurst. The remedial alternatives in the 2012 FFS Report include expanding and upgrading the existing CTP in Kellogg.

[3] Active water treatment typically requires frequent or continuous operator attention, power, and the addition of treatment chemicals, and is typically most appropriate for sites with good access and water with high metals concentrations. Semi-passive water treatment systems are generally designed to function for extended periods of time with little or no operator attention and are typically most appropriate for remote sites and/or water with relatively low metals concentrations. The term "semi-passive" is used for these TCDs rather than "passive" because they are not considered to be truly passive and will require periodic attention, although at a less frequent rate than an active system.

[4] Hydraulic isolation actions are designed to isolate waste materials and contaminated groundwater from relatively clean water sources. In the Upper Basin, hydraulic isolation actions are intended to isolate wastes and contaminated groundwater from the SFCDR and its tributaries to prevent the migration of contaminants. These actions are assigned to sites only in areas where waste removal is infeasible, such as where wastes are located

- **Updated conceptual design for hydraulic isolation of the SFCDR.** The 2001 FS Report included a slurry wall and groundwater collection drains along the length of the SFCDR between Wallace and Elizabeth Park to accomplish hydraulic isolation from contaminated fill materials and floodplain sediments. Based on an updated analysis presented in the 2012 FFS Report, stream liners will be used in place of the slurry wall and in conjunction with groundwater collection drains for this reach.
- **Sites with a water treatment component.** Based on the updated water treatment TCDs, a total of 59 sites in Alternative 3+ and 96 sites in Alternative 4+ include different water treatment TCDs than those included in Ecological Alternatives 3 and 4, respectively, in the 2001 FS Report.
- **Sites within the Pine Creek Watershed.** Based on discussions with BLM during preparation of the FFS Report, the remedial actions identified for the Pine Creek Watershed were modified to account for remedial work that has been completed and new data that have been collected since the 2001 FS Report was issued. In addition, several sites were added to the list for remedial action based on recommendations provided by BLM.
- **Sites located within the Woodland Park area of the Canyon Creek Watershed.** Woodland Park has been an area of focused study since the 2002 ROD for OU 3 was issued because it is a significant source of dissolved metals loading to surface water in the Upper Basin. It is also an area where contaminated fill materials are located beneath existing infrastructure such as residential areas and roads. The 2002 ROD for OU 3 selected surface water treatment actions in Woodland Park to treat all surface water at the mouth of Canyon Creek. The ROD also included provisions for additional studies, and the post-ROD studies have included groundwater modeling, groundwater-surface water interaction studies, and water treatability studies (CH2M HILL, 2007b, 2009d, 2009f, 2009l). These studies found that rather than collecting large volumes of surface water for treatment as included in the 2002 ROD, significantly smaller volumes of contaminated groundwater could be collected and treated to achieve the same degree of loading reduction in Canyon Creek. Therefore, remedial components for Woodland Park under Alternatives 3+ and 4+ were developed based on the post-ROD studies and evaluation of remedial options.

As was the case with Ecological Alternatives 3 and 4 in the 2001 FS Report, the primary difference between Alternatives 3+ and 4+ is the extent of excavation and removal of wastes. Alternative 3+ focuses on a combination of in-place containment and excavation of wastes inside the 100-year floodplain, as well as wastes outside the 100-year floodplain that are probable sources of metals loading. Active and semi-passive water treatment of adit drainages and hydraulic isolation of groundwater are also included in Alternative 3+. Under Alternative 3+, an estimated average flow of 12,000 gallons per minute (gpm) of

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beneath communities and roadways. Hydraulic isolation methods include groundwater interception to prevent discharge to surface water, and barrier methods such as slurry walls and stream liners.

contaminated water would be treated at the CTP in Kellogg,[5] and an additional 800 gpm (average flow) would be treated by onsite semi-passive systems.

Alternative 4+ focuses on complete excavation and hydraulic isolation of all known wastes that are probable sources of metals loading. Wastes that are outside the 100-year floodplain and probably not significant sources of metals loading would be covered in place. Expanded use of active and semi-passive water treatment of adit drainages and hydraulic isolation of groundwater are also included in Alternative 4+. Under Alternative 4+, an estimated average flow of 14,000 gpm of contaminated water would be treated at the CTP[6] and an additional 1,400 gpm would be treated by onsite semi-passive systems.

Section 6.0 of the 2012 FFS Report includes additional text and tables detailing the differences between Alternatives 3 and 3+ and Alternatives 4 and 4+, as well as the waste material quantities at each source site.

9.1.2 Remedial Alternatives for OU 2 (Within the Bunker Hill Box)

A different method was used to develop remedial alternatives for OU 2 than that used to develop the OU 3 alternatives described in Section 9.1.1. The remedial alternatives for OU 2 were not based on previously evaluated alternatives, as was the case for the Upper Basin portion of OU 3. Instead, the OU 2 remedial alternatives were developed by taking into consideration the Phase I source removal, containment, and surface capping remedial actions completed in OU 2 by EPA and IDEQ from 1994 to 2002; the effectiveness of those actions; and EPA's commitment not to displace communities by implementing large-scale source removal actions within OU 2. Given these considerations, remedial alternatives with the potential to address significant portions of the remaining metals loading to the SFCDR in the Bunker Hill Box were identified in the FFS Report (EPA, 2012) for Phase II work in OU 2.

Phase I work at OU 2 focused on source control actions to minimize direct exposure to contaminants that posed a risk to human health and the environment. The Phase I remedial actions consisted of capping contaminated materials in-place and/or removing and consolidating contaminated materials into two primary onsite waste consolidation areas (the Smelter Closure Area [SCA] and the Central Impoundment Area [CIA]); capping the SCA and CIA; demolishing and encapsulating structures; excavating and revegetating Smelterville Flats and revegetating the hillsides surrounding OU 2; developing and implementing the ICP for OUs 1 and 2; conducting studies of long-term water quality improvement; and evaluating remedial action effectiveness.

The Phase I effectiveness evaluation (CH2M HILL, 2007c) indicated that the largest sources of dissolved metals contamination to groundwater and surface water in OU 2 are subsurface contamination located in floodplains and fill materials beneath the populated areas and

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[5] The flow of 12,000 gpm for Alternative 3+ is in addition to Bunker Hill Mine water that is currently being treated at the CTP. This represents the annual average flow expected and not the peak flow that will be needed for design of capital equipment.

[6] The flow of 14,000 gpm for Alternative 4+ is in addition to Bunker Hill mine water that is currently being treated at the CTP.

infrastructure within the Bunker Hill Box. Because of the widespread nature of the contamination, EPA's commitment not to displace communities, and the complexity of contaminant transport within OU 2, a remedial approach focusing on groundwater-based actions was developed for the FFS Report (EPA, 2012). These actions achieve the RAOs of (1) preventing discharge of COCs in groundwater to surface water at concentrations that exceed surface water quality ARARs, (2) reducing risks from COCs in surface water to acceptable exposure levels that are protective of ecological receptors (based on the ingestion of and direct contact with surface water) and comply with identified ARARs, and (3) restoring surface water designated for beneficial use as drinking water to meet drinking water and water quality standards. Remedial alternatives for the Box were developed based on the current understanding of groundwater-surface water interactions as described in Section 5.2.2.3 of this Decision Summary.

To support this, a groundwater flow model (CH2M HILL, 2009d) was developed, calibrated, and used to assist with the development of Phase II remedial alternatives. Model simulations were performed for all water management/collection actions, and subsequent dissolved zinc load reductions in the SFCDR for each action were estimated. To aid in the evaluation of alternatives, the model was used to estimate the cost per pound of dissolved zinc load reduction to the SFCDR for each individual action.

The development of remedial alternatives focused on general response actions consisting of source control, water collection and management, and water treatment, which were combined into the five OU 2 Alternatives (a) through (e).

The same action for phased water collection and management of the Reed and Russell Adit discharge (from the Bunker Hill Mine) is included in each of the five remedial alternatives for OU 2. The initial phase of this action consists of installing a check dam within the Reed and Russell Adits to redirect AMD back into the mine and prevent it from flowing out of the adits. If the required water quality criteria are not achieved in the residual Reed and Russell Adit discharge, additional measures will be implemented to collect and convey the AMD to the CTP for active treatment.

The five remedial alternatives for OU 2 are summarized as follows (additional details about the development and components of each alternative can be found in Section 6.3.4 of the FFS Report):

- **OU 2 Alternative (a): Minimal Stream Lining.** OU 2 Alternative (a) consists of limited stream-lining actions in losing reaches[7] of OU 2 streams to reduce recharge to groundwater. Actions would include lining the SFCDR on the north side of the CIA; lining Bunker, Deadwood, and Magnet Creeks where they cross the SFCDR alluvial deposits; and phased implementation of the Reed and Russell Adit actions discussed above. No additional water would be collected for treatment under this alternative.
- **OU 2 Alternative (b): Extensive Stream Lining**. OU 2 Alternative (b) consists of extensive stream-lining actions in OU 2 streams to reduce the interaction of relatively

[7] Losing reaches are lengths of a stream along which there is a net reduction in stream flow due to subsurface discharge to groundwater.

clean surface water with the contaminated groundwater and sediments beneath. Groundwater cutoff walls would be installed at selected locations as part of this alternative. Actions would include lining Bunker, Government, Deadwood, and Magnet Creeks over their full length from far up each gulch down to the SFCDR; installing a slurry wall and extraction wells upgradient from tributary stream liners (except Bunker Creek) to direct clean groundwater into the lined channels; and phased implementation of the Reed and Russell Adit actions discussed above. No additional water would be collected for treatment under this alternative.

- **OU 2 Alternative (c): French Drains.** OU 2 Alternative (c) consists of a French drain system located in the central portion of OU 2, along the northern end of the CIA in the area with the highest dissolved metals load gains observed in the SFCDR. This French drain system would intercept dissolved-metals-contaminated groundwater prior to discharging to the SFCDR. Actions include installing a French drain along the northwest end of the CIA and to the southwest across the SFCDR valley floor, terminating on the west side of Government Gulch; conveyance of collected water to the CTP for treatment; conveyance of the CTP effluent directly to the SFCDR in a pipeline installed on the east side of the CIA or in a pipe along Bunker Creek (instead of discharging to Bunker Creek as is currently done, which results in recontamination of this treated water); and phased implementation of the Reed and Russell Adit actions discussed above. An estimated average flow of 3,900 gpm of contaminated groundwater would be treated at the CTP (in addition to current flows of AMD from the Bunker Hill Mine and waters to be added from OU 3).
- **OU 2 Alternative (d): Stream Lining/French Drain Combination.** OU 2 Alternative (d) consists of French drains, stream linings, cutoff walls, and extraction wells located in the central portion of OU 2, primarily in the area with the highest dissolved metals load gains observed in the SFCDR. Actions would include lining Government Creek; installing a slurry wall and extraction wells across Government Gulch (on the upgradient end of the liner); installing a French drain along the northwest end of the CIA (which would extend south from the drain above and across the SFCDR valley, terminating on the east side of Government Gulch); conveying the collected water to the CTP for treatment; installing extraction wells across the mouth of Government Gulch and conveying the collected water to the CTP for treatment; conveying treated CTP effluent directly into the SFCDR via a pipeline installed on the east side of the CIA or in a pipe along Bunker Creek; and phased implementation of the Reed and Russell Adit actions discussed above. An estimated average flow of 3,900 gpm of contaminated groundwater would be treated at the CTP (in addition to current flows of AMD from the Bunker Hill Mine and waters to be added from OU 3).
- **OU 2 Alternative (e): Extensive Stream Lining/French Drain Combination.** OU 2 Alternative (e) is the most extensive water collection and management alternative, incorporating extensive stream lining of the SFCDR and its tributaries as well as French drain systems. Actions would include lining of the SFCDR and Bunker, Government, Deadwood, Magnet, Grouse, and Humbolt Creeks; installing a French drain along the northern end of the CIA in the area with the highest dissolved metals load gains observed in the SFCDR, as in OU 2 Alternatives (c) and (d), and conveying the collected water to the CTP for treatment; installing a French drain extending from mid-

Smelterville Flats west to the Pinehurst Narrows, and conveying the collected water to the CTP for treatment; installing slurry walls and extraction wells upgradient of tributary liners (except Bunker Creek) to guide groundwater into the lined channels; installing a slurry wall and extraction wells across the SFCDR valley floor perpendicular to SFCDR flow at Elizabeth Park, and a slurry wall across the SFCDR valley floor at Pinehurst Narrows; and phased implementation of the Reed and Russell Adit actions discussed above. An estimated average flow of 2,400 gpm of contaminated groundwater would be treated at the CTP (in addition to current flows of AMD from the Bunker Hill Mine and waters to be added from OU 3).

9.1.3 Combined Remedial Alternatives for the Upper Basin

The separate alternatives for the Upper Basin portion of OU 3 (outside the Bunker Hill Box) and for OU 2 (within the Box) were combined to produce 10 remedial alternatives that address all of the Upper Basin. Each combined remedial alternative for the Upper Basin consists of components for the Upper Basin portion of OU 3 and for OU 2, as shown in Figure 9-1. There are significantly more remedial actions included in OU 3 Alternatives 3+ and 4+ compared to the OU 2 alternatives; therefore, the majority of the estimated cost (approximately 80 to 99 percent of the total for each alternative) comprises OU 3 actions.

Along with the No Action Alternative, which is included for comparative purposes, the 10 combined remedial alternatives as presented in the FFS Report (EPA, 2012) are summarized in Table 9-2 along with the estimated capital costs, operation and maintenance (O&M) costs, and total costs associated with implementation of the alternatives, using a 7-percent discount rate. In the FFS Report, the combined remedial alternatives are evaluated individually and then compared with one another to assist in the selection of a Preferred Remedial Alternative, which was presented in Section 9.1 of the Upper Basin Proposed Plan (EPA, 2010a). The comparative analysis of remedial alternatives is summarized in Section 10.1 of this Decision Summary.

9.2 Remedy Protection Alternatives

The remedy protection alternatives for the Upper Basin focus on protecting the portions of the existing Selected Remedies focusing on human health in the RODs for OUs 1 and 2, and in the ROD for OU 3 as it applies specifically to the Upper Basin. These existing remedies include the placement of clean, protective barriers that are installed in residential, commercial, common-use, and right-of-way areas to prevent direct contact with and exposure to mining-related contaminants. Long-term maintenance of these barriers is a key component of the success of these remedies. To date, the remedies that have been implemented are functioning as designed and are protective of human health, as described previously in this Decision Summary (Sections 2.2, 4.2.1, and 7.1). However, EPA is aware of certain limited circumstances where the potential for adverse impacts from erosion and/or recontamination has already threatened or could threaten the long-term effectiveness and permanence of these remedies.

Before developing alternatives to enhance the protectiveness of the portions of the existing Selected Remedies focusing on human health as they apply to the Upper Basin, the potential threat of damage posed to the remedies by localized storm events was assessed. The assessment focused on eight of the most densely populated communities in the Upper Basin: Pinehurst, Smelterville, Kellogg, Wardner, Osburn, Silverton, Wallace, and Mullan. Erosion (also referred to as "scour") of clean barriers that exposes contamination and the deposition of contaminated sediments on previously clean barriers are the major threats posed to the existing remedies. The threat of sediment deposition exists in the following scenarios: (1) deposition of contaminated creek sediments on protective barriers if a creek overtops its banks during a flood; (2) erosion of contaminated materials below a protective barrier, and deposition of these materials on a previously clean area; and (3) erosion of contaminated materials from a nearby hillside or another source, and deposition of these materials on previously clean barriers.

The remedy protection alternatives evaluated in the FFS Report (EPA, 2012) focused on localized tributary flooding and high-precipitation (storm) events. These events can impact human health and the environment by eroding protective barriers and/or by depositing contaminated sediments in previously clean areas, thereby exposing contaminated soil to humans and ecological receptors. Hydrologic and hydraulic models analyzed the total expected impact area of barrier scouring and the deposition of potentially contaminated sediments for 5-, 25-, and 50-year storm events. The results of these analyses (presented in Section 9.0 of the FFS Report) were used to assess whether remedy protection projects could improve the long-term effectiveness and permanence of the in-place barriers within each community.

Two remedy protection alternatives were developed to address these potential issues. These alternatives are described below and in Table 9-3, which includes the estimated capital, O&M, and total costs associated with implementation of the alternatives.

- **Alternative RP-1: No Further Action (Post-Event Response).** Alternative RP-1 would not modify any of the existing conditions in the Upper Basin to increase the current level of long-term permanence of the existing protective barriers installed to protect human health. If the existing remedies were damaged during storm events and this damage posed risks to human health and/or the environment that warranted response actions to reduce the risks, EPA and state agencies would determine the best approaches for addressing such contamination. In the event of catastrophic flooding, EPA, other federal agencies, and state agencies would evaluate response needs as appropriate.

  Because portions of the existing remedies are expected to be damaged during storm events, based on hydrologic and hydraulic analyses conducted during the FFS, Alternative RP-1 includes the estimated costs for repair of the existing remedies in the Upper Basin communities. Repair work would include cleanup of contaminated materials on residential and commercial properties and within rights of way, and replacement of protective barriers if these barriers were contaminated by flood deposition and/or damaged due to erosion during storm events. Although detailed analyses were not conducted for the side gulches (i.e., drainage areas with residential properties located within the Upper Basin but outside the eight primary communities), the expected damage during storm events was estimated based on the trends found in the hydrologic and hydraulic analyses of the Upper Basin communities. Under Alternative RP-1, if the existing Selected Remedies were damaged during storm events and this damage posed risks to human health and/or the environment that warranted response actions to reduce the risks, EPA and state agencies would determine the best tools for addressing such contamination, including replacement of existing barriers preventing exposure to underlying contamination. In the event of catastrophic flooding, EPA, other federal agencies, and state agencies would evaluate response needs as appropriate.

- **Alternative RP-2: Modifications to Selected Remedies to Enhance Protectiveness (Remedy Protection Projects).** Alternative RP-2 comprises combinations of various actions to protect the existing protective barriers installed to protect human health against tributary flooding and high-precipitation events up to the 50-year storm. Each community has different water conveyance infrastructure-related issues that may pose risks to the existing remedies. Actions that could be applicable to remedy protection projects were developed from common engineering practice for stormwater conveyance projects. The actions identified to mitigate the risks posed to the existing remedies in Alternative RP-2 were determined based on current conditions in each community area and on the hydrologic and hydraulic analyses presented in the FFS Report (EPA, 2012).

  For the purposes of this evaluation, the Alternative RP-2 remedy protection projects and estimated costs were preliminarily defined for each of the eight communities. Section 9.5.2 of the FFS Report provides details of the specific RP-2 remedy protection project(s) identified for each of the eight communities. Generally these actions consist of installation or upgrade of surface water management structures such as culverts, bypass pipes, and road shoulder hardening. Although detailed analyses were not conducted for the side gulches as noted above, approximate costs to address problems in the side gulches were developed for Alternative RP-2 based on the trends found in the analyses of the Upper Basin communities referenced above. Easements and operation and maintenance (O&M) agreements may be necessary components of Alternative RP-2 to ensure long-term access and the functionality of the remedy protection projects. If necessary to ensure long-term maintenance of the remedy protection projects, EPA and IDEQ will also coordinate with local governments to ensure continued O&M as property uses change.

In the FFS Report, the remedy protection alternatives are evaluated individually and then compared with one another to assist in the selection of a Preferred Remedy Protection Alternative, which was presented in Section 9.2 of the Upper Basin Proposed Plan (EPA, 2010a). The comparative analysis of the remedy protection alternatives is summarized in Section 10.2 of this Decision Summary.

SECTION 10.0

Summary of Comparative Analysis of Alternatives

This section describes the comparative evaluation of alternatives as presented in the FFS Report (EPA, 2012) for protection of human health and the environment in the Upper Basin. The NCP (Section 300.430 (e)(9)(ii)) requires that the alternatives described in Section 9.0 of this Decision Summary be evaluated using nine CERCLA evaluation criteria and compared against one another. The purpose of the comparison is to identify the relative advantages and disadvantages of the alternatives in terms of these CERCLA criteria, with a view to selecting a Preferred Alternative (in the Proposed Plan) and ultimately a Selected Remedy.

The Proposed Plan identified Alternative 3+(d) and Alternative RP-2 for remedial actions and remedy protection actions, respectively. The remedial actions included in the Selected Remedy are based on Alternative 3+(d), although as described in Section 12.0 of this Decision Summary, the scope has been significantly reduced such that the Selected Remedy is an interim remedy. This section describes the evaluation of the alternatives presented in the FFS Report against CERCLA criteria.

The nine CERCLA evaluation criteria are divided into three categories: Threshold Criteria, Primary Balancing Criteria, and Modifying Criteria. The two Threshold Criteria are:

- **Overall Protection of Human Health and the Environment.** Evaluates the overall protectiveness of an alternative and describes how risks posed will be eliminated, reduced, or controlled through treatment, engineering, or institutional controls.
- **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs).**[1] Evaluates whether an alternative meets federal, state, and Tribal environmental statutes, regulations, and other requirements that pertain to the site, and/or whether a waiver is justified.

The five CERCLA Primary Balancing Criteria are:

- **Long-Term Effectiveness and Permanence.** Considers an alternative's ability to protect human health and the environment over time.
- **Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment.** Evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

[1] ARARs include substantive provisions of any promulgated federal or more stringent state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements for a CERCLA site or action.

- **Short-Term Effectiveness.** Considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
- **Implementability.** Considers the technical and administrative feasibility of implementing an alternative, including factors such as the availability of materials and services.
- **Cost.** Includes estimated net present value (NPV) capital, O&M, and total costs associated with implementation of an alternative. O&M costs are estimated for a 30-year period using a discount rate of 7 percent per EPA guidance (EPA, 2000b).

The two CERCLA Modifying Criteria are:

- **State, Tribe, and Federal Natural Resource Trustee Acceptance.**[2] Considers whether the local state(s) and Tribe(s) and the federal Natural Resource Trustees (the U.S. Departments of the Interior and Agriculture) agree with EPA's analyses and recommendations presented in the Proposed Plan for the project. Comments received on the Proposed Plan during the public comment period are an important indicator of state, Tribe, and federal Natural Resource Trustee acceptance.
- **Community Acceptance.** Considers whether the local community agrees with EPA's analyses and recommendations presented in the Proposed Plan for the project. Comments received on the Proposed Plan during the public comment period are an important indicator of community acceptance.

The three criteria categories are based on the role of each criterion during the alternatives evaluation and remedy selection processes. The Threshold Criteria relate directly to statutory requirements that must be satisfied by a selected alternative. The Primary Balancing Criteria represent the primary technical, cost, institutional, and risk factors that form the basis of the alternatives evaluation. The Modifying Criteria are evaluated following the receipt of comments on the Proposed Plan for the project.

For the Upper Basin of the Coeur d'Alene River, the alternatives described in Section 9.0 of this Decision Summary are evaluated using the Threshold and Primary Balancing Criteria in the FFS Report (EPA, 2012). The comparative analyses of the remedial alternatives and the remedy protection alternatives using these seven criteria are summarized in the following Sections 10.1 and 10.2, respectively. More details of the comparative analyses are provided in the FFS Report, which also presents an individual evaluation of each alternative in terms of these seven CERCLA criteria.

In accordance with CERCLA, the alternatives are further evaluated in this Upper Basin ROD Amendment using the two Modifying Criteria. This evaluation is also presented in Sections 10.1 and 10.2. It should be noted, however, that the comments received on the Upper Basin Proposed Plan (EPA, 2010a) and the Draft Final FFS Report (CH2M HILL, 2010) focused primarily on EPA's Preferred Alternative for the Upper Basin as identified in the Proposed

[2] The name of the first CERCLA Modifying Criterion can vary slightly depending on the context of the particular cleanup project and the interested stakeholders and other parties. "State, Tribe, and Federal Natural Resource Trustee Acceptance" is the name of the criterion used throughout this Upper Basin ROD Amendment.

Plan. Relatively little feedback was received on the range of alternatives considered in the Draft Final FFS Report and summarized in the Proposed Plan.

10.1 Remedial Alternatives

Tables 10-1 (for the No Action Alternative and Alternatives 3+(a) through 3+(e)) and 10-2 (for Alternatives 4+(a) through 4+(e)) provide detailed comparative analyses of the remedial alternatives for the Upper Basin. A summary of the comparative analysis of the remedial alternatives is presented in Figure 10-1. Key technical issues identified for comparison between the remedial alternatives included the following:

- **Impacted sediment accessibility.** Impacted sediments located in river banks and beds are a major source of dissolved metals loading in the Upper Basin. Many of these impacted sediments are inaccessible, located beneath I-90, local communities, and other infrastructure or on private property. Removal or isolation of these impacted sediments is difficult and costly, with impacts on the local communities and the natural environment.

- **Estimated remedial effectiveness.** The prediction of long-term water quality trends and specific water quality in the SFCDR Watershed in the future is subject to considerable uncertainty. The uncertainty factors include complex weathering rates and the changes in these rates for the numerous mine waste types and source areas in the watershed. The effectiveness of cleanup actions further complicates these predictions. Despite these uncertainties, estimates of relative effectiveness can be made based on the principles of mass balance (i.e., if a certain mass of a metal is removed from the watershed or isolated through remedial action, it is no longer a source of loading to surface water) and using predictive tools such as the groundwater model for the SFCDR Watershed (CH2M HILL, 2009d) and the Predictive Analysis that was used in the FFS (EPA, 2012). These estimates, although subject to uncertainty, provide a sound basis for comparison of the *relative* effectiveness of alternatives.

- **Availability of materials.** Uncontaminated materials are required for covers, backfill, and revegetation actions included in the alternatives. Obtaining these materials in enough quantity could present challenges in implementing the alternatives and could cause environmental impacts at offsite source locations if not properly planned and managed.

- **Repository siting.** Finding suitable available sites and fulfilling substantive permit requirements of action- and location-specific ARARs for siting and construction of repositories may be difficult. The repository siting process is ongoing, and has been led by IDEQ since 2002. Public meetings and workshops will continue to provide citizens with the opportunity to comment on the proposed repository locations and designs.

- **Long-term management and associated costs.** Overall O&M requirements are associated with engineered controls such as repositories, waste consolidation areas, and barriers on mine waste piles; groundwater collection systems; and active and semi-passive water treatment systems.

- **Socio-economic impacts.** Construction associated with implementation of the Selected Remedy will have short-term "quality of life" and potential economic impacts for the local communities. These impacts could include increased truck traffic, dust, noise, and temporary disruption of services and recreational opportunities.

In the following sections, the comparative analysis of the remedial alternatives is presented in terms of the nine CERCLA evaluation criteria.

10.1.1 Overall Protection of Human Health and the Environment

All of the remedial alternatives for the Upper Basin as presented in the FFS Report (EPA, 2012), except the No Action Alternative, would achieve the criterion of overall protection of human health and the environment.

Although this criterion is evaluated as either "meets" or "does not meet", it can be helpful to also look at the different approaches to protectiveness, in that some alternatives may be more favorable than others. For example, all of the alternatives based on Alternative 3+ may provide benefits different from Alternative 4+, regardless of which OU 2 alternative is included. This is because the estimated implementation time frame for Alternative 4+ may be decades longer than that for Alternative 3+. During this time, Alternative 4+ would pose construction-related risks for workers, the community, and the environment resulting from the much larger extent of long-term construction and hauling involved, which are risks that would outweigh the additional long-term benefits of the proposed actions compared to Alternative 3+. Alternative 4+ would also have the greatest short-term environmental effects at offsite locations where borrow materials would be obtained. Implementation time frames are shorter for Alternative 3+, and the remedial actions are less extensive and carry fewer risks to workers, the community, and the environment.

10.1.2 Compliance with ARARs

With the exception of the No Action Alternative and within the context of their scope, all of the remedial alternatives as presented in the FFS Report would achieve the criterion of compliance with the ARARs for the Upper Basin cleanup. Cleanup levels for soil and sediments would be met upon the completion of each discrete remedial action project where remedial actions are taken under each alternative. ARARs for surface water would be met for all the alternatives through implementation of the collective remedial actions in a drainage area and following different periods of natural recovery (discussed further below). Given the pervasive nature of the subsurface contamination, the alternatives were not intended to achieve drinking water standards for groundwater at all locations.

As with the overall protectiveness criterion, and although this criterion is evaluated as either "meets" or "does not meet", it can be helpful to also look at the differences between the estimated effectiveness of the alternatives in the progress towards meeting surface water quality standards (i.e., AWQC).[3] An analysis was conducted during the FFS to estimate

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[3] Note that MCLs for drinking water are also ARARs for surface water as a drinking water source in the Upper Basin. However, the AWQC are used as an indication of compliance with surface water ARARs because, in general, the AWQC are lower (i.e., more stringent) than the MCLs for the Upper Basin COCs.

relative post-remediation AWQC ratios and dissolved zinc load reduction in the SFCDR at Elizabeth Park and Pinehurst under each alternative. Elizabeth Park was selected for this analysis because it is located at the upstream end of the Bunker Hill Box; Pinehurst was selected because it is located at the downstream end of the Bunker Hill Box, near the confluence with the North Fork of the river, which coincides relatively closely with the downstream end of the Upper Basin. Both of these locations have extensive water quality monitoring records and are part of the long-term environmental monitoring program for the Site (EPA, 2004; CH2M HILL, 2006a, 2009l). The difference in projected water quality between Elizabeth Park and Pinehurst, therefore, provides an indication of the progress and effectiveness of remedial actions in the Bunker Hill Box, as well as in the Upper Basin portion of OU 3. The initial relative effectiveness of the alternatives in reducing AWQC ratios is shown in Table 10-3.

The results of this analysis indicate that all of the action alternatives would provide significant improvements in water quality and that some would provide greater improvements than others. The results presented in Table 10-3 reflect the estimated improvements in water quality at the completion of discrete remedial action projects for each alternative. All the action alternatives are expected to meet the Threshold Criterion of compliance with ARARs for surface water, but only after a natural recovery period.[4] The relative period of time required for compliance between alternatives is expected to be related to the water quality improvement achieved upon the completion of all necessary Upper Basin remedial actions. It is important to note that this analysis was only conducted at two key locations on the SFCDR, Elizabeth Park and Pinehurst. It is expected that significant localized improvements in surface water quality would be observed throughout areas of the Upper Basin resulting from remedial actions in various watersheds and tributaries to the SFCDR.

Note: Because the No Action Alternative was only included for baseline comparison purposes and does not meet either of the Threshold Criteria, it is not discussed further in the following sections that evaluate the remedial alternatives in terms of the remaining CERCLA criteria.

10.1.3 Long-Term Effectiveness and Permanence

All of the remedial alternatives based on Alternative 4+ as presented in the FFS Report are expected to provide greater long-term effectiveness and permanence than those based on Alternative 3+, regardless of which OU 2 alternative they are coupled with. Alternative 4+ would achieve the highest degree of long-term effectiveness and permanence and would result in the fewest residual risks to human health and ecological receptors. Alternative 4+ has a higher degree of long-term effectiveness and permanence than Alternative 3+ as a result of the much higher volumes of contaminated materials that would be removed from the system as sources of loading and managed in repositories. The estimated effectiveness at the completion of Upper Basin remedial actions is also slightly higher for Alternative 4+ than for Alternative 3+. The differences among the OU 2 alternatives under this criterion do

[4] "Natural recovery" refers to the natural processes by which residual contamination remaining after the period of active remediation would be dispersed and diluted, resulting in improvements to surface water and groundwater quality over time.

not outweigh the magnitude of the differences between Alternatives 3+ and 4+. The relative assessment of long-term effectiveness and permanence of the OU 2 alternatives, from highest to lowest, is based on the relative differences in estimated post-remedial dissolved zinc loads in the SFCDR, where the greatest long-term effectiveness and permanence is associated with the highest reduction in dissolved zinc load. On that basis, OU 2 Alternative (e) provides the greatest degree of long-term effectiveness and permanence, followed, in order of decreasing effectiveness and permanence, by OU 2 Alternatives (d), (c), (a), and (b).

10.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

All 10 remedial alternatives as presented in the FFS Report satisfy the statutory preference for treatment. The statutory preference for treatment is satisfied through reduction of total volume of contaminated media—in this case, groundwater and surface water. The water treatment technologies to be employed would separate the metals from the water. These metals would then require disposal in repositories.

Although the treated water flow rates are relatively similar for all the alternatives, the estimated mass of dissolved zinc removed through treatment ranges from 230 to 1,500 pounds per day (lb/day). Surface water treatment would occur through both active treatment at the CTP in Kellogg and semi-passive treatment near the source sites.

The relative degree to which an alternative satisfies this criterion can be assessed by comparing the metals load that would be treated under each alternative. OU 2 Alternatives (a) and (b) do not include treatment and, therefore, do not satisfy this criterion to the same degree that other alternatives do (although both Alternatives 3+ and 4+ do include treatment; therefore the combined Upper Basin alternatives including OU 2 Alternatives (a) and (b) are still considered to satisfy the statutory preference for treatment). OU 2 Alternative (c) would treat the greatest dissolved zinc load, followed by Alternative (d) and then (e). Alternative 4+ includes greater volumes of water treated at the CTP than Alternative 3+. However, Alternative 3+ is expected to remove more contaminant mass through treatment than Alternative 4+ (330 lb/day versus 230 lb/day, respectively); therefore, Alternative 3+ is considered to satisfy this criterion to a greater degree than Alternative 4+ does. The lower mass of contaminants treated under Alternative 4+ is due to the higher degree of source removals that would be conducted. Under Alternative 3+, some wastes would be left in place and protectiveness would be provided by collecting and treating the impacted water. Under Alternative 4+, some of these wastes would be excavated and disposed of so that water treatment was no longer required. Alternative 4+ would also include collection and treatment of some higher-flow, lower-concentration adit discharges that are not included in Alternative 3+.

10.1.5 Short-Term Effectiveness

All of the remedial alternatives based on Alternative 3+ as presented in the FFS Report are considered to provide greater short-term effectiveness than those based on Alternative 4+ because Alternative 4+ would have much greater short-term negative impacts during construction than Alternative 3+, regardless of which OU 2 alternative they are coupled with. This is primarily due to the more extensive nature of the remedial actions that would be conducted under Alternative 4+, which would require a much longer time period to complete (up to decades longer). OU 2 Alternative (d) provides the greatest degree of short-term effectiveness, followed, in order of decreasing short-term effectiveness, by OU 2 Alternatives (c), (b), (a), and (e). This relative assessment is based on a balance of implementation time, effectiveness, and short-term risks.

10.1.6 Implementability

All of the remedial alternatives based on Alternative 3+ as presented in the FFS Report are considered more implementable than those based on Alternative 4+, because Alternative 4+ would have substantially increased technical and administrative feasibility considerations compared to Alternative 3+. Alternative 4+ has generally the same types of implementability considerations as Alternative 3+, but with much larger quantities of wastes to be remediated and larger repository requirements. The relative implementability of the OU 2 alternatives from most implementable to least implementable is as follows: (c), (d), (b), (a), and (e). This assessment of relative implementability is based on technical and administrative feasibility considerations. For example, OU 2 Alternative (e) involves extensive stream lining throughout the Bunker Hill Box and including the SFCDR. This alternative would be the most difficult to implement. OU 2 Alternatives (a) and (b) also include stream lining components and, therefore, are also considered to be difficult to implement. The most implementable of the OU 2 alternatives is (c), which includes no stream lining at all. OU 2 Alternative (d) is considered less implementable than OU 2 Alternative (c) because it does include some stream lining, although only for Government Creek and not the SFCDR.

10.1.7 Cost

Estimated costs for each remedial alternative as presented in the FFS Report are included in Table 9-2 of this Decision Summary. As shown, the costs for alternatives based on Alternative 4+ are consistently higher than for those based on Alternative 3+, regardless of which OU 2 alternative they are coupled with. The OU 2 costs represent a relatively small proportion of the total alternative costs, ranging from approximately 1 to 20 percent. The ranking of the OU 2 alternatives based on lowest to highest cost is as follows: (b), (c), (d), (a), and (e). The cost for OU 2 Alternative (a) is higher than the cost for OU 2 Alternative (b) because, although (b) includes more linear feet of stream lining, (a) includes a liner on the SFCDR that carries a significantly higher cost. Figure 10-2 depicts the relationship between the total cost (30-year NPV) and the predicted post-remediation AWQC ratios at the Pinehurst monitoring location (Station SF-271) under each alternative.

10.1.8 State, Tribe, and Federal Natural Resource Trustee Acceptance

This section summarizes state, Tribe, and federal Natural Resource Trustee acceptance of EPA's Preferred Remedial Alternative (Alternative 3+(d)) identified in the Proposed Plan based on comments submitted by the States of Idaho and Washington, the Coeur d'Alene and Spokane Tribes, and the U.S. Departments of the Interior and Agriculture. The comments generally focused on specific aspects of EPA's Preferred Remedial Alternative, and did not address other remedial alternatives considered. The statements included in Sections 10.1.8.1 through 10.1.8.6 were compiled by EPA from submittals from the entity referenced in each section heading and reflect the views expressed by that entity. The comments were carefully considered in the development of the Selected Remedy, as described in Section 12.0 of this Decision Summary. The full comments submitted by these entities, and EPA's responses to those comments, are presented in the Responsiveness Summary (Part 3 of this ROD Amendment).

For issuance of this ROD Amendment, EPA sought formal concurrence from the State of Idaho and the Coeur d'Alene Tribe and support from the State of Washington and the Spokane Tribe. EPA sought the support of the State of Washington and the Spokane Tribe because it recognizes their concerns and interests in site cleanup given their jurisdiction in areas downstream of where the remedial actions in the Upper Basin Selected Remedy will take place. In addition, EPA recognizes the concerns of the State of Washington with respect to contamination entering the state via the Spokane River.

10.1.8.1 State of Idaho Acceptance

IDEQ agreed with EPA that additional cleanup is needed at the Bunker Hill Superfund Site. However, IDEQ had a number of concerns about the Proposed Plan and suggested that EPA adopt a cleanup plan that would significantly modify the Proposed Plan. IDEQ commented that the overall scope of the remedy for the Upper Basin should be limited to prioritized remedial actions that can be designed and implemented within a reasonably foreseeable period of time, such as 10 to 15 years. IDEQ was concerned that a remedy of the scope outlined in the Proposed Plan would circumvent or minimize the public input process as the remedy is implemented over a period of decades.

Other concerns of IDEQ related to specific remedial actions included:

- **SFCDR and Pine Creek Flooding.** IDEQ recognized that although SFCDR and Pine Creek flooding poses risks to EPA's Preferred Alternative, major flood control projects on these waters are also necessary for the overall protection of human life and property in adjoining communities. IDEQ commented that it would like to work with EPA to identify actions that can be included in the Selected Remedy to partner with and significantly advance the efforts of local communities and other state and federal agencies to adequately address this common threat.

- **Mine and Mill Sites.** IDEQ commented that the list of mine and mill sites included in the Proposed Plan should be carefully evaluated and pared down, or at a minimum prioritized, prior to inclusion in the Selected Remedy. IDEQ specifically mentioned that active mining sites should be removed, such as the tailings impoundments in Mullan and Big Creek, as well as sites that are considered to be insignificant contaminant sources. IDEQ also commented that work proposed in the Big Creek drainage and in the Upper SFCDR areas upstream of Mullan is unnecessary.

- **Waste Repositories.** IDEQ commented that maximum utilization of local waste consolidation areas will minimize the need for large, centralized, waste repositories and be consistent with the community objective to preserve development potential to the extent possible. IDEQ asked that specific language be included in this ROD Amendment discussing the preference for waste consolidation areas. IDEQ also commented that EPA should not commit to large regional repositories to accommodate mine and mill site wastes.

- **Water Collection and Treatment in OU 3 (upstream of the Bunker Hill Box).** IDEQ commented that EPA's proposal to collect and convey water to the CTP for treatment is unnecessary and premature at this time. IDEQ also commented that source control should be implemented first, and its effectiveness assessed prior to implementation of active water treatment.
- **Natural Attenuation/Source Depletion.** IDEQ commented that improvements in water quality have been made over the last approximately 30 years in the absence of significant remediation, because of natural attenuation or source depletion processes. IDEQ suggested that these processes be studied to evaluate what degree of site cleanup can be achieved through natural attenuation, or at least through source control actions with no water treatment.
- **Water Rights.** IDEQ commented that it expects EPA to comply with Idaho water law and seek water rights prior to collection of contaminated groundwater or surface water for treatment.
- **ARARs Waivers.** IDEQ commented that ARAR waivers may ultimately be warranted for both groundwater and surface water quality standards on the grounds of technical impracticability.
- **Remedial Action Objectives.** IDEQ commented that EPA should continue to use goals based on measurable fishery "benchmarks" rather than numerical standards and criteria, and that habitat is and will be the critical limiting factor related to fisheries' health.
- **Bunker Hill Box Remedial Actions.** IDEQ supported the hydraulic isolation and water treatment actions proposed for the Box. IDEQ commented that these actions can and should serve as a pilot test for groundwater collection drains proposed in other areas (Osburn and Canyon Creek) as part of EPA's Preferred Alternative.
- **Large Scale Floodplain Removals.** IDEQ commented that planning, design, and construction of large-scale floodplain removals must be integrated with and complement flood control planning, design, and construction. IDEQ also commented that the planned Osburn Tailings Impoundment should not be used for upland removals and should be reserved for floodplain removals to avoid construction of large regional repositories on the SFCDR valley floor.
- **Funding.** IDEQ was concerned that funding from previous legal settlements will not be adequate for all actions, and that the State of Idaho cannot support the level of financial commitment that would be required by the actions in the Proposed Plan.

10.1.8.2 State of Washington Acceptance

The Washington State Department of Ecology (Ecology) supported EPA's Preferred Alternative and urged EPA to prioritize actions that will provide the greatest reduction in metals loading to surface water as soon as possible. Ecology specifically mentioned construction of the pipeline to convey Canyon Creek groundwater to the CTP for active treatment and the Phase II remedial actions in the Bunker Hill Box as high-priority actions. Ecology was concerned that, without this prioritization, the Lower Basin, Coeur d'Alene Lake, and Washington State will continue to be heavily impacted for decades.

Ecology emphasized that the success of Washington's Total Maximum Daily Loads (TMDL) program for metals (http://www.ecy.wa.gov/programs/wq/tmdl/) largely relies on controlling the upstream metals sources in Idaho so that the toxicity criteria of Washington's Water Quality Standards for surface water are met at the Washington/Idaho border.

10.1.8.3 Coeur d'Alene Tribe Acceptance

The Coeur d'Alene Tribe generally supported EPA's Preferred Alternative. Specifically, the Coeur d'Alene Tribe supported the Basin-wide cleanup approach that EPA has taken with the Preferred Alternative, as well as EPA's efforts in involving the community during this process.

The Coeur d'Alene Tribe expressed the following concerns related to EPA's Preferred Alternative:

- **Scope of the Preferred Alternative.** The Coeur d'Alene Tribe commented that it would prefer to see the longer-term vision of Basin-wide cleanup articulated at this time to include the Lower Basin and Coeur d'Alene Lake. The Coeur d'Alene Tribe requested that EPA expand the Preferred Alternative to include these areas.
- **Repositories**. The Coeur d'Alene Tribe expressed considerable concern about the design of repositories and commented that they should be sited well above the floodplain, designed with sufficient lining and leak detection, and be covered with low-permeability caps when full.
- **Hydraulic Isolation**. The Coeur d'Alene Tribe suggested that during design of hydraulic isolation systems near or within streams (stream liners, groundwater collection drains), fisheries' habitat be taken into consideration and potential impacts of the actions assessed.
- **Lower Basin**. The Coeur d'Alene Tribe commented that it would like to see specific language in this ROD Amendment that confirms there will be a ROD Amendment in the future for the Lower Basin as well as a future plan for using the Enhanced Conceptual Site Model for the Lower Basin, which will assist in decision-making for Lower Basin remedies.
- **Coeur d'Alene Lake**. Since no remedy has been developed for Coeur d'Alene Lake, the Coeur d'Alene Tribe commented that the Five-Year Review process will not take into account the evaluation of the efficacy of the Lake Management Plan in effectively managing metals in the lakebed sediments. The Coeur d'Alene Tribe requested that a formal process be included in this ROD Amendment to explain how EPA will evaluate their decision to continue to "defer" the Lake from CERCLA remedial actions if the Lake is not included in future Five-Year Reviews. The Coeur d'Alene Tribe suggested that this explanation could be presented in the Introduction section of the ROD Amendment, after the discussion of why EPA is making this ROD Amendment specific to the Upper Basin only.

10.1.8.4 Spokane Tribe Acceptance

The Spokane Tribe did not submit comments on EPA's Preferred Alternative, but made the following two requests:

- **Surface Water Monitoring.** The Spokane Tribe requested that a permanent surface water monitoring station be installed on the Spokane River at the reservation boundary.
- **Re-evaluation of Human Health Risks.** The Spokane Tribe requested that EPA re-evaluate human health risks based on information gathered since the 2002 ROD for OU 3 regarding subsistence use rates.[5,6]

10.1.8.5 U.S. Department of the Interior Acceptance

The U.S. Department of the Interior (DOI) generally supported EPA's Preferred Alternative and agreed that a long-term approach to cleanup of the Upper Basin, combined with adaptive management, is needed.

DOI expressed the following general preferences for consideration during the implementation phase of the Upper Basin cleanup:

- **Source Control**. DOI expressed a preference for permanent source control solutions requiring minimal long-term O&M where practicable to minimize the risk of remedy failure.
- **Smelterville Flats**. DOI commented that EPA should identify significant soil and sediment contamination in OU 2 and the lower SFCDR from Smelterville Flats to the confluence with the North Fork of the Coeur d'Alene River. DOI further commented that this area is a source of metal exposure for migrating songbirds and waterfowl and that these areas should be remediated once upstream contaminant sources have been controlled to minimize the risk of recontamination.
- **Lower Basin**. DOI expressed concerns about risks to human health and the environment in the Lower Basin and suggested that EPA balance the allocation of resources between the Upper and Lower Basins.

10.1.8.6 U.S. Department of Agriculture Acceptance

The U.S. Department of Agriculture's (DOA's) U.S. Forest Service (USFS) supported EPA's Preferred Alternative and commented that it is consistent with DOA's primary objective of restoring and maintaining healthy watersheds and diverse habitats. USFS agreed with EPA that flexibility and adaptive management will be critical during implementation.

10.1.9 Community Acceptance

This section summarizes community acceptance of EPA's Preferred Alternative based on comments on the Proposed Plan. EPA received comments on the Proposed Plan from local residents, businesses, organizations, community leaders and elected representatives. Many comments were received on the Preferred Alternative as identified in the Proposed Plan,

[5] Harper et al., 2002. "The Spokane Tribe's Multipathway Subsistence Exposure Scenario and Screening Level RME" in *Risk Analysis*, Vol. 22, No. 33, pp. 513-526.

[6] Harper et al., 2007. *Regional Tribal Exposure Scenarios Based on Major Ecological Zones and Traditional Subsistence Lifestyles*. This document can be found at: http://www.hhs.oregonstate.edu/ph/tribal-grant-main-page.

while relatively little feedback was received on the range of alternatives considered in the FFS Report and summarized in the Proposed Plan.

EPA's work in the Coeur d'Alene Basin has been the subject of considerable controversy and scrutiny. Given the large scope and geographic area encompassed by the historical studies and cleanup activities, community concerns are numerous and wide-ranging. Public opinion has been sharply divided about such overarching issues as whether cleanup is needed in the Basin, how much cleanup is needed, and who should be in charge of the cleanup. Since 2008, EPA Project Managers have attended approximately 75 meetings with local organizations, community leaders, and elected officials to discuss the development of this Upper Basin ROD Amendment. EPA also worked extensively with the Basin Commission and associated technical focus groups to develop the Proposed Plan and address key comments raised during the comment period. Their input has helped shape the process and the content of technical documents and, ultimately, the Selected Remedy for the Upper Basin (a detailed description of community involvement activities is provided in Section 3.0 of this Decision Summary). By engaging the public and regulatory stakeholders early and often during development of the FFS and the Proposed Plan and providing regular opportunities for input, EPA was able to respond to issues and concerns as the cleanup plan was being developed.

For the Proposed Plan, in response to high public interest, EPA set an initial public comment period of 45 days instead of the usual 30 days. Based on subsequent requests from the public, the comment period was extended 90 more days, for a total of 135 days for public and stakeholder comment on both the Proposed Plan (EPA, 2010a) and the Draft Final FFS Report (CH2M HILL, 2010). During the comment period on both documents, EPA received more than 1,000 individual submittals that contained a total of more than 7,000 separate comments. EPA has responded to each individual comment and has provided a summary of the general comments and responses. Both general and detailed comments and responses can be found in Part 3 of this ROD Amendment, the Responsiveness Summary.

A broad range of opinions was represented in the public comments on the Proposed Plan. Many comments were very general and expressed lack of support for EPA and other government agencies or expressed the belief that no cleanup is needed in the Coeur d'Alene Basin. Other comments either generally supported EPA's plan or expressed a desire for a more aggressive cleanup approach. The primary concerns expressed by the community during the comment period for the Proposed Plan and the Draft Final FFS Report included:

- **Cleanup Duration and Cost**. Comments were received expressing concern about how long cleanup will take and how costly it will be. Those who voiced this concern were generally also concerned that the Proposed Plan provided no certainty about when the cleanup will be finished and ultimately how much it will cost.
- **Impacts to the Mining Industry**. Comments were received expressing concern that the cleanup plan would threaten the mining industry and mining jobs in the Silver Valley.
- **Water Collection and Treatment**. Comments were received expressing concern that water collection actions adjacent to the SFCDR and its tributaries in the Upper Basin could reduce stream flows and impact fishery conditions. Many of these community

members also expressed the belief that EPA does not have the right to implement these actions because the groundwater and surface water belong to the State of Idaho.

- **Public Involvement**. Comments were received expressing concern that the cleanup plan as presented in the Proposed Plan was too vague and that there would not be meaningful opportunities for public involvement during the pre-design and design phases and throughout the implementation period.

Additional stated concerns included:

- **Human Health Risks**. Comments were received stating that human health risks have been overestimated. These community members therefore believe that cleanup of the Upper Basin under the "pretext" of protection of human health is not necessary.
- **Environmental Risks**. Comments were received stating that the risks to the environment have been overestimated, or that the Coeur d'Alene Basin environment should be allowed to recover on its own without any active cleanup work.
- **Superfund Stigma**. Comments were received expressing concern that the stigma associated with Superfund sites and the disruption to the community that may occur during implementation of the Preferred Alternative would stand in the way of economic progress and development in the Basin.
- **Multiple ROD Amendments.** Comments were received expressing a preference for multiple ROD Amendments of reduced scope and duration (10 years was commonly mentioned) rather than the longer-term, more comprehensive Upper Basin ROD Amendment as envisioned by EPA's Preferred Alternative identified in the Proposed Plan.
- **Flooding**. Comments were received stating the belief that EPA should address potential flooding concerns associated with the SFCDR and Pine Creek to protect the existing protective barriers for these watersheds.
- **More Aggressive Cleanup Needed.** Comments were received stating that EPA needs a more aggressive cleanup plan to fully protect local human health and the environment as well as downstream areas.

EPA has worked closely with community members to understand and address these concerns. Despite the fact that on many issues there are widely divergent opinions, there has steadily been a growing recognition in the Upper Basin communities that some cleanup work is needed. Most community members agree that the work should be done quickly and with as little disruption as possible, and that the states, Tribes, local governments, and citizens should be directly involved in planning and implementing the cleanup activities that affect them.

10.2 Remedy Protection Alternatives

The comparative analysis of the remedy protection alternatives for the Upper Basin is summarized in the sections below and in Figure 10-3. Table 10-4 contains a detailed comparative analysis of the remedy protection alternatives.

10.2.1 Overall Protection of Human Health and the Environment

Both Alternatives RP-1 and RP-2 would be protective of human health and the environment because the existing portions of the Selected Remedies focusing on human health have been shown to be protective (EPA, 2010b). Alternative RP-2 would be more protective of human health and the environment because it would increase the long-term effectiveness and permanence of the existing remedies by decreasing the risk of recontamination due to tributary flooding and uncontrolled surface water flows.

10.2.2 Compliance with ARARs

Both Alternatives RP-1 and RP-2 could be implemented in compliance with the location- and action-specific ARARs for the Upper Basin cleanup. Chemical-specific ARARs were not included in the analysis because the remedy protection alternatives would only enhance the protectiveness of existing remedies and would not directly address metals contamination.

10.2.3 Long-Term Effectiveness and Permanence

Alternative RP-2 would increase the long-term effectiveness and permanence of the existing remedies by increasing tributary flooding controls and localized surface water controls, thereby decreasing the risk of recontamination and damage to the existing remedies due to flooding and uncontrolled surface water flows. Alternative RP-1 would only maintain and repair the existing remedies if they were damaged or recontaminated.

10.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Neither Alternative RP-1 nor Alternative RP-2 would include treatment. Therefore, neither alternative would reduce the toxicity, mobility, or volume of metals contamination through treatment.

10.2.5 Short-Term Effectiveness

Both alternatives would be effective in the short term because the existing remedies have proven effective in protecting human health. Alternative RP-2 would reduce the mobility of potentially contaminated sediments transported by floodwaters and surface water flows through the communities by effectively conveying tributary floodwaters up to a 50-year storm event, thereby reducing the potential routes of exposure. Alternative RP-1 would not reduce the mobility of contaminated sediments transported by floodwaters through the communities.

10.2.6 Implementability

Both Alternatives RP-1 and RP-2 are implementable. Each would have relatively straightforward implementation issues that would need to be addressed. Alternative RP-1 would require cleanup of recontaminated or eroded portions of the existing remedies. The effective implementation of Alternative RP-1 would require a coordinated overall response within the communities and among response agencies. Alternative RP-1 would have administrative implementability issues with respect to the repair and replacement of the existing remedies following storm events. These storm events and the availability of funds to repair the remedies and maintain their protectiveness in the future are unpredictable. In some cases, the repair of protective barriers could be time-sensitive in order to maintain protectiveness and limit community residents' risk of exposure.

By comparison, Alternative RP-2 would have minimal implementability issues, except that it would be beneficial to construct the remedy protection projects during the low-flow season to minimize cost. Alternative RP-2 would also have administrative implementability issues associated with O&M of the water conveyance improvement projects. Prior to construction, agreements would have to be reached regarding which state entity, local entity, and/or local regulatory authority would perform O&M tasks associated with Alternative RP-2, ensure that O&M tasks are performed adequately, and ensure that sufficient resources are available. Additionally, there would be logistical feasibility issues associated with construction of the remedy protection projects on private properties. Access and easement agreements would have to be obtained prior to the implementation of Alternative RP-2.

10.2.7 Cost

Alternative RP-2 would cost less than Alternative RP-1. Table 9-3 of this Decision Summary presents a side-by-side comparison of the total estimated costs (30-year NPV) for Alternatives RP-1 and Alternative RP-2. The total cost for Alternative RP-1 includes the expected cost to repair and re-remediate the existing remedies based on model outputs and flood event probabilities. For Alternative RP-2, the total cost includes direct and indirect capital costs and O&M costs for construction of the remedy protection projects. Total costs for both alternatives include estimated costs for the side gulches. Detailed analyses were not conducted for the side gulches, but approximate costs were developed for both alternatives based on trends observed in the Upper Basin communities.

10.2.8 State, Tribe, and Federal Natural Resource Trustee Acceptance

This section summarizes state, Tribe, and federal Natural Resource Trustee acceptance of EPA's Preferred Remedy Protection Alternative identified in the Proposed Plan based on comments submitted by the States of Idaho and Washington, the Coeur d'Alene and Spokane Tribes, and the U.S. Departments of the Interior and Agriculture. Limited feedback was received on the Preferred Remedy Protection Alternative and the remedy protection alternatives considered in the FFS Report. The statements included in Sections 10.2.8.1 through 10.2.8.6 were compiled by EPA from submittals from the entity referenced in each section heading and reflect the views expressed by that entity. The full comments submitted by these entities, and EPA's responses to those comments, are presented in the Responsiveness Summary (Part 3 of this Upper Basin ROD Amendment). In some cases, no comments specifically related to remedy protection were received from a particular entity; these cases are noted below.

10.2.8.1 State of Idaho Acceptance

IDEQ generally supported the actions included in EPA's Preferred Remedy Protection Alternative, but suggested that EPA consider a wide range of design bases rather than simply the 50-year flood event that the actions in the Preferred Remedy Protection Alternative are based on. IDEQ expressed the belief that a cost-benefit analysis should be done to consider less frequent flood events and potential impacts to the remedy to arrive at the most cost-effective solution. IDEQ also commented that the remedy protection actions should be expanded to address all actions in the Selected Remedy at potential risk from flood damage. The Idaho Department of Water Resources expressed the belief that the Selected Remedy should be designed to withstand a 500-year flood event.

IDEQ recognized that although SFCDR and Pine Creek flooding will pose risks to EPA's Selected Remedy, major flood control projects on these waters are also necessary for the overall protection of human life and property in adjoining communities. IDEQ commented that it would like to work with EPA to identify concrete actions that can be included in the Upper Basin Selected Remedy to partner with and significantly advance the efforts of local communities and other state and federal agencies to adequately address this common threat.

10.2.8.2 State of Washington Acceptance

The Washington State Department of Ecology did not provide comments directly related to the Preferred Remedy Protection Alternative, although Ecology did express support for EPA's Preferred Alternative for the Upper Basin that comprises both its Preferred Remedial Alternative and its Preferred Remedy Protection Alternative.

10.2.8.3 Coeur d'Alene Tribe Acceptance

The Coeur d'Alene Tribe generally supported EPA's Preferred Alternative for the Upper Basin, which includes both its Preferred Remedial Alternative and its Preferred Remedy Protection Alternative. However, the Coeur d'Alene Tribe expressed concern about recontamination of the remedy within floodplain areas. The Coeur d'Alene Tribe stated that it views the levee system as a remedy protection barrier and suggested that EPA work with the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers (USACE) to resolve issues associated with the levees.

10.2.8.4 Spokane Tribe Acceptance

The Spokane Tribe has not submitted comments in opposition to EPA's Preferred Alternative, and did not provide any comments directly related to EPA's Preferred Remedy Protection Alternative.

10.2.8.5 U.S. Department of the Interior Acceptance

DOI generally supported EPA's Preferred Alternative for the Upper Basin that comprises both its Preferred Remedial Alternative and its Preferred Remedy Protection Alternative. DOI suggested that EPA consider the impacts of flood events on protective barriers included in its Preferred Remedy Protection Alternative.

10.2.8.6 U.S. Department of Agriculture Acceptance

DOA did not provide comments directly related to the Preferred Remedy Protection Alternative, although DOA did express support for EPA's Preferred Alternative for the Upper Basin that comprises both its Preferred Remedial Alternative and its Preferred Remedy Protection Alternative.

10.2.9 Community Acceptance

Limited feedback was received from the local community regarding EPA's Preferred Remedy Protection Alternative. The major community concerns related to remedy protection that were expressed during the comment period for the Proposed Plan and the Draft Final FFS Report included:

- **Flooding**. Comments were received stating that EPA should address potential flooding concerns associated with the SFCDR and Pine Creek to protect the existing protective barriers.
- **Protection of Barriers**. Comments were received encouraging EPA to commit more resources to the protection of remediated yards and home sites in the Upper Basin.

In general, community members agreed that the implementation of remedy protection actions in the Upper Basin is worthwhile and were supportive of the actions included in EPA's Preferred Remedy Protection Alternative.

10.3 Summary of Comparative Analysis Conclusions

The conclusions of the comparative analysis of alternatives for the Upper Basin are summarized in Section 10.3.1 for the remedial alternatives, and in Section 10.3.2 for the remedy protection alternatives.

10.3.1 Remedial Alternatives

Based on the comparative analysis, EPA determined that Alternative 3+(d) represents the best balance of tradeoffs for a comprehensive approach to cleanup in the Upper Basin.

The key factors leading to the preference of the remedial actions in Alternative 3+(d) over those in the other remedial alternatives were as follows:

- **Most significant improvements in water quality.** The most significant localized surface water quality improvements throughout the Upper Basin are expected following implementation of the remedial actions included in Alternative 3+(d). With respect to the OU 3 and OU 2 components of this alternative:
  - Under Alternative 3+ for the Upper Basin portion of OU 3, the estimated post-remediation AWQC ratio for dissolved zinc in the SFCDR at Elizabeth Park (upstream of the Bunker Hill Box) is 1.9, which represents a substantial decrease from the current ratio of 5.5.
  - The remedial actions in OU 2 Alternative (d) are estimated to reduce the AWQC ratio for dissolved zinc in the SDCDR at Pinehurst from the current ratio of 5.2 to 1.7, when coupled with Alternative 3+ actions in the Upper Basin portion of OU 3. OU 2 Alternative (d) also addresses surface water contamination in Government Creek.

- **Relatively high reduction of the toxicity, mobility, or volume of contaminants through treatment.** With respect to the OU 3 and OU 2 components of Alternative 3+(d):
  - The remedial actions included in Alternative 3+ for the Upper Basin portion of OU 3 would satisfy the statutory preference for treatment and would remove more metal mass through treatment than Alternative 4+, which is more focused on source removals.
  - The remedial actions in OU 2 Alternative (d) are estimated to remove a relatively high amount of metal mass from surface water through treatment (comparable to the amount of mass removal predicted for OU 2 Alternative (c) and greater than all other OU 2 Alternatives), while providing rapid improvements to water quality in Government Creek.
- **Fewest implementability concerns.** The Alternative 3+(d) remedial actions have substantially fewer technical and administrative feasibility difficulties compared to the other remedial alternatives. In the Upper Basin portion of OU 3, the smaller quantities of contaminated materials addressed by the Alternative 3+ remedial actions will mean less repository space and therefore less difficulty in implementation and long-term management than under Alternative 4+. The OU 2 Alternative (d) remedial actions have slightly more implementability concerns relative to the OU 2 Alternative (c) remedial actions because of the additional actions included for Government Creek, but fewer implementability concerns than would be associated with the remedial actions in all the other OU 2 alternatives.
- **Greatest short-term effectiveness.** With respect to the OU 3 and OU 2 components of Alternative 3+(d):
  - For the Upper Basin portion of OU 3, the time required for implementation of the remedial actions in Alternative 3+ is likely to be decades shorter than that needed for those in Alternative 4+. In addition, the comparatively smaller quantity of contaminated materials to be handled translates into less truck traffic and smaller areas needed within the Upper Basin for waste consolidation areas and repositories.
  - The remedial actions in OU 2 Alternative (d) are projected to have the greatest short-term effectiveness. OU 2 Alternative (d) is very similar to OU 2 Alternative (c), with the addition of remedial actions to address water quality in Government Gulch. These additional actions in Government Gulch will likely result in Government Creek achieving cleanup levels immediately following the completion of remedial actions. Although there is some additional short-term risk to workers, the community, and to a lesser extent the environment with this alternative compared with OU 2 Alternative (c), achieving cleanup levels for Government Creek far outweighs the additional risk of the actions. Aside from OU 2 Alternative (c), OU 2 Alternative (d) is anticipated to have much greater short-term effectiveness than the other OU 2 alternatives.
- **Lowest cost**. In terms of 30-year NPV, the estimated total cost of the remedial actions in Alternative 3+(d) is significantly lower than the costs of those in the other alternatives, based on the estimated costs of Alternatives 3+ and/or 4+ for the Upper Basin portion of OU 3 in combination with individual alternatives for OU 2.

EPA identified Alternative 3+(d) as its Preferred Remedial Alternative for the Upper Basin in the Proposed Plan (EPA, 2010a). However, as described in detail in Section 12.0 of this Decision Summary, EPA, in response to comments, has reduced the scope of the Selected Remedy and is not including all of the remedial actions that were presented in its Preferred Alternative in the Proposed Plan. The Selected Remedy is expected to result in significant improvements to surface water quality in the Upper Basin, although it is not expected to fully address surface water contamination at all locations. The Selected Remedy is also not intended to fully address groundwater contamination. The Selected Remedy is expected to result in the achievement of cleanup levels for soil and sediments where actions are taken. Thus, as discussed in more detail in Section 12.0, the Selected Remedy is an interim remedy for the Upper Basin. The Selected Remedy will address many significant sources of contamination in the Upper Basin and will be protective of human health and the environment commensurate with its scope. Consistent with 40 CFR 300.430(a)(ii)(B) and 40 CFR 300.430(f)(1)(ii)(C)(1), this Selected Remedy, an interim remedy, is neither inconsistent with nor precludes implementation of a final remedy that will attain ARARs. The final remedy will be identified in subsequent decision documents.

10.3.2 Remedy Protection Alternatives

Based on the comparative analysis, EPA determined that the remedy protection actions included in Alternative RP-2 (Modifications to Selected Remedies to Enhance Protectiveness [Remedy Protection Projects]) provide the best balance of tradeoffs for a comprehensive approach to cleanup in the Upper Basin. The key factors leading to the preference for Alternative RP-2 over Alternative RP-1 included:

- **Greater long-term effectiveness and permanence.** The remedy protection actions included in Alternative RP-2 will be more protective of human health and the environment than the actions included in Alternative RP-1 because they will increase the long-term effectiveness and permanence of the portions of the existing Selected Remedies focusing on human health for OUs 1 and 2 and the Upper Basin portion of OU 3, which have been shown to be protective (EPA, 2010b), by decreasing the risk of recontamination due to tributary flooding and uncontrolled surface water flows. By proactively implementing stormwater control actions to enhance the permanence of the existing remedies, the Alternative RP-2 remedy protection actions will mitigate potential damage to these remedies and subsequent routes of exposure to contamination.

- **Greater short-term effectiveness.** The Alternative RP-2 remedy protection actions will provide greater short-term effectiveness than the actions in Alternative RP-1 by reducing the mobility of potentially contaminated sediments transported by tributary floodwaters and surface water flows within populated areas. This will reduce the potential routes of exposure to contamination by humans and ecological receptors and address concerns about the protectiveness of the portions of the existing Selected Remedies focusing on human health.

- **Fewer implementability issues.** The Alternative RP-2 remedy protection actions will have fewer implementability issues than the actions in Alternative RP-1. Alternative RP-2's only technical implementation issue is that it will be beneficial to implement the remedy protection actions during the low-flow season in order to minimize cost. These remedy protection actions will also have administrative implementability issues associated with O&M of the water conveyance improvement projects. Prior to construction, agreements will have to be completed regarding which state entity, local entity, and/or local regulatory authority will perform O&M tasks associated with the Alternative RP-2 actions, to ensure that O&M tasks are performed adequately and that sufficient resources are available. In addition, there will be issues associated with the implementation of remedy protection actions on private property; access agreements and easements will have to be obtained prior to the implementation of the remedy protection actions. The above implementation issues are relatively minor considering the long-term benefits of the remedy protection actions included in Alternative RP-2.

- **Significantly lower cost.** The estimated cost of the Alternative RP-2 remedy protection actions, in terms of 30-year NPV, is $33.8 million, which is significantly less ($16.2 million) than the estimated cost of the actions included in Alternative RP-1 ($50.1 million).

EPA identified Alternative RP-2 as the Preferred Remedy Protection Alternative in the Proposed Plan (EPA, 2010a). As described in detail in Section 12.0 of this Decision Summary, Alternative RP-2 and the modified Preferred Remedial Alternative described in earlier sections comprise the Selected Remedy for the Upper Basin.

SECTION 11.0

Principal Threat Wastes

The NCP states that EPA expects to use "treatment to address the principal threats posed by a site, wherever practicable" and "engineering controls, for waste that poses a relatively low long-term threat." PTWs are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment if exposure were to occur. This definition and additional information for identifying PTWs can be found in *A Guide to Principal Threat and Low Level Threat Wastes* (EPA, 1991b). The guidance notes that identification of PTWs is made on a site-specific basis and is intended to help streamline and focus the remedy selection process.

PTWs were previously examined and defined by EPA in the RODs for OU 2 (EPA, 1992) and OU 3 (EPA, 2002), and reflect historical mine waste generation in the Basin from mining, milling and smelting operations. PTW concentrations were determined by identifying contaminant levels that would be expected to induce acute or symptomatic health effects (requiring emergency treatment) in an individual based on a 70 milligram per day (mg/day) soil ingestion rate for a short (up to three months) duration (EPA, 1991b). The PTW concentrations include:

Parameter	PTW Concentrations (parts per million [ppm])
Antimony	127,000 ppm
Arsenic	15,000 ppm
Cadmium	71,000 ppm
Lead	84,600 ppm
Mercury	33,000 ppm

EPA developed the PTW concentrations based upon an evaluation of the acute toxicity of contaminants of concern at the Bunker Hill Superfund Site (EPA, 1991b).

The 1996 ROD Amendment for OU 2 (EPA, 1996b) required that all PTWs[1] be placed in a high-density polyethylene (HDPE) bottom-lined and three-ply-copolymer top-lined monocell. Complete containment was selected, rather than treatment, for non-mercury-contaminated PTWs in the 1996 ROD Amendment because containment was significantly (90 percent) less costly than treatment via cement stabilization (the treatment method identified in the 1992 ROD for OU 2); complied with all ARARs; and provided long-term protectiveness and overall protection of human health and the environment. In addition to substantial cost savings, containment was noted to have other advantages over treatment, including faster implementation, fewer onsite worker exposures, and preservation of

[1] In the 1996 ROD Amendment, PTWs were referred to as Principal Threat Materials (PTM).

reprocessing potential for the contained materials as technology develops. Mercury-contaminated PTWs were required to be subjected to cement-based stabilization, as previously required in the 1992 ROD, prior to being contained with the non-mercury-contaminated PTWs. The PTW monocell is contained within the larger Smelter Closure Area (SCA) and under the SCA's HDPE cap, affording an additional layer of protection.

A review of these PTW definitions and the methods chosen to address them indicates that they are still relevant for use in this ROD Amendment. Non-smelter areas addressed since the 2002 ROD have generally been found to be contaminated with large volumes of materials with lower levels of COCs than PTW concentrations, and consequently pose lower-level long-term threats for which engineering controls such as containment have been protective. For the non-smelter areas addressed by this ROD Amendment, it is not expected that additional PTWs will be encountered when Upper Basin remedial actions are conducted. This is because the smelting and associated processes located in the Bunker Hill Box were designed to concentrate the metals coming from the Upper Basin mills, creating high-concentration wastes. (Smelting activities were not conducted in the Upper Basin outside the Bunker Hill Box.) Tailings from the mills, on the other hand, were less concentrated.

However, if mining concentrates or other materials that meet the site-specific definition of PTWs are encountered during remedy implementation, these materials will be remediated in accordance with the remedies for PTWs selected in the earlier RODs, including treatment of mercury-contaminated PTWs prior to containment. If EPA determines that stabilization and placement of mercury-contaminated PTWs and/or placement of non-mercury-contaminated PTWs in a monocell, as required by the 1996 ROD Amendment, is not practicable and they must be disposed of in another manner that is protective of human health and the environment, complies with CERCLA, and is consistent with the NCP, that decision will be documented in an appropriate decision document such as an ESD.

SECTION 12.0

Selected Remedy

As described in Section 10.0 of this Decision Summary, EPA used nine criteria, as required by the NCP and CERCLA, to evaluate the remedial alternatives and remedy protection alternatives for the Upper Basin that were developed in the FFS Report (EPA, 2012). EPA evaluated the alternatives individually and against each other in order to select a remedy. Each of the evaluated remedial alternatives was intended to address surface water contamination at all locations, improve groundwater quality, and address soil and sediments where actions are taken. In the Upper Basin Proposed Plan (EPA, 2010a), EPA identified Alternative 3+(d) as its Preferred Remedial Alternative and Alternative RP-2 as its Preferred Remedy Protection Alternative. Together these comprised EPA's Preferred Alternative for the Upper Basin.

Following consideration of comments on and discussions of the Proposed Plan, and as a result of additional information that EPA has developed, EPA has reduced the scope of the Selected Remedy and is not including all of the remedial actions that were presented in its Preferred Alternative in the Proposed Plan. As a result of this reduction in scope, the Selected Remedy is not expected to fully address surface water contamination at all locations in the Upper Basin. The Selected Remedy is also not intended to fully address groundwater contamination. Thus, the Selected Remedy is an interim remedy for the Upper Basin. The Selected Remedy will address many significant sources of contamination in the Upper Basin and will be protective of human health and the environment commensurate with its scope. As described further below, the Selected Remedy will cost significantly less and take less time to implement than the Preferred Alternative identified in the Proposed Plan.

The Selected Remedy is expected to result in significant improvements to surface water quality in the Upper Basin and may achieve AWQC ARARs under the Clean Water Act at many locations; however, the Remedy may not achieve these ARARs at all locations. Furthermore, although the Selected Remedy is expected to result in significant improvements to groundwater quality, it is not intended to achieve groundwater MCL ARARs under the Safe Drinking Water Act throughout the Upper Basin. Similarly, although the Selected Remedy is expected to provide additional safe habitat for special-status species and is intended to achieve ARARs under the MBTA and the ESA where remedial actions are taken, it will not achieve these ARARs at all locations. The remedial actions included in the Selected Remedy are expected to result in the achievement of cleanup levels for soil and sediments where actions are taken.

The Selected Remedy satisfies CERCLA's protectiveness criteria as applied to an interim remedy. The level of protectiveness provided by an interim remedy is evaluated by the scope of its actions. Accordingly, the Selected Remedy, by its nature, need not be as protective as the final remedy is required to be under the statute. The Selected Remedy is designed to provide significant improvements to surface water and groundwater, and to significantly reduce risks posed to human health and the environment within the Upper

Basin. Thus, the level of protection that the Selected Remedy will provide is commensurate with the scope of the Selected Remedy, and the Selected Remedy is deemed to be protective in the context of its scope, even though it does not, by itself, meet the statutory protectiveness standard that a final remedy would meet. Consistent with 40 CFR 300.430(a)(ii)(B) and 40 CFR 300.430(f)(1)(ii)(C)(1), this Selected Remedy, an interim remedy, is neither inconsistent with nor precludes implementation of a final remedy that will attain ARARs. The final remedy will be identified in subsequent decision documents.

The Selected Remedy for the Upper Basin includes two key components:

- **Remedial actions** consisting of a subset of actions from Remedial Alternative 3+(d),[1] and
- **Remedy protection actions** consisting of Remedy Protection Alternative RP-2.

Sections 12.1 and 12.2 present the rationale for these two key components of the Selected Remedy, describe the components, and summarize their estimated costs and expected outcomes. Section 12.3 provides additional information about how the Remedy will be implemented.

12.1 Remedial Actions

This section presents the rationale for the remedial actions included in the Upper Basin Selected Remedy, describes these actions, and summarizes their estimated costs and expected outcomes.

12.1.1 Rationale

As discussed in Section 2.2 of this Decision Summary, EPA began selecting remedies for the Upper Basin in the early 1990s. The Selected Remedy identified for the Upper Basin in this ROD Amendment builds upon the remedies identified in the previous RODs and incorporates additional information obtained since 2002. The Selected Remedy includes actions that update, modify and add to the previous cleanup plans for the Upper Basin described in the RODs for OUs 1, 2, and 3 and related decision documents. This Selected Remedy is intended to significantly advance the cleanup process toward future selection of a final remedy for the Upper Basin. For the Upper Basin, the remedial actions included in the Selected Remedy will provide a number of improvements over the interim Ecological Remedy selected in the ROD for OU 3 (EPA, 2002), including:

- An updated remedial plan for the OU 3 portion of the Upper Basin based on information and data collected over the last 10 years;
- Remedial actions in the Bunker Hill Box to address contaminated surface water;
- A more effective approach for onsite treatment of contaminated adit discharges based on treatability testing conducted since 2002; and
- A framework for planning, prioritizing, and implementing remedial actions.

[1] As described in Section 9.0, Alternative 3+ includes remedial actions for the Upper Basin portion of OU 3 and Alternative (d) includes remedial actions for OU 2.

As summarized in Section 10.3.1 of this Decision Summary, EPA used nine criteria, as required by the NCP and CERCLA, to evaluate the remedial alternatives and remedy protection alternatives for the Upper Basin that were developed in the FFS Report (EPA, 2012). EPA evaluated the alternatives individually and against each other in order to select a remedy. In the Upper Basin Proposed Plan (EPA, 2010a), EPA identified Alternative 3+(d) as its Preferred Remedial Alternative. In response to comments, as noted above, EPA has reduced the scope of the Selected Remedy and is not including all of the remedial actions that were presented in its Preferred Remedial Alternative in the Proposed Plan. The Selected Remedy is a prioritized subset of the actions included in the Preferred Alternative, and will be less costly and can be implemented more quickly than would have been the case if the Preferred Remedial Alternative had been adopted as the Selected Remedy.

12.1.2 Description

This decision document selects an interim remedy for the Upper Basin. Actions selected in the previous RODs are not modified and continue to be required by those RODs unless expressly modified in Section 4.0 of this Decision Summary. The Selected Remedy includes remedial actions within the Bunker Hill Box and elsewhere along the SFCDR and its primary tributaries. The Selected Remedy defines OU 2 Phase II cleanup actions[2] to address ongoing water quality issues. The Selected Remedy replaces the Upper Basin portion of the interim ecological actions selected in the ROD for OU 3 (EPA, 2002) with a subset of remedial actions from Alternative 3+, as described in this ROD Amendment. As described in more detail in Section 4.0 of the Decision Summary, the Selected Remedy does not replace the human health remedy selected in the 2002 ROD for OU 3, nor does it replace previously selected remedial actions for the Lower Basin.

Major components of the remedial actions within the Bunker Hill Box (OU 1 and OU 2) are:

- Actions to reduce the flow of contaminated groundwater entering the SFCDR and Government Creek;
- Conveyance of effluent from the CTP (i.e., clean, treated water) directly to the SFCDR in a pipeline to prevent recontamination through contact with contaminated subsurface Box soils;
- Collection and treatment of groundwater and water management actions to reduce the flow of contaminated discharges near the Reed and Russell Adits;
- Expansion and upgrade of the CTP to provide treatment of collected water from OU 2, consistently achieve discharge requirements, allow for operation in high-density sludge mode, and reduce the volume of waste sludge generated; and

[2] The OU 2 ROD (EPA, 1992) identified source control actions (referred to in this document as Phase I cleanup actions) for OU 2. This ROD Amendment identifies the Phase II cleanup actions for OU 2, which focus on groundwater collection and treatment.

- Continued implementation of the Institutional Controls Program (ICP, administered by the Panhandle Health District)[3] for protection of human health.

Major components of the remedial actions in the Upper Basin outside the Box (in the eastern portion of OU 3) are:

- Extensive excavation and consolidation of waste rock, tailings, and floodplain sediments;
- Capping, regrading, and revegetation of tailings and waste rock areas;
- Collection and treatment of contaminated adit discharges, seeps, and groundwater;
- Stream and riparian stabilization actions in watersheds where sediment removal actions are implemented;
- Additional expansions and upgrades of the CTP to provide treatment of collected water from OU 3, consistently achieve discharge requirements, allow for operation in high-density sludge mode, and reduce the volume of waste sludge generated; and
- Continued implementation of the ICP (administered by the Panhandle Health District) for protection of human health.

The remedial actions included in the Selected Remedy comprise a prioritized subset of actions from Alternative 3+(d) in the FFS Report and the Proposed Plan, with a number of the specific actions from the Preferred Alternative removed, reduced, and/or modified in scope. The Selected Remedy differs from Alternative 3+(d) in that it includes:

- Reduction in scope from 345 mine and mill site source areas to 145 sites, based on the following:
  - Removal of some previously proposed remedial actions for sites that exhibited low risk based on additional site characterization work conducted in 2011;
  - Removal of sites where some cleanup has already been implemented under CERCLA or another removal authority;
  - Removal of sites where active industrial and/or commercial activities are currently occurring;
  - Removal of remedial actions from active areas of Hecla Mining Company's Lucky Friday operation; and
  - Removal of sites determined to be of lower priority for cleanup based on either site-specific data or downstream water quality.
- Reduction in scope of the groundwater collection action along the SFCDR between Wallace and Elizabeth Park.

[3] Idaho Administrative Procedures Act (IDAPA) 41.01.01, Rules of Panhandle Health District 1, is the promulgated rule establishing the ICP. It describes the Panhandle Health District's authority and the ICP's scope and intent.

- Refinement of estimated contaminant volumes and TCDs for Ninemile Creek based on additional site characterization work conducted in 2011.
- Removal of some stream and riparian actions due to the reduced scope of remedial actions in the Selected Remedy.

Section 14.0 of this Decision Summary includes additional description of the changes made from the Preferred Remedial Alternative in the Proposed Plan to the interim remedy represented by the Upper Basin Selected Remedy.

Given the large geographic area and scope of the required work, the implementation of the Selected Remedy is expected to take about 30 years. EPA will implement the Selected Remedy in a prioritized manner using an adaptive management process and implementation planning, as discussed in Section 12.3, to ensure that the actions taken are the most effective in achieving the overall goals of protection of human health and the environment through improvements to surface water and groundwater quality. During implementation, monitoring data and input from stakeholders and community representatives will continue to be used to inform the adaptive management process.

The remedial actions included in the Selected Remedy include source control, water collection and treatment, institutional controls, and stream and riparian stabilization actions, all of which are discussed in detail in the following sections.

12.1.2.1 Source Control Actions

Source control actions included in the Selected Remedy are focused on Upper Basin areas outside the Bunker Hill Box because source control actions within the Bunker Hill Box were the focus of the Phase I cleanup in OU 2 (CH2M HILL, 2007c). Source control actions were only selected for mine and mill sites that have the greatest impact to surface water and groundwater quality. These sites were selected by reviewing various factors and data including potential human health risks, downstream water quality, site-specific data such as the location within a watershed, contaminant concentrations, riparian acreage, erosion potential, and the volume of waste material.

The only source control actions included in the Selected Remedy within the Box are hydraulic isolation actions. Hydraulic isolation is a type of action that includes both source control and water treatment components and is targeted at contamination that is not accessible for removal.

Figure 12-1 shows the overall source control actions anticipated for the Upper Basin watersheds, including the number of source sites and the estimated total volume of contaminated materials to be addressed in each watershed. Specific source control actions to be implemented under the Selected Remedy in OU 2 include:

- Hydraulic controls in Government Gulch, which include stream lining, an upgradient cutoff wall, and downstream extraction wells to isolate contaminated soil and sediments underlying Government Gulch.
- Hydraulic isolation of the SFCDR near the CIA to prevent contaminated groundwater from reaching the SFCDR.

- Installation of a check dam within the Reed and Russell Adits to block the flow of contaminated water.

Specific source control actions to be implemented under the Selected Remedy in OU 3 include:

- Extensive excavation of waste rock, tailings, and floodplain sediments. Excavated material will be placed in repositories and waste consolidation areas. Appropriate locations for repositories will be developed prior to the implementation of excavation activities with input from agencies and the local communities. Waste consolidation areas are anticipated to be located within certain watersheds near source sites and will provide a relatively high degree of protectiveness for tailings and tailings/waste rock mixtures via onsite capping of waste materials. Sites that are appropriate for waste consolidation areas will also be determined prior to the implementation of excavation activities.
- Closure of existing tailings impoundments at selected sites.
- Low-permeability capping or regrading, consolidation, and revegetation for many waste rock sources. Hydraulic isolation of contaminated groundwater in the Woodland Park area of Canyon Creek and in the SFCDR near Osburn will prevent the contaminated groundwater from reaching the surface streams.

The source control actions included in the Selected Remedy for sites in each Upper Basin watershed outside the Bunker Hill Box are shown in Figures 12-2 through 12-8. Tables 12-1 though 12-8 list the waste (or source) types, the remedial actions (TCDs), the material quantities addressed, and the estimated remediation cost for each site included in the Selected Remedy, by Upper Basin watershed.

In addition to the source control actions discussed above, additional actions are included to address potential risks to human health at mine and mill sites. The Selected Remedy includes remedial actions for 15 mine and mill sites that pose unacceptable risks to human health (see Tables 12-1, 12-2, 12-7, and 12-8). The remedial actions for these mine and mill sites will include soil cover conceptual designs to further reduce the potential for unacceptable human exposures. The specific locations for implementing these actions at mine and mill sites will be determined during site characterization and pre-design as appropriate to protect human health. Additionally, the Selected Remedy includes actions for abandoned structures posing significant potential for unacceptable human exposures at three mine and mill sites (BUR128, OSB039, and KLE035). The conceptual designs for these sites include decontamination, to the extent practicable, and/or fencing around the structures.

As noted previously and in Section 14.0 of this Decision Summary, this ROD Amendment does not select all the remedial actions identified in the Preferred Alternative as presented in the Proposed Plan. Information developed during cleanup may identify sites where risks to human health or the environment require response actions not selected in this ROD Amendment. In these circumstances, response actions will be selected from the TCDs presented in the FFS Report (EPA, 2012) via an Action Memorandum, an ESD, or an appropriate decision document.

12.1.2.2 Water Collection and Treatment Actions

The water collection and treatment components of the Selected Remedy for the Upper Basin, based on a subset of actions from Alternative 3+, are summarized in Figure 12-9 and detailed on a watershed level in Figures 12-10 through 12-14. The water collection and treatment remedial actions in OU 3 include:

- Water collection and treatment near individual contaminant sources (adit drainages and one seep) using semi-passive treatment methods ("Onsite Treatment" in Figure 12-9, also shown on a watershed level in Figures 12-10 through 12-14).
- Conveyance of contaminated adit discharges to the CTP for consolidated active treatment ("CTP Treatment" in Figure 12-9, also shown on a watershed level in Figures 12-10 through 12-14).
- Collection of contaminated groundwater adjacent to Canyon Creek in Woodland Park and in the SFCDR in Osburn Flats in subsurface drains to hydraulically isolate Canyon Creek and the SFCDR from contaminated groundwater, thereby inhibiting metals loading. Groundwater collection and treatment actions have been selected at these locations because highly contaminated materials are located in close proximity to Canyon Creek and the SFCDR, and these wastes cannot be excavated without the relocation of people and infrastructure. In Woodland Park, stream lining will be used in conjunction with a groundwater drain to further isolate Canyon Creek from contaminated groundwater. The locations and conceptual layouts of these groundwater collection actions in Woodland Park and Osburn Flats are presented in Figures 12-15 and 12-16, respectively.

The water treatment elements of the Selected Remedy for the Bunker Hill Box, based on OU 2 Alternative (d), are summarized in Figure 12-17 and Table 12-9 and include:

- A phased approach, working with the property owner, to address drainage from the Reed and Russell Adits within the Milo Creek Watershed. Direct-discharge pipeline installation from the CTP to the SFCDR so that treated CTP effluent will no longer discharge into Bunker Creek and infiltrate into contaminated subsurface materials.
- Subsurface drain installation between the CIA and the SFCDR and extending south to the eastern side of the mouth of Government Gulch, to reduce contaminated groundwater flow to the SFCDR.
- Stream lining and groundwater extraction wells on Government Creek. The stream lining will be accompanied by an upstream clean groundwater cutoff wall that will divert clean groundwater into the lined stream. Groundwater extraction wells at the mouth of Government Gulch and an associated conveyance system will intercept and transport contaminated groundwater to the CTP for treatment.

The phased approach to address drainage from the Reed and Russell Adits will begin with the installation of a check dam as discussed above as part of the source control actions. Following installation of the check dam, additional contaminated water from the adits may be collected and conveyed to the CTP for treatment.

Table 12-10 lists the Selected Remedy sites with water to be collected for treatment (both passive and active). Included in the table are the water sources, estimated average and maximum flow rates, estimated dissolved zinc loads, and the types of treatment planned (TCDs WT01 through WT03).

All active water treatment will take place at the CTP in Kellogg, which will be expanded to accommodate the additional inflow from Selected Remedy sites with active water treatment. In addition to expansion of the CTP, the Selected Remedy includes plans to upgrade the CTP to achieve current National Pollutant Discharge Elimination System (NPDES) discharge requirements. The CTP currently operates under the requirements of a previously issued and expired NPDES permit. These upgrades are needed to comply with NPDES discharge requirements whether or not additional flows are sent to the CTP as a result of remedial actions in the Upper Basin. The upgrades to the CTP included in the Selected Remedy are based on those included in the 2001 ROD Amendment for OU 2 (EPA, 2001d) and described in the 2001 *Bunker Hill Mine Water Management Remedial Investigation/Feasibility Study* (EPA, 2001a). While some components of the 2001 ROD Amendment for OU 2 were implemented by EPA in 2003 and 2004 as emergency actions, other upgrades have not yet been conducted. To date, as noted in Section 4.2.2 of this Decision Summary, EPA and the State of Idaho have not concluded negotiations on a State Superfund Contract (SSC) amendment that would allow full implementation of the water treatment upgrades included in the 2001 ROD Amendment; therefore, these upgrades are a component of the Selected Remedy for the Upper Basin. Further, the 2001 ROD Amendment provided for upgrades to the CTP based on existing capacity, and the Selected Remedy includes an expansion of those upgrades to accommodate treatment of additional waters from OU 2 and OU 3.

Conveyance piping will also be installed as part of the Selected Remedy to transport contaminated water from specific areas of the Upper Basin to the CTP. A phased approach will be taken in the construction of conveyance pipelines and expansion of the CTP. It is expected that upgrade and expansion of the CTP would be conducted in two phases. The first phase would include upgrades to existing systems to improve efficiency and effectiveness and would also provide expanded treatment capacity for OU 2 groundwater collected by the CIA drain. The second phase of CTP upgrade and expansion would provide additional treatment capacity for OU 3 waters. With implementation of this second phase, conveyance pipelines would also be constructed to convey adit discharges and groundwater in OU 3 to the CTP for treatment.

12.1.2.3 Stream and Riparian Stabilization Actions

In addition to sediment removal actions as discussed in Section 12.1.2.1, stream and riparian stabilization actions identified in specific stream reaches within the Upper Basin are also included as part of the Selected Remedy. The objective of the stream and riparian stabilization actions is to reduce bank erosion following removal of contaminated sediments. This includes actions such as installation of current deflectors, vegetative bank stabilization, and sediment traps in selected locations (additional details about stream and riparian stabilization actions can be found in the FFS Report [EPA, 2012]). Following the implementation of stream and riparian actions, the federal Natural Resource Trustees may conduct restoration activities to further improve ecosystem function consistent with their authorities. Tables 12-1 through 12-8 list the stream and riparian stabilization actions, associated TCDs, and costs. Figures 12-18 through 12-22 depict the stream reaches for each watershed where stream and riparian stabilization actions are included in the Selected Remedy. No stream and riparian stabilization actions are identified for the Upper SFCDR and Pine Creek Watersheds in the Selected Remedy. The exact locations of stream and riparian stabilization actions will be determined during remedial design.

The stream and riparian stabilization actions included in the Selected Remedy are a subset of the stream and riparian cleanup actions included in the Preferred Alternative. During the review period of the Proposed Plan, EPA received comments from stakeholders and the public concerning the locations, extent, and in some cases the technical approach proposed for some of the stream and riparian cleanup actions included the Preferred Alternative. Following consideration of those comments and as part of EPA's evaluation to reduce the scope of the Preferred Alternative, the stream and riparian actions that are co-located with floodplain and sediment removal actions were determined to be priority actions for inclusion in the Selected Remedy. These sediment removal actions are primarily designated for riparian areas (along rivers and creeks). Stream and riparian stabilization actions will be conducted following the removal actions to stabilize the banks of rivers and creeks where remedial actions are conducted.

As noted above, EPA re-evaluated stream and riparian reaches in the Upper Basin and prepared a technical memorandum included in the Final FFS Report (EPA, 2012) that documents the changes made to the stream and riparian actions described in the Draft Final FFS Report (CH2M HILL, 2010) and the Proposed Plan. Section 14.0 of this Decision Summary provides additional details regarding the changes made to stream and riparian actions since the Proposed Plan.

12.1.2.4 Institutional Controls

At sites where hazardous substances are above levels that allow for unlimited use and unrestricted exposure, institutional controls will likely be required to manage potential exposures and maintain the integrity of the Selected Remedy. As noted previously and in the Proposed Plan (Section 7.1.4), the existing ICP, adopted by the Idaho State Legislature and administered by the Panhandle Health District, provides a locally enforced set of rules and regulations established to maintain the integrity of installed barriers and to ensure that new barriers are installed during redevelopment that may occur within the Bunker Hill Superfund Site. The ICP applies to all wastes left in place within the Bunker Hill Superfund Site ICP boundary (IDAPA 41.01.01). The ICP also applies to ground-disturbing actions within the Site with the exception of certain agricultural and mining activities. The ICP issues permits for work that may encounter mine-waste-contaminated materials, stipulates mine-waste-contaminated material handling procedures and disposal requirements, directs disposal to specific ICP repositories, and trains and certifies contractors prior to working with potentially contaminated materials.

EPA has further evaluated the existing ICP since the issuance of the Proposed Plan and has determined that in some circumstances, in order to preserve the integrity of an engineered cap, drainage, or another engineered remedy, the existing ICP will likely need to be supplemented by institutional controls such as proprietary deed restrictions and Uniform Environmental Covenants Act (UECA) covenants that will prevent interference with the implementation of remedial actions or with actions that have already been implemented. In areas outside the scope of the existing ICP where contaminants remain above acceptable levels such that use of groundwater for drinking water purposes must be prohibited, land uses must be restricted (e.g., precluding residential use) or specific actions must be taken in the event that a protective cover is breached to prevent unacceptable exposure or the spread of contamination. Such supplemental institutional controls will be developed in coordination with the respective property owners, and the public will have opportunities to provide input during implementation of the Selected Remedy.

12.1.3 Estimated Costs

Tables 12-1 through 12-9 provide cost estimate summaries for the Upper Basin remedial actions included in the Selected Remedy. Costs are summarized on a watershed level in Table 12-11. Costs were developed based upon principles outlined in EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA, 2000b). The cost estimate information in Tables 12-1 through 12-9 is based on the best available information regarding the anticipated scope of the remedial actions. Changes in the cost components are likely to occur as a result of new information and data collected during engineering designs for the Selected Remedy. A major change may be documented in the form of a memorandum to the Administrative Record, an ESD, or another ROD Amendment. The estimates presented in Tables 12-1 through 12-9 are expected to be within +50 to -30 percent of the actual project costs, consistent with CERCLA guidance.

During the FFS, detailed unit cost estimates were developed for each TCD. Direct capital costs were calculated for each individual action, characterized by a TCD, on a source material. Total costs for the Selected Remedy remedial actions by TCD are included in Table 12-12. The direct capital cost was calculated using the TCD unit cost and the appropriate measurement, which is specific to the site and the source material. The indirect capital costs were assumed to be 70 percent of the direct capital costs for all TCDs except WT01, active treatment at the CTP,[4] which is discussed in Attachment D-1 to Appendix D in the FFS Report (EPA, 2012). This assumption was based on information provided in EPA's cost estimating guide (EPA, 2000b). O&M costs were assumed to be a percentage of the direct capital costs and varied for each TCD. The O&M costs were calculated as the NPV of 30 years of O&M at a discount rate of 7 percent (EPA, 2000b).

For the purposes of considering costs, assumptions have not been made on the sequence of implementing the remedial actions included in the Selected Remedy. Thus, all capital costs are considered NPV costs assuming year 2009 dollars.[5] The effect of remedy implementation over years into the future would be to reduce the NPV of both capital and O&M costs. Some components of the Selected Remedy are expected to have O&M requirements that extend beyond the 30-year period of performance assumed in the 2000 EPA cost-estimating guide, which could increase total O&M costs. If the O&M period were extended to 100 years, the increase in total cost would be relatively small (approximately 1.5 percent).

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[4] As shown in Table 9-1, the formal name of TCD WT01 is "Centralized High-Density Sludge (HDS) Treatment at the Central Treatment Plant (CTP)."

[5] These estimated costs are based on costs presented in the FFS Report (EPA, 2012), which were developed using year 2009 cost data.

The total estimated NPV cost of the remedial actions included in the Selected Remedy for the Upper Basin is $601 million,[6] a significant reduction ($709 million) from the cost of remedial actions in EPA's Preferred Alternative in the Proposed Plan ($1.31 billion). Table 12-13 summarizes the estimated total costs for the Selected Remedy, including the remedy protection actions described in Section 12.2.

12.1.4 Expected Outcomes

This section summarizes the expected outcomes of the remedial actions included in the Selected Remedy in terms of cleanup levels, anticipated benefits to human health and the environment, available land and groundwater uses, and socio-economic and community impacts. This section also identifies the differences in expected outcomes between the remedial actions included in the Upper Basin Selected Remedy and those in the existing Selected Remedies for OU 2 and the Upper Basin portion of OU 3.

12.1.4.1 Cleanup Levels

The purpose of the Selected Remedy is to minimize risks to human health and the environment posed by direct contact with mining wastes, mining-contaminated soil and sediments, and contaminated surface water and groundwater. Cleanup levels for the Selected Remedy are based on a combination of site-specific risk assessment results and chemical-specific ARARs. Tables 8-1 and 8-2 of this Decision Summary present the cleanup levels for COCs in the Upper Basin for surface water and groundwater, respectively. As discussed previously, the Selected Remedy is an interim remedy that is expected to result in significant improvements to surface water quality in the Upper Basin and may achieve AWQC ARARs under the Clean Water Act at many locations; however, the Remedy may not achieve these ARARs at all locations. Furthermore, although the Selected Remedy is expected to result in significant improvement to groundwater quality, it is not intended to achieve groundwater MCL ARARs under the Safe Drinking Water Act throughout the Upper Basin.

There are no promulgated cleanup criteria or standards that are ARARs for the soil or sediments in the Upper Basin. Lead is the primary risk driver in the soil and sediments and, accordingly, EPA has identified lead as the indicator contaminant for the Upper Basin cleanup of soil and sediments.

The EcoRA that was conducted as part of the RI/FS for the Coeur d'Alene Basin (CH2M HILL and URS Greiner, 2001a) and the ROD for OU 3 (EPA, 2002) identified the lack of site-specific riparian songbird data and a corresponding protective cleanup level of songbirds as two data gaps that should be addressed. Songbirds were identified for further study because they are at higher risk than most other terrestrial ecological receptors in the Upper Basin (as documented in Section 4.0, Attachment 4-1 in the FFS Report [EPA, 2012]). They are exposed to hazardous substances (such as lead) by direct ingestion of soil as well as via concentrations in their food, especially because of their ground-feeding habits of foraging. Therefore, actions to protect songbirds would be protective of other terrestrial ecological receptors. As a result, a riparian songbird study was conducted by USFWS (Hansen, 2007),

[6] The total estimated NPV cost for the Selected Remedy is $635 million, and includes remedy protection actions.

and a Focused EcoRA was performed (CH2M HILL, 2006d). (See also Sample et al., 2011 and Hansen et al., 2011.) Given the absence of promulgated criteria for metals in soil, and using the results from these studies with other relevant information, EPA has made a risk-management-based determination to use a site-specific cleanup level of 530 mg/kg for lead in soil to be protective of riparian songbirds in the Upper Basin. This cleanup level is more conservative than the site-specific human health cleanup level for lead selected in previous decision documents,[7] and therefore is also protective of direct human contact with soil (and sediments). In addition to being protective of both avian and human health, this is a consistent protective value that provides operational clarity and efficiency for ecological remedial design and cleanup decisions. For more information on the determination of this value, refer to Section 4.0, Attachment 4-1 in the FFS Report.

Like soil, sediments in the Upper Basin contain elevated concentrations of metals. There are no federal- or state-promulgated human health and ecological standards or criteria for freshwater sediments. Given the absence of promulgated criteria for metals in sediments, and the results of the site-specific EcoRA which demonstrated that songbirds and waterfowl are the ecological receptors at greatest risk, EPA has made the risk-management-based decision to use the site-specific cleanup level of 530 mg/kg for lead in soil and sediments.

Numerical cleanup criteria for soil and sediments may be revised as additional information becomes available. Any revisions to criteria would be documented in future decision documents.

12.1.4.2 Anticipated Benefits

The Upper Basin Selected Remedy includes extensive remedial actions that will address RAOs and result in the following:

- 145 mine and mill sites remediated within OU 3.[8]
- 3.58 million cubic yards of floodplain sediments, tailings, and waste rock excavated and placed in repositories or waste consolidation areas.
- 2.62 million cubic yards of waste rock and tailings capped or regraded, consolidated, and revegetated.
- Phase II cleanup of OU 2, focused primarily on reducing metals loading to the SFCDR. On average, these actions are estimated to reduce dissolved zinc loading by 550 lb/day (resulting in a decrease of approximately 24 percent).
- Collection and treatment of contaminated groundwater from the Woodland Park area of Canyon Creek. On average, these actions are estimated to reduce dissolved zinc loading to Canyon Creek (and subsequently to the SFCDR) by 87 lb/day.

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[7] Lead cleanup levels used for the remedies focused on human health have included 1,000 mg/kg for work completed in OU 1 and OU 2 and 700 mg/kg for ongoing work in OU 3.

[8] Remedial actions are also included for the Bunker Hill Box (OU 2), although these actions are not tied to specific mine and mill sites as are the actions in OU 3.

- Collection and treatment of contaminated groundwater from the Osburn area of the SFCDR. On average, these actions are estimated to reduce dissolved zinc loading to the SFCDR by 52 lb/day.
- 7,000 gpm of contaminated groundwater and adit drainage water collected, treated at the CTP, and returned to the SFCDR.
- 530 gpm of contaminated water treated at specific source sites using semi-passive technologies and then returned to the receiving water bodies.
- Approximately 28 river miles of stream and riparian stabilization actions along the SFCDR and tributaries where sediment removal actions are taken.

The remedial actions included in the Selected Remedy are primarily focused on treating, excavating, and/or containing mining-related contaminants, thereby reducing dissolved metals and particulate lead in rivers and streams and direct contact exposures. Such actions are expected to reduce unacceptable risks to humans and the environment. The anticipated overall benefits of the remedial actions in the Selected Remedy include the following:

- **Reduction of direct contact with mining-contaminated wastes.** Heavy metals are present in mining-contaminated materials throughout the Upper Basin and pose unacceptable risks to humans, wildlife, fish, and plants. Through a combination of excavation and disposal, regrading, consolidation, capping, revegetation, and institutional controls, the risks to humans and the environment from direct contact with mining-contaminated wastes will be significantly reduced in comparison to current conditions.
- **Reduction of dissolved metals in surface water and groundwater.** Dissolved metals have harmful effects on fish and other aquatic receptors. Approximately 20 miles of the SFCDR and 46 miles of its tributaries have adversely impacted fish populations. Species density and diversity have been reduced throughout the Upper Basin, and Ninemile and Canyon Creeks have been observed to have severe impacts on fish and other aquatic life in areas of mining-related operations. Following the implementation of the remedial actions in the Selected Remedy, the health of the Upper Basin fisheries is expected to improve dramatically. The Selected Remedy is expected to provide significant reductions in dissolved metals in surface water in the Upper Basin, thereby resulting in similar improvements in water quality.
- **Reduction of particulate lead in surface water.** Particulate lead transported downstream from the Upper Basin is a continuing source of contamination to the Lower Basin, Coeur d'Alene Lake, and the Spokane River. Reduction of lead loads in sediments transported and deposited in downstream areas is necessary to prevent recontamination of remediated areas, protect humans and the environment from exposure, and enable Lower Basin cleanups to proceed. The Upper Basin Selected Remedy is expected to provide significant reductions in lead loads in sediments throughout the Coeur d'Alene Basin.
- **Socio-economic and community impacts**. Implementation of the Selected Remedy is expected to improve the socio-economic conditions of the Upper Basin. The cleanup will expand the recreational use of riparian areas and will allow for potential redevelopment

of abandoned mine and mill sites. Significant spending on cleanup will encourage the hiring of local businesses and workforce for the cleanup work.

Throughout the Selected Remedy implementation period, affected media will be monitored to assess progress towards achieving the cleanup levels presented in Section 12.1.4.1. It is anticipated that at some locations, significant improvements in the protection of human health and aquatic life will be immediate, such as those where contaminated groundwater and adit discharges are collected for treatment or where wastes are consolidated and capped, essentially isolating them from surface water and groundwater as well as from humans and ecological receptors. At other locations, reduction of risks and improvements in surface water quality may take more time. Implementation of the Selected Remedy overall is expected to take about 30 years. During implementation, monitoring will be continued to assess remedy effectiveness and the potential need for additional remedial actions to achieve RAOs and cleanup levels in all areas of the Upper Basin.

12.1.4.3 Available Land Uses

The anticipated future land uses in the Upper Basin (outside cities and residential areas) are wildlife habitat, recreational use, subsistence use, logging, commercial use, and mining. In addition, some former mine and mill sites within the Upper Basin have the potential for redevelopment for commercial, recreational, or residential use. Implementation of the Selected Remedy is expected to support these potential future uses. As noted previously, at sites where hazardous substances are above levels that allow for unlimited use and unrestricted exposure, institutional controls will likely be required to manage potential exposures and maintain the integrity of the Selected Remedy. Institutional controls[9] and engineering controls will be needed in the Upper Basin to ensure the continued effectiveness of the Selected Remedy and prevent land uses that are inconsistent with the level of protection achieved by this remedy. These institutional and engineering controls may include:

- Legal and administrative controls, such as zoning restrictions, environmental protection easements, restrictive (UECA) covenants, or equitable servitudes, may be used to ensure that such measures are maintained; and
- Physical measures, such as fences and signs, may be used to limit activities that may interfere with remedial actions or result in exposure to hazardous substances at the site.

Implementation of the Selected Remedy will require some land to be dedicated for the management of waste materials that are generated by the cleanup activities. Waste materials will be placed in repositories and onsite waste consolidation areas, as discussed in Section 12.1.2.1.

12.1.4.4 Available Groundwater Uses

Currently, groundwater in many areas of the Upper Basin is contaminated with metals and is not available for beneficial uses. In 1989, IDWR established an Area of Drilling Concern

[9] Institutional controls, including controls outside the scope of the existing ICP (IDAPA 41.01.01), will be developed as necessary as the Selected Remedy is implemented; the public will have opportunities to provide input.

for groundwater within the 21-square-mile Bunker Hill Box to protect public health in recognition of the existing groundwater contamination. (An area designated as an "Area of Drilling Concern" has special well construction requirements and prohibitions.) Future use of groundwater as drinking water from shallow, unconfined aquifers within the area of mining impacts in the Upper Basin may be limited by concentrations of cadmium, lead, and zinc that exceed MCLs until cleanup is implemented. Although the Selected Remedy is expected to result in improvements to groundwater quality, it is not intended to satisfy the groundwater protection strategy for returning beneficial uses of groundwater as outlined in the NCP.

During and after implementation of the Selected Remedy, groundwater that meets cleanup levels will be made available for full beneficial use. Institutional controls to prevent development of groundwater as a drinking water source may be needed at some locations. Groundwater that does not meet cleanup levels may be made available for restricted use (e.g., industrial purposes) depending on contaminant concentrations.

12.1.4.5 Socio-Economic and Community Impacts

Cleanup of abandoned mine and mill sites will allow redevelopment of these properties and related increases in tax revenues. Remedial actions completed in the Bunker Hill Box and other areas of the Upper Basin have already led to retail development in Smelterville, development of the Galena Ridge golf community, and construction of the Trail of the Coeur d'Alenes, which are examples of the types of redevelopment that can occur on remediated properties.

Cleanup is not expected to restrict future mining and exploration in the Silver Valley. EPA has recently entered in to a settlement with Hecla Mining Company that includes a protocol for coordinating cleanup and mining activities. This protocol may, as appropriate, serve as a template for coordinating cleanup and mining with other companies.

The elements of the Selected Remedy focusing on water quality improvements and the subsequent increase in fish populations and diversity will expand the recreational use of these resources. Remediation of the riverbanks will inhibit erosion and improve the riparian corridors for greater recreational use.

The work associated with implementation of the Selected Remedy will provide additional jobs for the local labor force and contractors. The relatively long duration of the work should encourage investment in training and development of the local labor force to establish the necessary skills and expertise that will benefit workers and contractors for many years. This should result in growth of the tax base for local economic benefit. The work should also provide opportunities for local supply contractors. Additionally, remediation dollars spent in the Silver Valley are expected to create other opportunities for local businesses, such as new redevelopment possibilities and tourism.

12.2 Remedy Protection Actions

This section presents the rationale for the remedy protection actions included in the Selected Remedy, describes these actions, and summarizes their estimated costs and expected outcomes. The remedy protection actions focus on the populated areas of the Upper Basin including the most densely populated communities: Pinehurst, Smelterville, Kellogg, Wardner, Osburn, Silverton, Wallace, and Mullan (see Figure 1-1 of this Decision Summary).

12.2.1 Rationale

Analyses completed during the FFS (EPA, 2012) found that portions of the clean barriers installed as part of the portions of the existing Selected Remedies focusing on human health for OUs 1 and 2 and the Upper Basin portion of OU 3 are vulnerable to damage resulting from relatively small storm events. Consequently, additional remedy protection actions are warranted and are included in the Selected Remedy to enhance the long-term effectiveness and permanence of the existing remedies. These existing remedies include the placement of clean, protective barriers that are installed in residential, commercial, common-use, and right-of-way areas to prevent direct contact with and exposure to mining-related contaminants.

The remedy protection actions included in Alternative RP-2 (Modifications to Selected Remedies to Enhance Protectiveness [Remedy Protection Projects]) were identified as components of the Selected Remedy over the actions in Alternative RP-1 (No Further Action [Post-Event Response]). Section 10.3.2 of this Decision Summary summarizes the conclusions of the comparative analysis of the remedy protection alternatives. The Selected Remedy does not modify Alternative RP-2 as presented in the FFS Report (EPA, 2012) and the Proposed Plan (EPA, 2010a).

Key benefits of the remedy protection actions will include:

- Greater long-term protection of human health and the environment in community areas in the Upper Basin, achieved through improvements to existing water conveyance systems (i.e., culvert replacements, asphalt ditches, etc.), and
- A proactive approach to addressing recontamination issues associated with the potential erosion and/or recontamination of existing clean barriers.

12.2.2 Description

The Selected Remedy includes stormwater control actions to protect the portions of the existing Selected Remedies focusing on human health for OUs 1 and 2 (within the Bunker Hill Box) and the Upper Basin portion of OU 3 against stormwater runoff, tributary flooding, and heavy rain and snowfall. EPA has selected remedy protection actions to reduce the potential for erosion and recontamination of the existing clean barriers installed within community areas in the Upper Basin. Because these remedy protection actions are essentially improvements to existing infrastructure, EPA intends for these actions to be implemented one time only and that appropriate operation and maintenance of these actions will ensure their effectiveness in the long term. EPA recognizes that as these communities develop and expand, they will also need to improve or develop similar water control infrastructure. Major components of the remedy protection actions include:

- Specific remedy protection actions, such as culvert replacements, channel improvements, small diversion structures, and asphalt ditches, identified in the eight primary Upper Basin communities (Pinehurst, Smelterville, Kellogg, Wardner, Osburn, Silverton, Wallace, and Mullan), and

- Identification of generalized remedy protection actions that are expected to be needed in Upper Basin side gulches.[10]

Figure 12-23 shows the eight Upper Basin communities where detailed analyses were conducted and specific Alternative RP-2 actions were identified in the FFS Report. Figure 12-23 also identifies drainages, referred to as side gulches, outside the eight primary Upper Basin communities.

Table 12-14 lists the remedy protection conceptual designs included in the Selected Remedy for the eight primary Upper Basin communities. During remedial design and implementation, these actions may be modified and/or augmented with other, similar actions to address issues encountered during the design phase, identified by stakeholder input, and/or resulting from other emergent considerations.

Ongoing maintenance of constructed Alternative RP-2 remedy protection projects will be essential to ensure that remedy protection drainage improvements continue to function as designed. Prior to construction, agreements will be completed regarding which state or local entity will perform O&M tasks associated with the remedy protection projects and ensure that sufficient resources are available, or a determination will be made that a local regulatory scheme ensures performance of O&M. Easements and/or restrictive covenants may also be necessary components of Alternative RP-2 to ensure long-term access and the functionality of the remedy protection projects.

Generalized remedy protection actions in the side gulches are also included as part of Alternative RP-2. During the FFS, detailed analyses were not conducted for the side gulches to assess these portions of the existing protective barriers implemented to protect human health that are vulnerable to damage from storm events. The framework for evaluation and implementation of remedy protection actions in the side gulches will be applied to these areas in the future, as more detailed information is gathered on the side gulches or as the result of changing environmental conditions, stakeholder input, and/or other emergent considerations.

It should be noted that the side gulches and associated existing remedies generally have similar physical and topographical characteristics to the drainages that were analyzed in detail for the eight primary Upper Basin communities. The process for applying stormwater control technologies to the side gulches in the future will include (1) completing hydrologic and hydraulic analyses and field reconnaissance to assess the existing remedy areas at risk, and (2) if warranted, mitigating the risks posed to the existing remedies using the results of the hydrologic and hydraulic analyses, the specific physical constraints of each site, and engineering judgment to select appropriate remedy protection actions. Selection of specific remedy protection projects for the side gulches will be accomplished through future ESDs or other appropriate decision documents.

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[10] Side gulches are defined as tributaries of the SFCDR where lower densities of residential populations reside in the Upper Basin and, therefore, fewer of the existing Selected Remedies have been implemented. Section 9.0 of the FFS Report (EPA, 2012) provides a list of the Upper Basin side gulches. Detailed remedy protection projects were not identified for the side gulches because less information is currently available about the side gulch drainage areas. Selection of site-specific remedy protection actions for the side gulches will be accomplished through future ESDs or other appropriate decision documents.

As noted previously, the existing ICP provides a locally enforced set of rules and regulations established to maintain the integrity of installed barriers. These include ensuring that new barriers are installed during redevelopment that may occur within the administrative boundary of the ICP. The ICP applies to all wastes left in place within the Bunker Hill Superfund Site ICP boundary (IDAPA 41.01.01). The ICP also applies to ground-disturbing actions within the Site with the exception of certain agricultural and mining activities. The ICP issues permits for work that may encounter mine-waste-contaminated materials, stipulates mine-waste-contaminated material handling procedures and disposal, and trains and certifies contractors prior to working with potentially contaminated materials. Institutional controls outside the scope of the existing ICP will be developed as necessary during implementation of the Selected Remedy.

12.2.3 Estimated Costs

Table 12-14 provides cost estimates for the Upper Basin remedy protection actions included in the Selected Remedy. Costs were developed based upon principles outlined in EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA, 2000b). The cost estimate information in Table 12-14 is based on the best available information regarding the anticipated scope of the remedy protection actions. Changes in the cost components are likely to occur as a result of new information and data collected during the engineering design of the actions. Major changes may be documented in the form of a memorandum to the Administrative Record, an ESD, or another ROD Amendment. The engineering cost estimates presented in Table 12-14 are expected to be within +50 to -30 percent of the actual project costs, consistent with CERCLA guidance.

The design life of the remedy protection projects is expected to be greater than the 30-year project life used for this cost analysis per EPA guidance. The additional value of the remedy protection projects associated with the longer design life is not accounted for in this cost analysis. O&M costs were included for the remedy protection projects. Costs for O&M, including inspections and repairs, were developed on a community-specific basis. Assumptions were made that 2 percent of the capital costs will be spent annually on repairs and maintenance to the remedy protection projects beginning the year the project is implemented. One of the actions for the remedy protection projects is visual observation and documentation; this cost is included in O&M cost estimate for Alternative RP-2. This action does not include the cost for maintenance of the existing infrastructure if a problem is identified during visual observation and documentation. It is assumed that these maintenance items will be the responsibility of others (property owners, communities, etc.).

Because assumptions have not been made on the sequence of implementing the remedy protection actions, all capital costs are considered NPV costs assuming year 2009 dollars.[11] The effect of staging over the implementation period would be to reduce the NPV of both capital and O&M costs. Some components of the remedy are expected to have O&M requirements that extend beyond the assumed 30-year period of performance per EPA

[11] The estimated costs presented in this ROD Amendment are based on costs estimated in the FFS Report (EPA, 2012), which were developed using year 2009 cost data.

guidance (EPA, 2000b). If the O&M period was extended to 100-years, the increase in total cost would be relatively small, approximately 4 percent.

The total estimated NPV cost of the remedy protection actions included in the Selected Remedy is $33.8 million.

12.2.4 Expected Outcomes

This section summarizes the expected outcomes of the remedy protection actions included in the Selected Remedy in terms of cleanup levels, anticipated benefits to human health and the environment, available land and groundwater uses, and socio-economic and community impacts. This section also identifies the differences in expected outcomes between the remedy protection actions included in the Selected Remedy and the existing Selected Remedies for OUs 1 and 2 and the Upper Basin portion of OU 3.

12.2.4.1 Cleanup Levels

The RODs for OUs 1, 2 and 3 (EPA, 1991a, 1992, and 2002) identified cleanup criteria and action levels for implementing the portions of the existing remedies focusing on protection of human health in residential and community areas in the Upper Basin. The remedies in those OUs included installation of protective barriers to reduce the risk of exposure to lead in soil when sampling results exceeded action levels. The remedy protection actions included in the Upper Basin Selected Remedy do not update those cleanup or action levels. Instead, the remedy protection actions aim to improve water control measures to reduce the risk of recontamination of or damage to existing clean areas and/or existing protective barriers implemented as part of the portions of the existing Selected Remedies focusing on human health for OUs 1 and 2 and the Upper Basin portion of OU 3.

12.2.4.2 Anticipated Benefits

The remedy protection actions included in the Selected Remedy will provide improvements in the protectiveness of existing human health barriers. The anticipated key benefits of the remedy protection component of the Selected Remedy include the following:

- Greater long-term protection of human health and the environment in community areas in the Upper Basin, achieved through improvements to existing water conveyance systems (i.e., culvert replacements, asphalt ditches, etc.), and
- A proactive approach to addressing recontamination issues associated with the potential erosion and/or contamination of existing clean barriers. This is preferred over cleaning up contaminated areas following a storm event because it decreases risks of exposure to contaminated materials.

12.2.4.3 Available Land Uses

The remedy protection actions in the Selected Remedy will be conducted in community areas where the land uses are primarily residential and commercial. In some areas, land uses will include recreational use and wildlife habitat. It is not anticipated that the implementation of the remedy protection component of the Selected Remedy will result in any changes in land uses.

12.2.4.4 Available Groundwater Uses

The remedy protection actions in the Selected Remedy do not address groundwater and, therefore, are not anticipated to result in any changes to current groundwater uses.

12.2.4.5 Socio-Economic and Community Impacts

Implementation of the remedy protection component of the Selected Remedy is expected to improve socio-economic conditions in the Upper Basin. The enhanced protection of human health, focused on children, will maximize the long-term resilience and effectiveness of the portions of the existing Selected Remedies focusing on human health. In addition, remedy protection actions will protect private property from damage caused by tributary flooding and high-precipitation events. The work associated with implementation of the Selected Remedy is expected to provide additional jobs for the local labor force and contractors, including local supply contractors. Additionally, remediation dollars spent in the Upper Basin are expected to create other opportunities for local businesses, such as new opportunities for redevelopment projects and tourism.

12.3 Implementation of the Selected Remedy

Implementation of the Selected Remedy for the Upper Basin will present unique challenges given the nature and extent of the metals contamination in the Upper Basin, the number of remedial actions needed, and the size and complexity of the area. For these reasons, EPA has begun the critical process of implementation planning and prioritizing the actions in the Selected Remedy in collaboration with the Basin Commission and the Upper Basin PFT. The outcome of this process will be the initial Implementation Plan that will guide project-specific cleanup actions into the future, with the objective of ensuring that the actions taken are the most effective in achieving the overall goals of protecting human health and the environment and providing opportunities for substantive input to project stakeholders and community representatives. Consistent with the RAOs for the Upper Basin, opportunities will be sought during the implementation of the Selected Remedy to reduce its environmental footprint as defined in EPA Region 10's *Clean and Green Policy* (EPA, 2009a) and EPA's *Principles for Greener Cleanups* (EPA, 2009b).

This section provides additional details about the prioritization of remedial actions using an adaptive management process and the approach that will be used to implement cleanup actions in the Upper Basin.

12.3.1 Overview of the Adaptive Management Process

Adaptive management is a critical component of prioritizing and implementing the Selected Remedy actions because it is not possible for physical, biological, and chemical conditions to be fully defined and known for this large and complex area. Uncertainty is unavoidable, and the implementation of the Selected Remedy must be managed taking this uncertainty into account. An adaptive management framework provides a methodology to carry out the Selected Remedy in a structured, iterative way. Adaptive management considers uncertainty, and monitors and evaluates the effectiveness of the remedial actions and cleanup technologies including progress (ecological response metrics) towards long-term cleanup goals. "Lessons learned" are then incorporated such that uncertainty is reduced for future actions as the cleanup work progresses towards the achievement of RAOs. The adaptive management process will guide the collection of valuable information to prioritize cleanup actions in the Upper Basin so that the greatest amount of effective cleanup is achieved for the lowest cost.

Adaptive management, illustrated in Figure 12-24, is a process wherein decisions are made as part of an ongoing science-based process. Within the context of the Selected Remedy, adaptive management simply means that EPA will implement specific cleanup actions included in the Remedy, monitor the effectiveness of those actions to determine whether cleanup levels are being achieved, and make adjustments to future cleanup actions to benefit from the information gained through the effectiveness monitoring.

Updates of and changes to the schedule, priorities, and/or sequencing will be documented through updates to the Implementation Plan, and such changes will not be considered remedy changes. However, there may be situations in the future where the lessons learned from the adaptive management process may reveal the need to adjust a particular technology or cleanup action. In addition, as noted previously, this ROD Amendment does not select all the remedial actions indentified in the Preferred Alternative in the Proposed Plan. Information developed during cleanup may identify sites where risks to human health or the environment require response actions not selected in this ROD Amendment. In those circumstances, response actions will be selected from the TCDs in the FFS Report (EPA, 2012) via an Action Memorandum, an ESD, or an appropriate decision document.

Where changes to the Selected Remedy are significant, EPA will provide opportunities for public participation consistent with the requirements of Section 113(k) of CERCLA and 40 CFR 300.435(c). Depending on the significance of the changes in cleanup approach, there may be additional opportunities for public input as discussed in Section 12.3.2.

A key component of the success of the adaptive management process is refinement of the implementation processes and remedial approaches as new information becomes available that clarifies uncertainties regarding the understanding of a site, the effectiveness of the remedial approaches and technologies used, and the responses of environmental receptors to changes in contaminant concentrations, ecological conditions, and habitat. Adaptive management reviews, adjustments, and incorporation of changes into the management objectives (RAOs and other ecological indicators), strategies, approaches, and tools used in the implementation process will be conducted in a timely manner and consistent with CERCLA-required Five-Year Reviews.

12.3.2 Adaptive Management and Future Changes to the Selected Remedy

Implementation of the adaptive management process may reveal the need to make changes to the Selected Remedy. Updates of and changes to the Selected Remedy implementation schedule, priorities, and/or sequencing will be documented through updates to the Implementation Plan, and such changes will typically not be considered remedy changes. Exactly how changes to the Selected Remedy will be made, and the mechanism(s) for public input, will depend on the significance of the changes. Anticipated changes may include non-significant, significant, or fundamental modifications to the Selected Remedy. Remedy changes are expected to fall along a continuum from minor to fundamental changes.

12.3.2.1 Non-Significant or Minor Changes

Non-significant or minor changes to a remedy, as defined by CERCLA, include modifications made to the functional specifications of the remedy to address issues such as performance optimization, new technical information, support agency or community concerns, and/or cost minimization. For these types of changes, public input will be sought by working with the Basin Commission, the TLG, and the Upper Basin PFT as they revise the Implementation Plan as needed, review the cleanup actions identified in that process, and seek input from stakeholders and community representatives. An example of a non-significant or minor change would be changing the planned cover system for a tailings pile from a rock cover to a vegetative cover. Such changes will be documented through updates of the Implementation Plan and/or memoranda to the Administrative Record.

12.3.2.2 Significant Changes

A significant change to a remedy generally involves a change to a component of the remedy that does not fundamentally alter the overall cleanup approach. Public input on significant changes will typically be handled in the same ways as for minor changes, except that EPA will also publish an ESD describing the reasons such changes were made. A formal public comment period is not required and will not typically occur when an ESD is issued. As described in Section 2.2 of this Decision Summary, two prior ESDs have been issued to document significant changes to the OU 2 remedy selected by the 1992 ROD. An example of one of the significant changes documented in these ESDs was EPA's decision to construct only one demolition debris consolidation area (at the historical Lead Smelter location) versus two separate onsite debris consolidation areas. While significant, this change did not fundamentally alter the overall cleanup approach for OU 2. EPA anticipates publishing ESDs as necessary and as part of the adaptive management process. A single ESD may be used to document multiple significant changes. While the ESD is being prepared and made available to the public, EPA may proceed with the design, construction or operation activities associated with the Selected Remedy. However, depending on the significance of the changes in cleanup approach, there may be additional opportunities for public input.

12.3.2.3 Fundamental Changes

When EPA decides to select the final remedy for the Upper Basin, or determines via the adaptive management process or other new information that a remedial action is warranted that would fundamentally alter the basic features of this interim Selected Remedy with respect to scope, performance, or cost, such actions will be modified through another ROD Amendment. In those circumstances, EPA will continue to provide for public involvement through adaptive management and the implementation planning process described above, and will also be required to issue a Proposed Plan, provide a public comment period, and select a remedy in a ROD Amendment consistent with the NCP. Similarly, EPA could determine that an aggregate of non-significant, minor, and/or significant changes could result in a fundamental change, in which case the change(s) would be handled through an appropriate decision document.

12.3.3 Prioritization of Remedial Actions using Adaptive Management

With help from stakeholders and community members involved in the Basin Commission's Upper Basin PFT, EPA has developed a logical and transparent prioritization process over the past two years. EPA will continue to prioritize remedial actions included in this Selected Remedy using these processes as more data are gathered and the effectiveness of the initial remedial actions is determined. As described in more detail below, updates of and changes to the Selected Remedy implementation schedule, priorities, and/or sequencing will be documented through revisions to the Implementation Plan.

The following specific issues, at a minimum, will be considered to prioritize, schedule, and sequence specific actions that are part of the Selected Remedy:

- **Human health exposure to contaminated mine waste materials.** EPA will place a higher priority on sites that present a current exposure risk to people from contaminated mine wastes, including exposures that may occur from damage to existing protective barriers implemented to protect human health in the Upper Basin communities.
- **Metals loading to surface water.** EPA will prioritize the implementation of remedial actions at sites based on each site's potential to add metals, such as lead and zinc, to groundwater and surface water.
- **Potential for recontamination of cleaned areas.** EPA will prioritize the implementation of remedial actions in order to reduce the potential for recontamination of previously remediated areas. This typically means conducting work at sites that are topographically higher in a drainage area first, in order to avoid recontamination from sites above them.

Additional factors that may be considered prior to the implementation of remedial actions include, but are not limited to:

- **Water treatment.** Is water treatment necessary for the remedial action? What are the water contaminant concentrations and flows at the site? Can the water be treated with a "passive" technology, or will it require piping the water to the CTP?
- **Waste management.** Is repository space needed, and is the space currently available? Can a local waste consolidation area be established?
- **Restoration work.** Is restoration work already planned by the Coeur d'Alene Basin Natural Resource Restoration Plan (U.S. Department of the Interior et al., 2007)? Are there advantages to addressing relatively cleaner areas first in order to complete remedial actions in specific drainage areas and allow for restoration to proceed?
- **Construction staging.** How may construction be staged in order to minimize disruption in a community and make the cleanup of multiple sites in close proximity to each other the most efficient? How may work at a site be coordinated with property owners and/or allow for future development such as mining?
- **Design needs.** What are the design needs for the remedial action (e.g., pre-design investigations and treatability studies)?
- **Stakeholder and community input.** EPA will involve stakeholders and community members in the development of the Implementation Plan and during the implementation of cleanup actions. As currently envisioned, this will involve working through the Basin Commission process and with the Upper Basin PFT to revise the Implementation Plan as needed, review the sites identified in that process, and seek

input from stakeholders and community representatives on the prioritized sites. These activities will be documented in Basin Commission work plans (see Section 12.3.4.1).

- Other factors identified during implementation of initial remedial actions.

12.3.4 Focus Areas for the Initial Phase of Implementation

As discussed above, cleanup actions will be prioritized based on factors such as the potential for people and the environment to be exposed to contaminated materials; how much contamination is expected to be removed or reduced as a result of each action; the potential for recontamination of cleaned-up areas; the need for repository space; restoration needs; and construction staging and design needs. Given these considerations, working with the Basin Commission and the Upper Basin PFT, EPA has to date identified the following activities that will likely be implemented as part of the initial phase of cleanup actions:

- Remedy protection projects within the Upper Basin communities.
- Initiation of mine and mill site cleanups and construction of waste consolidation areas in the upper portions of drainage areas that currently exhibit the worst surface water quality, such as Ninemile and Canyon Creeks.
- Continuation of the regional repository siting process.
- Water treatment infrastructure projects to collect and convey contaminated groundwater to the CTP for treatment prior to discharge to the SFCDR. It is anticipated that groundwater collection and treatment will be conducted first within OU 2, including the first phase of expansion of the CTP to provide increased capacity for the additional OU 2 volume of collected groundwater. Water treatment infrastructure projects within OU 3 and the further upgrades of the CTP to increase treatment capacity for the OU 3 collected groundwater are anticipated to follow.
- Conveyance of the CTP effluent (i.e., clean, treated water) directly to the SFCDR in a pipeline to prevent recontamination through contact with contaminated subsurface soil in the Bunker Hill Box.
- Other OU 2 remedial actions included in the Selected Remedy that focus on minimizing the flow of metals with elevated levels into OU 2 tributaries and the SFCDR.
- Collection of additional information to refine the understanding of adit flows and sites in side drainages that could compromise remedy protection work, and identification of potential locations for onsite waste consolidation areas.
- Identification of stream segments where water quality is closer to the cleanup levels, and limited actions are needed to complete the cleanup in these areas and allow for restoration work by the federal Natural Resource Trustees.

12.3.5 Development of the Basin Commission Work Plans and the Implementation Plan

The results of implementation planning for the Selected Remedy will be documented in Basin Commission Work Plans and the Implementation Plan, as discussed in the following sections.

12.3.5.1 Basin Commission One-Year and Five-Year Work Plans

On an annual basis since the establishment of the Basin Commission and issuance of the OU 3 ROD in 2002, EPA has provided a summary of CERCLA-related activities to the Basin Commission, and the Commission has updated the one-year and five-year work plans that summarize the CERCLA-related activities to be conducted in the Coeur d'Alene Basin. The one-year work plans establish and maintain the sequencing of activities that will be needed to complete the goals and objectives of the five-year plan. The Basin Commission work plans focus on general areas of work and do not go into project-specific detail. Per Basin Commission protocol, the work plans are reviewed by the Commission's Technical Leadership Group (TLG) and Citizens' Coordinating Council (CCC), the Executive Director, and any other citizens who may wish to review and comment.

With the issuance of this Upper Basin ROD Amendment, EPA's summary of CERCLA-related activities for the Basin Commission's one-year and five-year work plans will be expanded to include the activities conducted to implement the Selected Remedy for the Upper Basin.

12.3.5.2 Implementation Plan

In addition to the more general Basin Commission work plans, EPA will prepare an Implementation Plan in collaboration with the Upper Basin PFT and other stakeholders, as noted previously. This Plan will present the results of the prioritization process described above, and will also summarize planned yearly CERCLA activities on a project- and site-specific basis for the entire Upper Basin.

A long-term Selected Remedy does not mean an end to public involvement; the public will have continuing opportunities to provide input on how the cleanup is being implemented. EPA has committed to implementing remedial actions in the Upper Basin through the Basin Commission process. This includes developing an Implementation Plan for specific remedial actions associated with the Selected Remedy. EPA will work with the Basin Commission to develop the Implementation Plan, and the public will have opportunities to provide input. In addition, EPA will continue to conduct Five-Year Reviews, as required by CERCLA, and the public will be invited to comment on drafts of Five-Year Review Reports.

12.3.6 Ecological Response Metrics

In order to demonstrate progress made towards achieving the cleanup levels discussed in Section 12.1.4.1, EPA, in collaboration with the Natural Resource Restoration Team (the Coeur d'Alene Tribe, BLM, USFWS, USFS, and the State of Idaho) has developed ecological response metrics for evaluating remedial progress during the implementation period for the Selected Remedy (Stratus Consulting, 2012). The AWQC remain the ARARs for surface water and the basis for quantitative cleanup levels. However, ecological response metrics are refined in part from the fishery tiers included in the 2002 ROD for OU 3, and reflect the current understanding of the river system. Fishery tiers were developed to provide a relationship between dissolved metals concentrations in surface water and the health of fisheries (i.e., the abundance of fish species, age of fish, fish migration, etc.) in the Upper Basin (CH2M HILL and URS Greiner, 2001b).

Identification of measurable ecological response metrics will provide EPA with a means to evaluate, predict, and report on environmental improvements associated with remedial actions planned and implemented in the Upper Basin. The ecological response metrics are intended to serve as estimated measures of change and are not considered ARARs. The intent of the ecological response metrics is limited to providing EPA and the public with the following:

- Tools with which to estimate potential environmental and ecological improvements that could result from specific remedial actions;
- Target receptors with which to evaluate environmental recovery; and
- A means for measuring environmental recovery and progress toward achieving cleanup levels during and after the implementation of remedial actions.

As part of the adaptive management process, response metrics will be evaluated, updated, and used to inform future implementation planning. Such metrics currently include:

<u>Water column metrics:</u>

- Concentrations of dissolved zinc and cadmium in surface water
- Trout abundance
- Sculpin presence/absence

<u>Benthic (sediment) metrics:</u>

- Concentrations of zinc and lead in fine-grained bed sediments
- Number of mayfly (*Ephemeroptera*) taxa
- Number of invertebrate taxa
- Sculpin presence/absence

<u>Riparian habitat metrics:</u>

- Concentrations of zinc and lead in riparian floodplain soil
- Percent vegetative cover
- Number of plant species (total)
- Number of herbaceous species
- Number of vegetation layers.

For each of these metrics, analysis of Upper-Basin-specific data was used to develop a suite of categorical threshold responses that can be used as general indices of ecological quality. A series of quantitative models were also developed that enable projections of responses of the indicator metrics across a gradient of metals concentrations. Results of future monitoring as part of the BEMP (see Section 12.4) will be used to evaluate the effectiveness of remedial actions and will be used as input to adaptive management and future implementation planning.

12.3.7 Anticipated Duration of Selected Remedy Implementation

An important consideration affecting implementation planning will be the amount of funding available for remedial actions on an annual basis. EPA recognizes the importance of securing and preserving sufficient resources to implement the Upper Basin Selected Remedy and other cleanup actions throughout the Coeur d'Alene Basin. Therefore, the Implementation Plan will include assumptions about annual funding levels and information about cleanup and restoration work conducted by other federal and state agencies, the federal Natural Resource Trustees, and other parties in the Basin. The prioritized implementation approach, along with the need to manage existing cleanup funds wisely, is expected to result in the cleanup actions included in the Selected Remedy taking about 30 years to complete.

12.4 Monitoring and Additional Data Needs

In support of the RODs for OU 2 (EPA, 1992) and OU 3 (EPA, 2002), EPA worked with Coeur d'Alene Basin stakeholders to collaboratively develop the initial Basin environmental monitoring programs to evaluate the success of the Selected Remedies for these OUs. The original monitoring programs were initiated for OU 3 and OU 2 respectively in the BEMP (EPA, 2004) and the EMP (CH2M HILL, 2006a).

EPA is currently working with stakeholders to develop an update to the original BEMP and EMP to be consistent with the Selected Remedy for the Upper Basin and to consolidate all the Basin-wide environmental monitoring efforts into an amended BEMP. The revised BEMP will guide all the monitoring efforts within the Upper and Lower Basins. Consistent with the framework of the original environmental monitoring programs, the revised BEMP will provide data to support the following objectives:

- Assess long-term status[12] and trends[13] of surface water, sediment, groundwater, and biological resource conditions in the Basin.
- Evaluate progress toward meeting RAOs and ARARs, and achieving cleanup levels (as presented in Sections 8.0 of this Decision Summary and in Section 12.1.4.1 above).

[12] Determination of "status" involves comparing monitoring data to established media-specific performance metrics relative to RAOs, ARARs, and cleanup levels.

[13] Determination of a "trend" involves a temporal assessment of changing conditions for key metrics to assess relative progress over the long-term implementation period.

- Improve the understanding of Coeur d'Alene Basin environmental processes and variability to improve the effectiveness and efficiency of cleanup actions included in the Upper Basin Selected Remedy. This includes evaluation of ecological response metrics as described in Section 12.3.6.
- Provide data for CERCLA-required Five-Year Reviews of remedy performance.

The BEMP includes two main components. The first is an overarching long-term status and trends assessment of the surface water, sediment, groundwater, and biological resource conditions within the Coeur d'Alene Basin. The long-term status and trends monitoring is expected to be ongoing while the Upper Basin Selected Remedy is being implemented and subsequently monitored at key locations, to assess the effectiveness of remedial actions and progress toward established performance metrics such as RAOs, ARARs, and cleanup levels. As noted above, the Selected Remedy is expected to take about 30 years to be fully implemented. The second monitoring component of the BEMP is action-specific monitoring that will be conducted to support the overarching long-term status and trends monitoring program. The action-specific monitoring elements will be developed as part of the remedial design and in support of evaluation of the effectiveness of specific cleanup actions. The action-specific monitoring programs may be initiated in focused areas at an expedited data collection frequency in preparation for remedial design efforts, and may also be adjusted or terminated as actions and data collection objectives are satisfied.

The fundamental approach of the BEMP is to assess changes and improvements in contaminated media, and to monitor changes in associated habitats and ecological receptors. As such, the media of interest for the long-term BEMP include surface water, sediments, groundwater (especially that which discharges dissolved metals to surface water), and biological resources. The affected ecological media include habitats and biological communities, which will also be monitored as part of this program. Collectively, assessment of these four media of interest over the long-term will be used to inform the adaptive management process and facilitate management decisions.

The BEMP includes indicators of ecological improvement and supporting data that are based on the ROD for OU 3 (EPA, 2002) along with the supporting RI/FS (EPA, 2001b, 2001c) and EcoRA (CH2M HILL and URS Greiner, 2001a), and are supportive of the Selected Remedy for the Upper Basin. The media of interest for the BEMP include:

- **Surface Water**: Dissolved and total metals concentrations, and hardness (calcium and magnesium). The surface water monitoring design emphasizes dissolved cadmium and zinc under a range of flow conditions, and total lead under high-flow conditions.
- **Sediments**: Metals concentrations in sediments in river, stream, and riparian environments in the Upper Basin (particularly Ninemile Creek, Pine Creek, and the SFCDR); metals concentrations in sediments within river, stream, riparian, lake, and wetland environments in the Lower Basin; and metals concentrations in sediments within depositional areas of the Spokane River. The BEMP aims to monitor sediments for long-term trends while soil in source areas may be targeted for action-specific testing and monitoring as appropriate.
- **Groundwater**: Dissolved metals concentrations of the primary COCs including arsenic, cadmium, copper, lead, mercury, and zinc.

- **Biological resources**, which generally include:
  - Fish, macroinvertebrates, periphyton, and aquatic habitat in river and stream environments;
  - Songbirds, small mammals, and vegetation in riparian environments;
  - Waterfowl in wetland environments; and
  - Waterfowl and fish in lake environments.

The focus of the BEMP is on environmental monitoring. The BEMP is not designed to monitor protection of human health in the communities and residential areas of the Basin upstream of Coeur d'Alene Lake. The BEMP supports a variety of non-CERCLA and state monitoring efforts, of which the most noteworthy is the Coeur d'Alene Lake Management Plan administered by IDEQ and the Coeur d'Alene Tribe; the BEMP includes monitoring stations and nutrient monitoring that support the Lake Management Plan.

SECTION 13.0

Statutory Determinations

This section describes how the Selected Remedy for the Upper Basin, which is an interim remedy as discussed previously, satisfies the five statutory requirements of CERCLA §121 (as required by NCP §300.430(f)(5)(ii)). This section also describes the CERCLA Five-Year Review requirements for the Selected Remedy.

The following is an overview of the five statutory requirements of CERCLA §121 as addressed in this section.

- **Section 13.1, Protection of human health and the environment**. This section describes how the Selected Remedy will attain a level of protection of human health and the environment, through treatment, engineering controls, and/or institutional controls, that is commensurate with the scope of the Selected Remedy (NCP §300.430(f)(5)(ii)(A)). Within its scope, the Selected Remedy protects human health and the environment from the exposure pathways and threats it is addressing and the waste materials being managed.
- **Section 13.2, Compliance with ARARs specific to the Selected Remedy**. This section describes the federal and state ARARs the Selected Remedy will attain. This section also describes other available information that does not constitute ARARs (e.g., advisories, criteria, and guidance, and to-be-considered [TBC] criteria) but which will be useful in designing and implementing the remedy.
- **Section 13.3, Cost-effectiveness**. This section describes how the Selected Remedy meets the Superfund program definition of a cost-effective remedy as one whose *"costs are proportional to its overall effectiveness"* (NCP §300.430(f)(1)(ii)(D)). The "overall effectiveness" of a remedy is determined by evaluating the following three of the five Primary Balancing Criteria used in the detailed analysis of alternatives: (1) long-term effectiveness and permanence; (2) reduction in toxicity, mobility, and volume through treatment; and (3) short-term effectiveness.
- **Section 13.4, Utilization of permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable**. This section describes the rationale for the Selected Remedy, explaining how the remedy provides the best balance of tradeoffs among the alternatives with respect to the Primary Balancing Criteria set out in NCP §300.430(f)(1)(i)(B), such that it represents the maximum extent to which permanence and treatment can be practicably utilized in the Upper Basin. The Selected Remedy is not designed or expected to be final, as it is an interim remedy as discussed previously, but it represents the best balance of tradeoffs among alternatives with respect to pertinent criteria, given the scope of the remedy.
- **Section 13.5, Preference for treatment as a principal element**. This section describes treatment components that support the statutory preference for treatment. The Selected Remedy satisfies the statutory preference because it contains treatment for adit

discharges and groundwater as a primary element within its scope. Furthermore, if PTWs are encountered, they will be remediated in accordance with the remedies for PTWs selected in the earlier RODs, including treatment of mercury-contaminated PTWs prior to containment.

The Selected Remedy described in this ROD Amendment will, commensurate with its scope:

1. Protect human health and the environment.
2. Attain federal and state requirements that are applicable or relevant and appropriate to the remedial actions.
3. Be cost-effective.
4. Use permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.
5. Satisfy the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

The Selected Remedy is not expected to fully address surface water contamination at all locations in the Upper Basin. The Selected Remedy is also not intended to fully address groundwater contamination. Thus, the Selected Remedy is an interim remedy for the Upper Basin. The Selected Remedy will address many significant sources of contamination in the Upper Basin and will be protective of human health and the environment commensurate with its scope.

The Selected Remedy is expected to result in significant improvements to surface water quality in the Upper Basin and may achieve AWQC ARARs under the Clean Water Act at many locations; however, the remedy may not achieve these ARARs at all locations. Furthermore, although the Selected Remedy is expected to result in significant improvements to groundwater quality, it is not intended to achieve groundwater MCL ARARs under the Safe Drinking Water Act throughout the Upper Basin. Similarly, although the Selected Remedy will provide additional safe habitat for special-status species and is intended to achieve ARARs under the MBTA and the ESA where remedial actions are taken, it will not achieve these ARARs at all locations. The remedial actions included in the Selected Remedy are expected to result in the achievement of cleanup levels for soil and sediments where actions are taken.

The Selected Remedy satisfies CERCLA's protectiveness criteria as applied to an interim remedy, which is evaluated by the scope of its actions. The Selected Remedy is designed to provide significant improvements to surface water and groundwater, and to significantly reduce risks posed to human health and the environment within the Upper Basin. Thus, the level of protection that the Selected Remedy will provide is commensurate with the scope of the Selected Remedy, and the Selected Remedy is protective in the context of its scope, even though it does not, by itself, meet the statutory protectiveness standard that a final remedy would meet. Consistent with 40 CFR 300.430(a)(ii)(B) and 40 CFR 300.430(f)(1)(ii)(C)(1), this Selected Remedy, an interim remedy, is neither inconsistent with nor precludes implementation of a final remedy that will attain ARARs. The final remedy will be identified in subsequent decision documents.

Because hazardous substances, pollutants, or contaminants will remain in the Upper Basin above levels that allow for unlimited use and unrestricted exposure before completion of the Selected Remedy, statutory CERCLA reviews will be conducted at least every five years after the initiation of remedial actions[1] to ensure that the Remedy is, or will be, protective of human health and the environment.

13.1 Protection of Human Health and the Environment

The Selected Remedy will attain a level of protection of human health and the environment, through treatment, engineering controls, and/or institutional controls, that is commensurate with the scope of the Selected Remedy (NCP §300.430(f)(5)(ii)(A)), which includes:

- Remedial actions to protect human health and the environment in the Upper Basin, and
- Remedy protection actions to protect the existing Selected Remedies focusing on human health in the Upper Basin.

As noted previously, the level of protectiveness provided by an interim remedy is evaluated by the scope of its actions. Accordingly, the Selected Remedy, by its nature, need not be as fully protective as the final remedy is required to be under the statute. The Selected Remedy is designed to provide significant improvements to surface water and groundwater, and to significantly reduce the risks posed to human health and the environment within the Upper Basin. Thus, the level of protection that the Selected Remedy will provide is commensurate with the scope of the Selected Remedy, and the Selected Remedy is deemed to be adequately protective in the context of its scope, even though it does not, by itself, meet the statutory protectiveness standard that a final remedy would meet.

13.1.1 Protection Afforded by Remedial Actions

The remedial actions included in the Selected Remedy for the Upper Basin will result in substantial reductions of exposures of humans and ecological receptors to metal contaminants in the areas addressed by the remedy. The anticipated benefits of the remedial actions in the Selected Remedy include:

- Greater protection of human health and wildlife by reducing the risk of exposure through direct contact with contaminated soil and sediments and potential contact with contaminated surface water.
- Significant reduction of the transport of dissolved metals contamination into the Coeur d'Alene River system from the Upper Basin.

[1] Cleanup actions are ongoing at the Bunker Hill Superfund Site to implement previous RODs, and several Five-Year Reviews have been completed (EPA, 2000a, 2000b, 2005, and 2010b). The next Five-Year Review for the Site is planned to be completed in 2015.

- Reduction of the downstream transport of lead-containing sediments as the result of cleanup actions at upstream contaminant source areas. This will reduce downstream exposures and the potential for recontamination.

The Selected Remedy is also expected to significantly reduce both groundwater contamination levels and the contribution of contaminated groundwater to surface water. However, given the pervasive nature of the subsurface contamination, the Selected Remedy is not intended to achieve the drinking water standards for groundwater at all locations, as discussed previously.

EPA will evaluate future monitoring data to determine whether additional actions are needed or would be effective in meeting drinking water standards and AWQC. If further actions would not be effective, EPA may evaluate whether a Technical Impracticability (TI) waiver is warranted at specific locations where groundwater and surface water do not achieve drinking water standards and AWQC, respectively.[2]

13.1.2 Protection Afforded by Remedy Protection Actions

The remedy protection component of the Selected Remedy for the Upper Basin combines stormwater control actions to protect the existing Selected Remedies focusing on human health for OUs 1 and 2 and the Upper Basin portion of OU 3 against tributary flooding and high-precipitation events.

Key benefits of the remedy protection component of the Selected Remedy will include:

- Greater long-term protection of human health and the environment in residential and community areas in the Upper Basin, achieved through improvements to existing water conveyance systems (i.e., culvert replacements, asphalt ditches, etc.).
- A proactive approach to addressing recontamination issues associated with the potential erosion and/or contamination of existing clean barriers. This is preferred over cleaning up contaminated areas following a storm event because it decreases risks of exposure to contaminated materials.

13.2 Compliance with Applicable or Relevant and Appropriate Requirements

The ARARs identification process is presented in the FFS Report (EPA, 2012) and is based on CERCLA guidance (*Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final* [EPA, 1988b]; the *CERCLA Compliance with Other Laws Manual: Interim Final* [EPA, 1988a]; and the *CERCLA Compliance with Other Laws Manual - Part II* [EPA, 1989]).

CERCLA Section 121 requires that any applicable or relevant and appropriate standard be met, or a waiver justified. **Applicable requirements** are those substantive environmental standards that specifically address the situation at a CERCLA site. **Relevant and appropriate requirements** are determined by a two-step process. First, to assign relevance,

[2] Specific ARARs can be waived if appropriately justified [40 CFR 300.430(f)(1)(ii)(C)].

it must be determined whether the requirement addresses problems or situations sufficiently similar to the circumstances of the proposed response action. Second, for appropriateness, a determination is made as to whether the requirement would also be well suited to the conditions of the site. In evaluating the relevance and appropriateness of a requirement, the eight comparison factors in 40 CFR 300.400(g)(2), "Identification of Applicable or Relevant and Appropriate Requirements," are considered:

(i) The purpose of the requirement and the purpose of the CERCLA action;

(ii) The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site;

(iii) The substances regulated by the requirement and the substances found at the CERCLA site;

(iv) The actions or activities regulated by the requirement and the remedial action contemplated at the CERCLA site;

(v) Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site;

(vi) The type of place regulated and the type of place affected by the release or CERCLA action;

(vii) The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action; and

(viii) Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resource at the CERCLA site.

To-be-considered information, or "TBCs", are often identified with ARARs because they are helpful in selecting or implementing remedies. TBCs, however, are not legally enforceable and are not ARARs. Frequently, TBCs come from federal, state, and Tribal environmental requirements and public health agencies' advisories, guidance, and proposed standards.

ARARs are evaluated to determine whether they apply to chemical-specific, location-specific, or action-specific circumstances related to CERCLA response actions. These categories are defined as follows.

- Chemical-specific requirements are usually health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of site cleanup levels that are protective of human health and ecological receptors.
- Location-specific requirements are restrictions placed on the concentration of dangerous substances or the conduct of activities solely because they occur in special geographic areas.
- Action-specific requirements are usually technology- or activity-based requirements or limitations triggered by the remedial actions performed at the site.

Only the substantive requirements (e.g., compliance with numerical standards, use of control/containment equipment, etc.) associated with ARARs apply to CERCLA onsite activities. According to CERCLA Section 121[e][1], ARARs associated with administrative requirements, such as permitting, are not applicable to CERCLA onsite activities. In general, the CERCLA permitting exemption will be extended to all remedial activities conducted in the Upper Basin.

The Selected Remedy is expected to result in significant improvements to surface water quality in the Upper Basin and may achieve AWQC ARARs under the Clean Water Act at many locations; however, the remedy may not achieve these ARARs at all locations. Furthermore, although the Selected Remedy is expected to result in significant improvements to groundwater quality, it is not intended to achieve groundwater MCL ARARs under the Safe Drinking Water Act throughout the Upper Basin. Similarly, although the Selected Remedy will provide additional safe habitat for special status species and is intended to achieve ARARs under the MBTA and the ESA where remedial actions are taken, it will not achieve these ARARs at all locations. The Selected Remedy will comply with those federal, state, and Tribal requirements that are applicable or relevant and appropriate to the scope of the response action. Background information on these ARARs can be found in Section 4.0 of the FFS Report (EPA, 2012). This Interim ROD Amendment invokes the waiver in Section 121(d)(4)(A) of CERCLA for interim remedial actions. Consistent with Section 121(d)(4)(A) of CERCLA and the NCP, the Selected Remedy is consistent with and will not preclude implementation of the expected final remedial actions for the Upper Basin. Moreover, the Selected Remedy will attain a level of protection for risks to human health and the environmental that is commensurate to the scope of the Selected Remedy, and will not exacerbate conditions at the Bunker Hill Mining and Metallurgical Complex Superfund Site. This Interim ROD Amendment will eventually be followed by a Final ROD Amendment that will fully address compliance with all ARARs, consistent with CERCLA, including any waivers.

Tables 13-1 through 13-3 present the ARARs and TBCs for the Selected Remedy for the Upper Basin along with summaries of each ARAR and an evaluation of how the ARAR applies to the Selected Remedy.

13.3 Cost-Effectiveness

In EPA's judgment, the Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness" (NCP §300.430(f)(l)(ii)(D)). This determination was accomplished by evaluating the overall effectiveness of those alternatives that would satisfy the CERCLA Threshold Criteria (i.e., would be protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five CERCLA Primary Balancing Criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). These assessments are described in the sections below. Overall effectiveness was then compared to costs to determine cost-effectiveness. To the extent that the costs of the alternatives comprising the Selected Remedy exceed the costs of other alternatives, the additional cost is proportional to the additional benefits in long-term effectiveness and permanence, reduction in toxicity, mobility, and volume through treatment, and short-term effectiveness.

The overall effectiveness of the Selected Remedy was determined to be proportional to its costs, and hence the remedy is cost-effective.

13.3.1 Long-Term Effectiveness and Permanence

Within its scope, the Selected Remedy will achieve overall effectiveness with respect to long-term effectiveness and permanence. The Selected Remedy will achieve substantial reductions in residual risks to aquatic receptors and other wildlife posed by metals contamination in surface water, soil, and sediments. The Selected Remedy is expected to achieve significant dissolved zinc load reductions in the SFCDR, Canyon Creek, and Ninemile Creek. The long-term effectiveness and permanence of the remedy will be enhanced by measures to limit the release of contaminated soil and sediments to surface water that would recontaminate remediated areas.

Through stormwater controls, remedy protection actions included in the Selected Remedy will increase the permanence of protective barriers previously installed as part of the portions of the existing Selected Remedies focusing on human health for OUs 1 and 2 and the Upper Basin portion of OU 3.

The Selected Remedy will be effectively maintained through monitoring, maintenance, and institutional controls. There will be moderate maintenance requirements for remedy protection projects, caps, stream and riparian stabilization actions, sediment traps, French drains, and stream liners, and there will be relatively high maintenance requirements for semi-passive and active water treatment measures.

13.3.2 Reduction in Toxicity, Mobility, or Volume through Treatment

Within its scope, the Selected Remedy will achieve overall effectiveness with respect to reduction in toxicity, mobility, or volume through treatment. The Selected Remedy includes water treatment to reduce the mobility and volume of contaminants in surface water and groundwater by separating the metals from collected water and disposing of the metals in a lined disposal cell.

13.3.3 Short-Term Effectiveness

Within its scope, the Selected Remedy will be effective in the short-term. The remedial actions included in the Selected Remedy will be prioritized to provide significant reductions in dissolved metals loading and risks to human health and the environment by addressing the largest sources of metals loading in the Upper Basin as quickly as possible.

Short-term impacts to the communities and workers during the implementation of remedial actions include increased construction traffic and vehicle emissions and limited chemical risks to workers while certain remedial actions are being conducted. Risks to communities will be minimized through traffic control plans and careful selection of repository and waste consolidation area locations. Risks to workers will be minimized with standard health and safety measures.

Remedy protection actions will reduce the mobility of potentially contaminated sediments transported by floodwaters and surface water flows through the communities by more effectively managing tributary floodwaters up to a 50-year storm event, thereby reducing potential routes of exposure.

13.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

EPA has determined that the remedial actions included within the scope of the Selected Remedy represent the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner in the Upper Basin. EPA has also determined that the Selected Remedy provides the best balance of tradeoffs in terms of the five CERCLA Primary Balancing Criteria, while also considering the statutory preference for treatment as a principal element and state and community acceptance. As discussed previously, the five Primary Balancing Criteria are: (1) long-term effectiveness and permanence; (2) reduction of toxicity, mobility, or volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost.

Engineering controls employed in the Selected Remedy, including removal and containment, are appropriate for metals-contaminated soil and sediments in the Upper Basin because there are very large volumes of these materials at concentrations that have relatively low toxicity, which can be reliably controlled in place. These engineering controls provide for long-term effectiveness and permanence, achieve short-term effectiveness, and are implementable.

13.5 Satisfaction of the Statutory Preference for Treatment as a Principal Element

The NCP has established an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (40 CFR 300.430(a)(1)(iii)(A)). EPA has also established an expectation for the use of engineering controls, such as containment, for wastes that pose a relatively low, long-term threat or where treatment is impracticable (40 CFR 300.430(a)(1)(iii)(B)). Principal Threat Wastes (PTWs) are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. As documented in Section 11.0 of this Decision Summary, the RODs for OU 2 (EPA, 1992) and OU 3 (EPA, 2002) identified levels for COCs that would constitute PTWs for the Upper Basin and selected remedies for such PTWs, including treatment of mercury-contaminated PTWs prior to containment and the rationale for why further treatment was not appropriate.

For the non-smelter areas addressed by this ROD Amendment, no soil or sediments have been found to contain COCs at PTW levels, and it is not expected that additional PTWs will be encountered when Upper Basin remedial actions are conducted. If mining concentrates or other materials that meet the site-specific definition of PTWs are encountered, they will be remediated in accord with the remedies for PTWs selected in the earlier RODs, including treatment of mercury-contaminated PTWs prior to containment. While groundwater is by definition not a PTW, contaminants in groundwater are causing significant environmental harm and ecological risk such that they are principal threats in the context of the Upper

Basin. Therefore, the Selected Remedy satisfies the statutory preference within its scope by utilizing treatment in part to address any PTWs that are found and as a principal element for removal of contaminants in groundwater, adit discharges, and seeps. The final decision document for the Upper Basin will fully address the statutory preference for treatment. Treatment of PTWs is discussed in Section 11.0 of this Decision Summary, and treatment of contaminated waters to reduce the volume of hazardous substances (metals) is included in the Selected Remedy as described in Section 12.1.2.2. Treatment will be implemented using several different methods, but each method involves the separation of metals from water. The metals will then be disposed of in a disposal cell onsite. Through removal of the metals from the water, the volume of media containing hazardous substances at each site will be significantly reduced.

13.6 Five-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, statutory CERCLA reviews will be conducted at least every five years after the initiation of remedial actions to ensure that the Selected Remedy is, or will be, protective of human health and the environment (NCP 300.430(f)(4)(ii)).

SECTION 14.0

Documentation of Significant Changes

The Selected Remedy contains significant changes from EPA's Preferred Alternative identified in the Upper Basin Proposed Plan (EPA, 2010a). However, no changes have been made to the remedy protection portion of the Preferred Alternative as identified in the Proposed Plan.

Following consideration of comments on and discussions of the Proposed Plan, and using additional information developed by EPA, EPA has reduced the scope of the Selected Remedy for the Upper Basin and is not including all the remedial actions that were identified in EPA's Preferred Alternative in the Proposed Plan. The Selected Remedy is expected to result in the achievement of cleanup levels for soil and sediments where actions are taken and is expected to result in significant improvements to surface water and groundwater quality, but the Selected Remedy is not expected to fully address surface water or groundwater contamination at all locations in the Upper Basin. Thus, the Selected Remedy is an interim remedy for the Upper Basin. Consistent with 40 CFR 300.430(a)(ii)(B) and 40 CFR 300.430(f)(1)(ii)(C)(1), this Selected Remedy, an interim remedy, is neither inconsistent with nor precludes implementation of a final remedy that will attain ARARs. The final remedy will be identified in subsequent decision documents.

The significant changes from EPA's Preferred Alternative identified in the Proposed Plan to the Selected Remedy described in this ROD Amendment, after consideration of comments and the development of new information by EPA, include the following:

- Reduction of the scope of the Preferred Alternative, including reduction of the number of mine and mill sites from 345 to 145 and changes to the groundwater collection and treatment actions between Wallace and Elizabeth Park;
- Updates to TCDs and removal quantities for sites in Ninemile Creek based on additional site characterization work; and
- Changes to stream and riparian cleanup actions included in the Preferred Alternative.

Sections 14.1 through 14.3 summarize these significant changes to the Preferred Alternative as identified in the Proposed Plan.

14.1 Reduction in Scope from the Preferred Alternative to the Selected Remedy

The Proposed Plan presented the Preferred Alternative as a comprehensive remedy for the Upper Basin that would address historical mining-related contamination. The Preferred

Alternative included remedial actions at 345 mine and mill sites[1] located in the Upper Basin that would be required to meet cleanup levels based on available data and predictions of the effectiveness of the cleanup. It is important to note that these 345 mine and mill sites did not include the groundwater-based remedial actions included in OU 2, which are not associated with specific mine and mill sites. No changes were made to the OU 2 groundwater collection and treatment actions or the remedy protection actions included in the Proposed Plan. Upon consideration of comments received on the Proposed Plan expressing concern about the cost and duration of the remedy, EPA decided to reduce the number of mine and mill sites addressed by the Selected Remedy. Table 14-1 provides a list of every mine and mill site included in the Preferred Alternative in the Proposed Plan, and identifies the sites retained for remedial action in the Selected Remedy and a rationale for each site that was not included in the Selected Remedy.

First, in developing the Selected Remedy described in this ROD Amendment, EPA made the following changes from the Preferred Alternative identified in the Proposed Plan:

- **Removal of the Lucky Friday Complex from the Selected Remedy.** The Selected Remedy does not include remedial actions for the Lucky Friday Complex owned by Hecla Mining Company (which is an active facility) that were included in the Preferred Alternative in the Proposed Plan. Lucky Friday sites included in the Preferred Alternative but not in the Selected Remedy are MUL037, MUL038, MUL058, and MUL131.
- **Mine and Mill Site Characterization**. Following EPA's consideration of stakeholder comments on the Proposed Plan and input from the Basin Commission and the Upper Basin PFT, which suggested that some of the listed mine and mill sites may not require remedial actions if additional site characterization were conducted, during the summer of 2011 EPA conducted additional focused characterization of some lower-priority sites. These sites were deemed to be low-priority on the basis of site-specific data, downstream water quality at or near AWQC, or both. As a result of this focused characterization sampling, 42 sites where contaminant concentrations in soil samples were found to be below screening levels are not included in the Selected Remedy. The sites that were included in the Preferred Alternative but are not included in the Selected Remedy are listed in Table 14-2. The FFS Report (EPA, 2012) provides additional details of these changes and the focused characterization sampling that led to them.

In addition, following conclusion of the Proposed Plan comment period, EPA worked with the Upper Basin PFT to categorize sites included in the Preferred Alternative based on available analytical data, field observations, historical information, current status, and other site knowledge. Some sites were categorized as active facilities and previously remediated sites. EPA decided to remove these sites from the Selected Remedy based on the following rationale:

[1] The Proposed Plan (EPA, 2010a) stated that the Preferred Alternative for OU 3 (Alternative 3+) included 348 mine and mill sites. This total erroneously included three sites in Canyon Creek (WAL007, WAL008, and The Proposed Plan (EPA, 2010a) stated that the Preferred Alternative for OU 3 (Alternative 3+) included 348 mine and mill sites. This total erroneously included three sites in Canyon Creek (WAL007, WAL008, and WAL012) that were in Alternative 4+ but not Alternative 3+. Therefore, the correct number of sites in the Preferred Alternative should have been 345.

- **Active Facility Sites**. These are sites where industrial and/or commercial activities are currently occurring. At some of these sites, access controls and/or ICP protective barriers are in place that prevent or minimize direct contact with source materials. In addition to the presence of in-place measures to reduce direct-contact risk, the active sites are typically overseen by regulatory agencies outside CERCLA. Therefore, regulatory methods outside of CERCLA are available to address the potential release of contaminants that may pose a risk to human health and the environment. If these other regulatory programs fail to adequately address these sites or if these sites are closed or are no longer active, EPA will need to evaluate whether cleanup actions are necessary to address contamination in the future. Fifteen sites were identified as Active Facility Sites and are not included in the Selected Remedy.
- **Remediated Sites**. Over time, cleanup actions have been conducted by EPA, other agencies, and property owners within the Upper Basin. The majority of actions taken at these sites focused on human health risks, but in some cases additional actions were taken to reduce contaminant loading to surface and groundwater. Currently, sites where cleanup actions have been conducted are being monitored to determine their effectiveness in meeting RAOs. Review of the monitoring results and the protectiveness of these cleanup actions is documented in Five-Year Reviews consistent with CERCLA and the 2002 ROD for OU 3 (EPA, 2002). Potential shortcomings of these cleanup actions in achieving RAOs and protection of human health and the environment will be addressed as part of the Five-Year Review process. Therefore, 25 sites where cleanup has already occurred were identified as Remediated Sites and are not included in the Selected Remedy.

With input from the Upper Basin PFT, the remaining sites were categorized as either "strong consensus" or "contingent." Strong consensus sites were defined as sites having available information confirming substantial risks to human health and the environment from mining-related contamination. The contingent sites had limited information available regarding potential risks to human health and the environment. EPA conducted a desktop data evaluation to determine which contingent sites could be excluded from the Selected Remedy. The result of this review was the list of sites included in the Selected Remedy and the elimination of the former site categories of strong consensus and contingent. The FFS Report (EPA, 2012) describes this evaluation in detail.

The results of the contingent site evaluation resulted in the identification of 114 sites for removal from the Selected Remedy based on available data showing that these sites posed a relatively lower risk to human health and the environment.[2] The rationale for removing sites included evaluation of factors such as (1) potential human health risks; (2) downstream water quality; (3) site-specific data such as location within a watershed, contaminant concentrations,[3] riparian acreage, and erosion potential; and (4) volume of waste material. Removal of these 114 mine and mill sites from the Selected Remedy does not mean that they do not pose a risk to human health and the environment. Additional data may be collected

[2] These sites are referred to as sites identified for "Contingent Site Removal" in Table 14-1.

[3] The review of site-specific contaminant concentrations included data collected in the summer of 2011 (following publication of the Proposed Plan) at selected source sites in the Upper Basin. The results of this sampling effort are documented in the FFS Report (EPA, 2012).

to ensure that these sites do not pose an unacceptable risk. As cleanup actions proceed in the Upper Basin and more information becomes available, it may be necessary to evaluate some of these sites for inclusion in another appropriate decision document for remedial actions.

Following the reduction in scope of the Preferred Alternative described above, the Selected Remedy now includes remedial actions at 145 sites in the Upper Basin versus the previous 345 sites. These 145 sites constitute the locations of the highest-priority actions for the Upper Basin based on the available data.

14.2 Changes to Water Collection Actions and Ninemile Creek TCDs from the Preferred Alternative to the Selected Remedy

EPA has also modified some of the remedial actions at the 145 sites carried forward from the Preferred Alternative in the Proposed Plan to the Upper Basin Selected Remedy. These modifications include the following:

- **Changes to the water collection actions between Wallace and Elizabeth Park.** Hydraulic isolation and groundwater collection actions along the SFCDR between Wallace and Elizabeth Park (a reach over 10 miles in length) were included in the Preferred Alternative in the Proposed Plan. Changes to these remedial actions include constructing a groundwater interception drain only in the Osburn area (a reach less than 1 mile in length) and elimination of the stream liner along the SFCDR between Wallace and Elizabeth Park. The FFS Report (EPA, 2012) documents and explains these changes. A summary of the changes is provided in Table 14-3.
- **Changes to estimated contaminant volumes and TCDs for Ninemile Creek.** In keeping with EPA's adaptive management approach, pre-design investigation work was conducted in the Ninemile Creek drainage in the summer of 2011. Data collected during the investigation also provided updated, more accurate estimates of contaminated waste volumes at specific sites. Site data and associated costs have been updated based on this new information. The FFS Report (EPA, 2012) documents and explains these changes. A summary of the changes is provided in Table 14-4.

14.3 Changes to Stream and Riparian Actions from the Preferred Alternative to the Selected Remedy

During the public review period on the Proposed Plan, EPA received comments from stakeholders and the public concerning the location, extent, and in some cases the technical approach proposed for some of the stream and riparian cleanup actions included the Preferred Alternative. In response to these comments and as part of EPA's evaluation to reduce the scope of the Preferred Alternative (as described in Sections 14.1 and 14.2), those stream and riparian actions that were co-located with floodplain and sediment removal actions were determined to be priority actions for inclusion in the Selected Remedy. These sediment removal actions are primarily designated for riparian areas (along rivers, streams, and creeks). Stream and riparian stabilization actions will be conducted following remedial actions to stabilize rivers and creeks at the remediated locations. Therefore, the Selected

Remedy refers to these actions as stream and riparian "stabilization" actions in the Selected Remedy (see Section 12.1.2.3 of this Decision Summary). Table 14-5 lists the stream and riparian reaches included in the Preferred Alternative and identifies the reaches included in the Selected Remedy. Changes to the stream and riparian cleanup actions as presented in the Proposed Plan are summarized below:

- **No stream and riparian actions in the Upper SFCDR Watershed (the SFCDR upstream of Wallace)**. EPA determined that stream and riparian stabilization actions are not needed in the Upper SFCDR at this time because the Selected Remedy includes only one sediment removal site (WAL038, located between Wallace and Mullan) and relatively few sediment removal actions in this watershed. In addition, most of the Upper SFCDR currently has abundant rock, riprap, and riparian vegetation, indicating that minimal erosion is likely occurring in this stretch of the river compared with other reaches of the SFCDR. Therefore, no stream and riparian stabilization actions are included for this watershed in the Selected Remedy.
- **Removal of stream and riparian actions in the Ninemile Creek Watershed.** The Selected Remedy does not include any remedial actions in the West Fork of Ninemile Creek; therefore, no stream and riparian stabilization actions will be needed for this reach (see Figure 12-19). Stream and riparian stabilization actions will be conducted at the remaining reaches in the Ninemile Creek Watershed, particularly the East Fork of Ninemile Creek.
- **Stream reaches removed from Big Creek and Moon Creek.** Based on the reduction of scope of the remedial actions included in the Selected Remedy, stream segments previously identified for stream and riparian actions along Big Creek and Moon Creek were removed for the Selected Remedy (see Figures 12-20 and 12-21).
- **No stream and riparian actions in SFCDR reaches through Wallace.** The Selected Remedy does not include stream and riparian stabilization actions through Wallace. It is not expected that any sediment removal actions will be conducted through this area due to existing infrastructure (a county bridge, culverts, Interstate 90 support columns, and a concrete channel). Therefore, stream and riparian stabilization actions will not be conducted (see Figure 12-22).
- **No stream and riparian actions in the Pine Creek Watershed.** The Selected Remedy does not include any stream and riparian stabilization actions for Pine Creek. With EPA's reduction of the scope of the remedial actions included in the Selected Remedy, relatively few sediment removal actions are identified in the Pine Creek Watershed.
- **No stream and riparian actions west of Pinehurst in the Mainstem SFCDR Watershed**. The Preferred Alternative proposed stream and riparian cleanup actions in three reaches to the west of Pinehurst (MG02-10 through -12; see Figure 12-22). The Selected Remedy does not include any remedial actions in this area; therefore, stream and riparian stabilization actions west of Pinehurst are not included in the Selected Remedy. Stream and riparian stabilization actions will be conducted in the Mainstem SFCDR Watershed east of Kellogg, as indicated in Figure 12-22.

The FFS Report (EPA, 2012) documents in greater detail the changes and associated rationale for reducing the scope of stream and riparian actions included in the Selected Remedy.

SECTION 15.0
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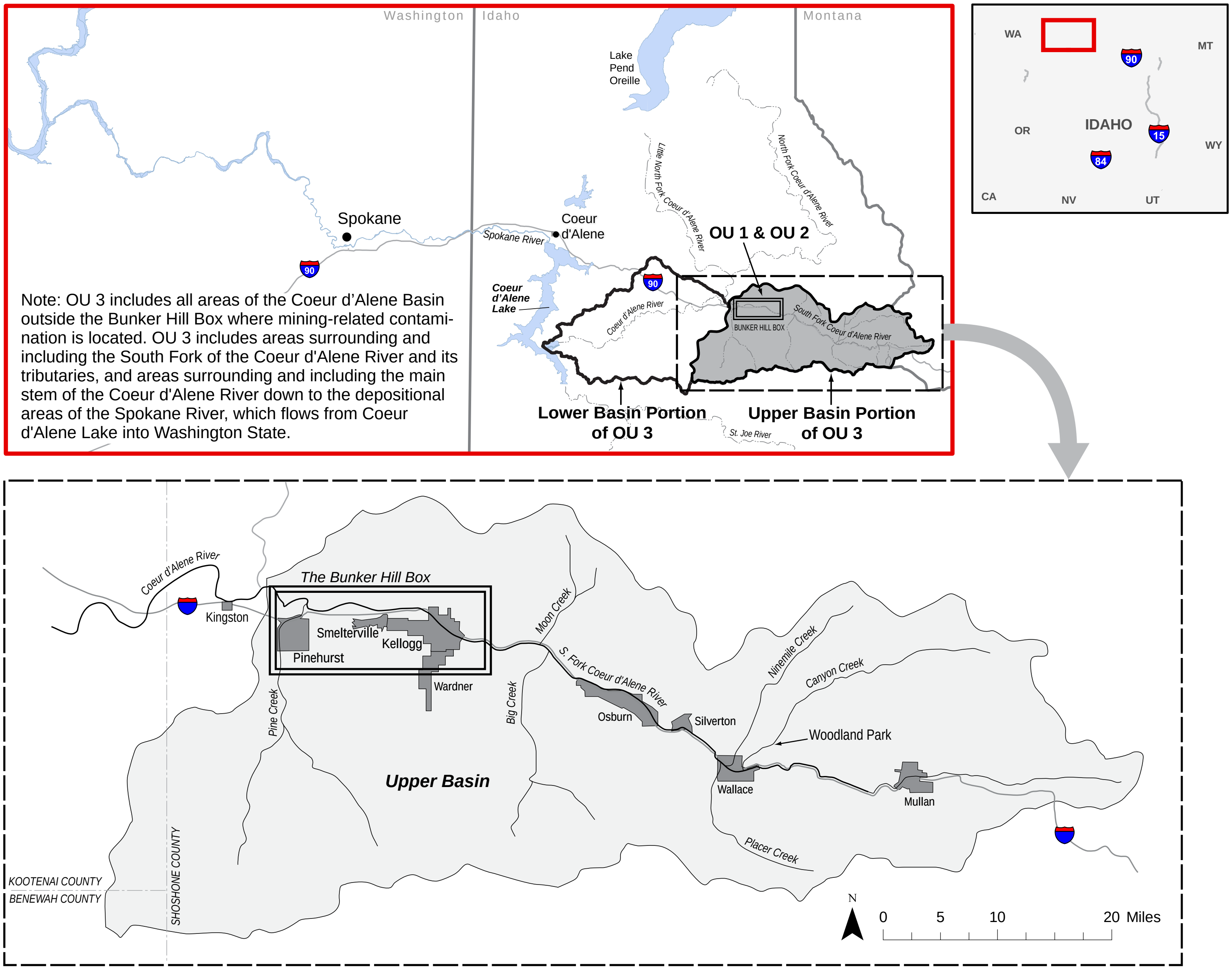
Figures for Part 2

Vicinity Map of Coeur d’Alene Basin



OU = Operable Unit

Note:
The river corridor portions of the South Fork of the Coeur d’Alene River and Pine Creek located within the Bunker Hill Box are considered to be part of OU 3.

Figure 1-1
Location Map
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d’Alene River
Bunker Hill Superfund Site

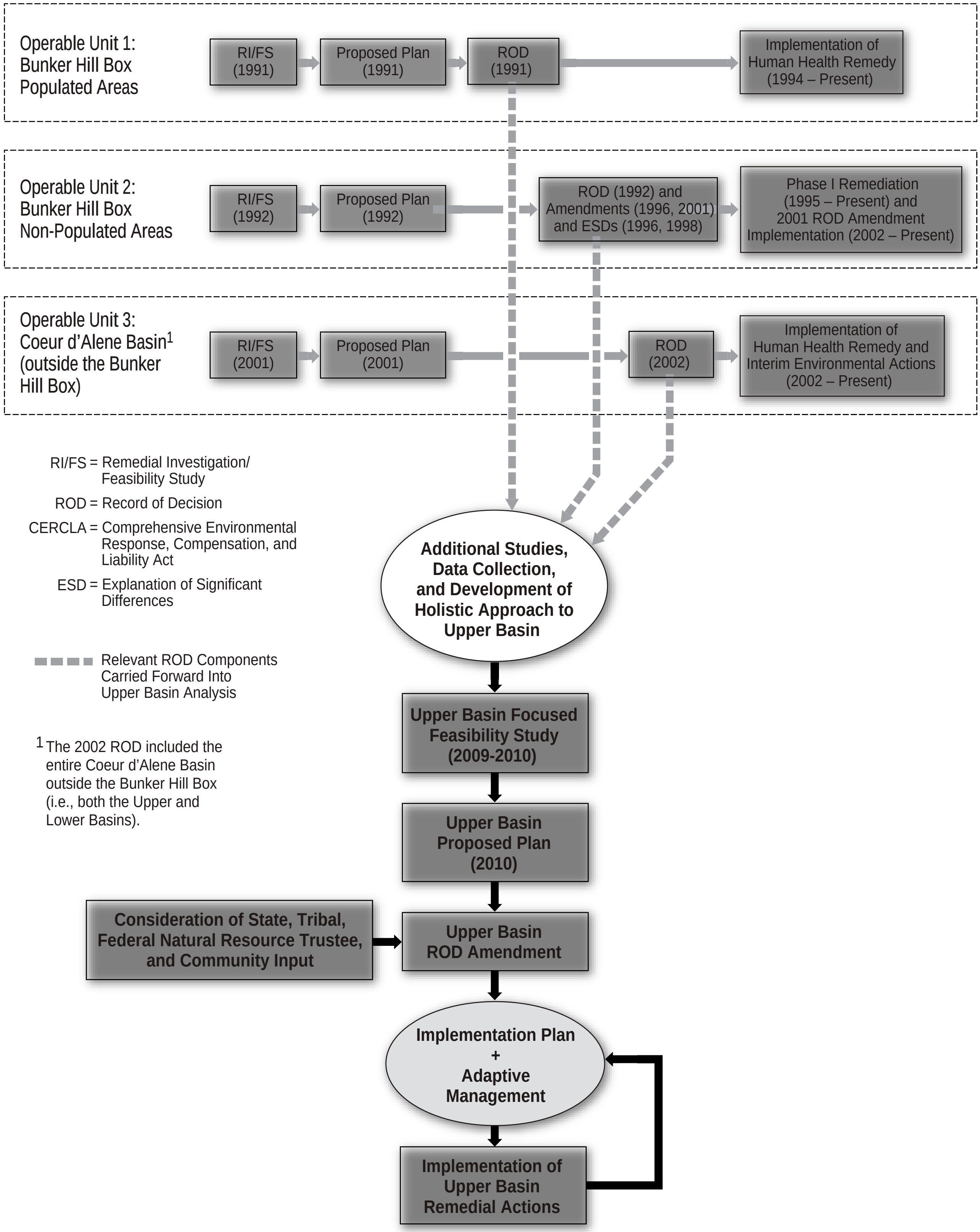


Figure 2-1
CERCLA Process
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

Area	Operable Unit(s)	Addressed by Past Decision Documents	Addressed by Upper Basin Selected Remedy
Bunker Hill Box	1 & 2	☑ Human health remedies in residential and community areas, selected in the 1991 ROD for OU 1, have been implemented.	☑ Additional actions to protect the existing human health remedies.
		☑ Phase I remedial actions have been implemented since the 1992 ROD for OU 2.	☑ Phase II remedial actions to reduce metals loading to the SFCDR to protect human health and the environment.
Upper Basin (outside the Bunker Hill Box)	3	☑ Human health remedies in residential and community areas, selected in the 2002 ROD, are being implemented.	☑ Additional actions to protect and enhance the existing human health remedies.
		☑ Relatively few interim ecological actions have been implemented since the 2002 ROD.	☑ An interim remedy that will provide significant improvements to surface water, soil, sediments, and groundwater, and will significantly reduce risks posed to human health and the environment throughout the Upper Basin.
Lower Basin	3	☑ For human health remedies in recreational areas, identified in the 2002 ROD, selected actions have been implemented.	Not addressed by the Upper Basin Selected Remedy.
		☑ Pilot-scale actions have been implemented since the 2002 ROD. An Enhanced Conceptual Site Model is being developed, which will be used to inform the selection, design, and implementation of remedial actions.	
Spokane River	3	☑ Human health remedies in recreational areas, selected in the 2002 ROD, have been implemented.	
Coeur d'Alene Lake	3	☑ Coeur d'Alene Lake is being managed by state, Tribal, federal, and local governments outside the Superfund process through the Lake Management Plan.	

ROD = Record of Decision
SFCDR = South Fork Coeur d'Alene River

Figure 4-1
Relationship of Upper Basin Selected Remedy to Overall Site Cleanup
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

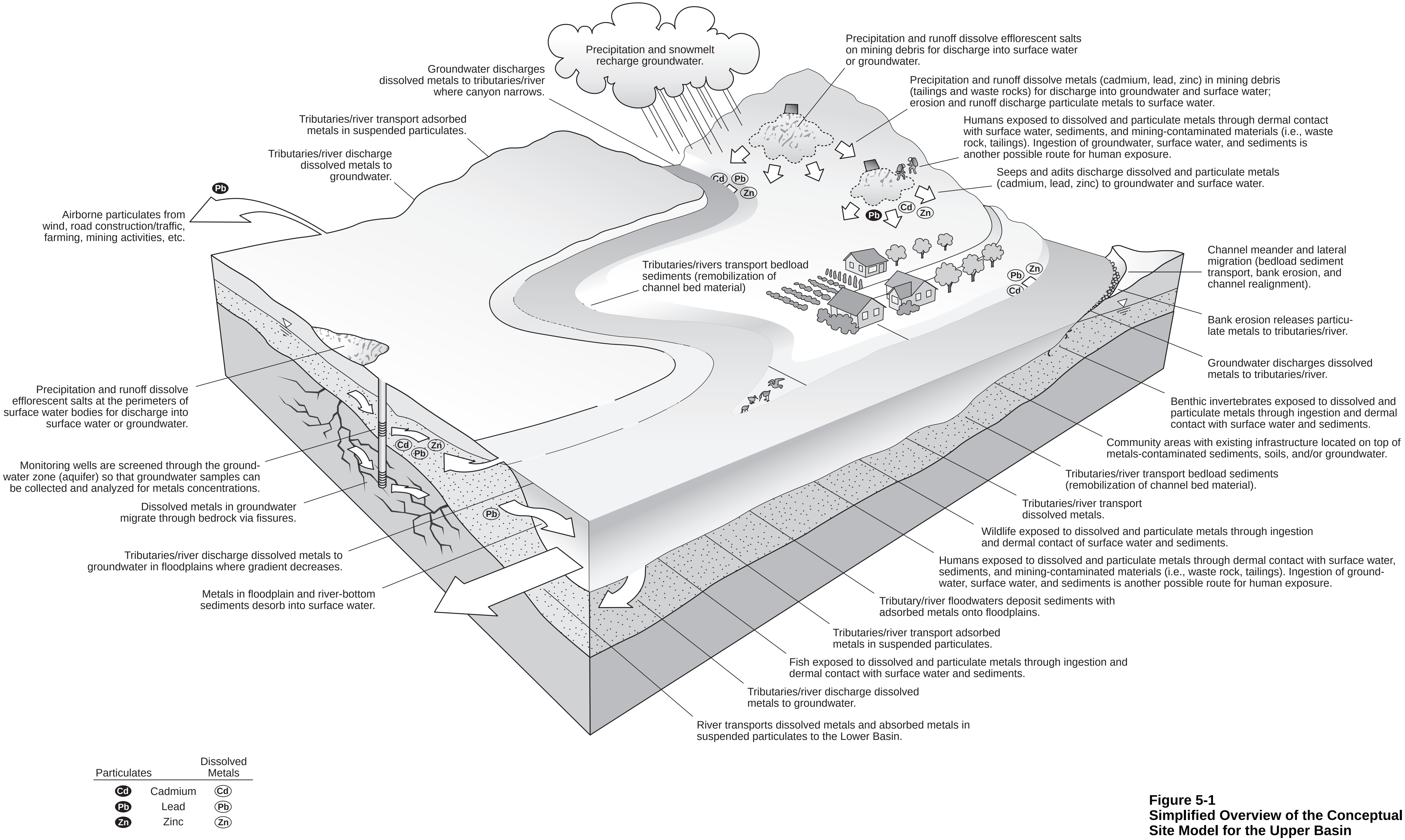
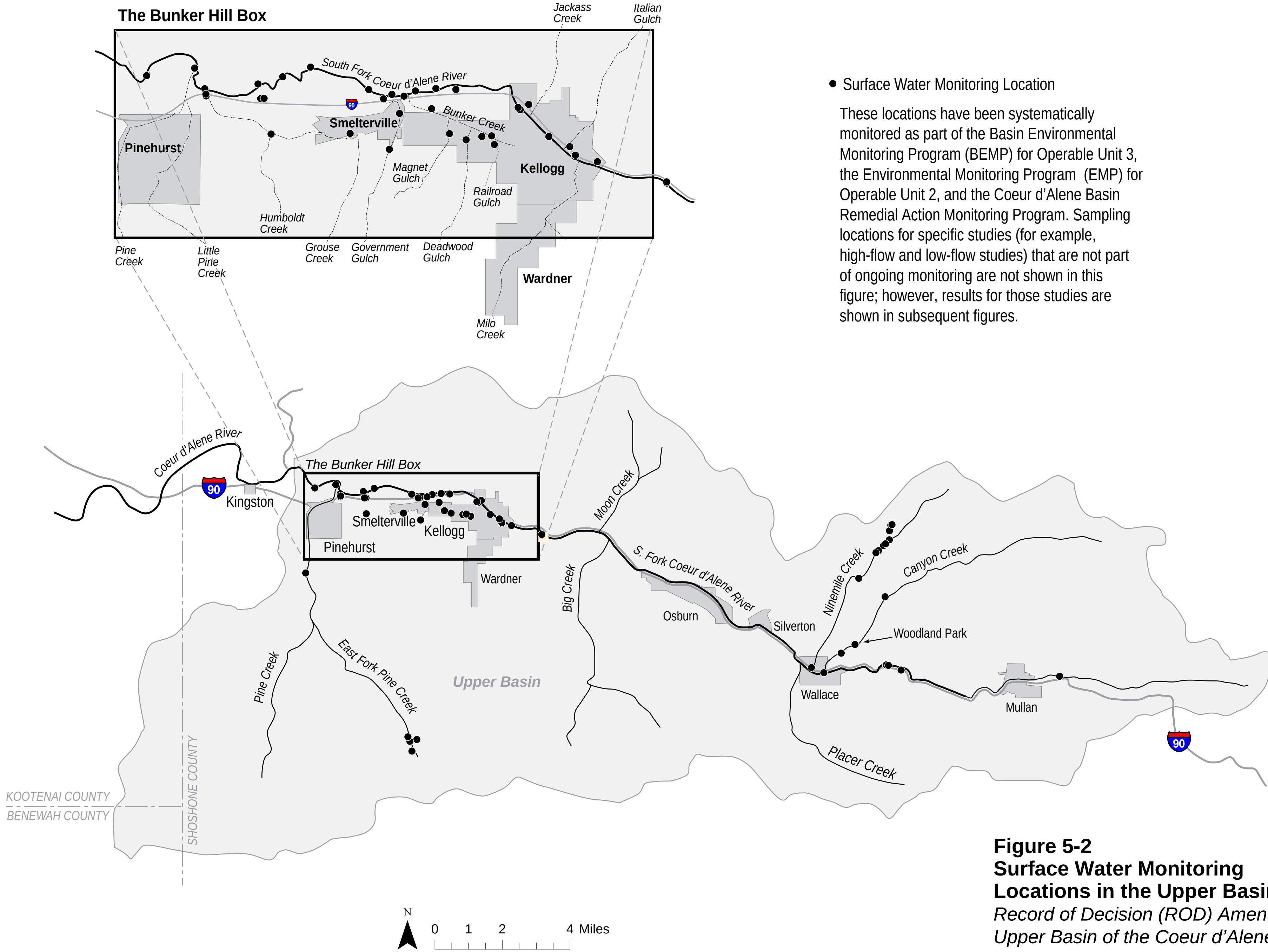


Figure 5-1
Simplified Overview of the Conceptual Site Model for the Upper Basin
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA



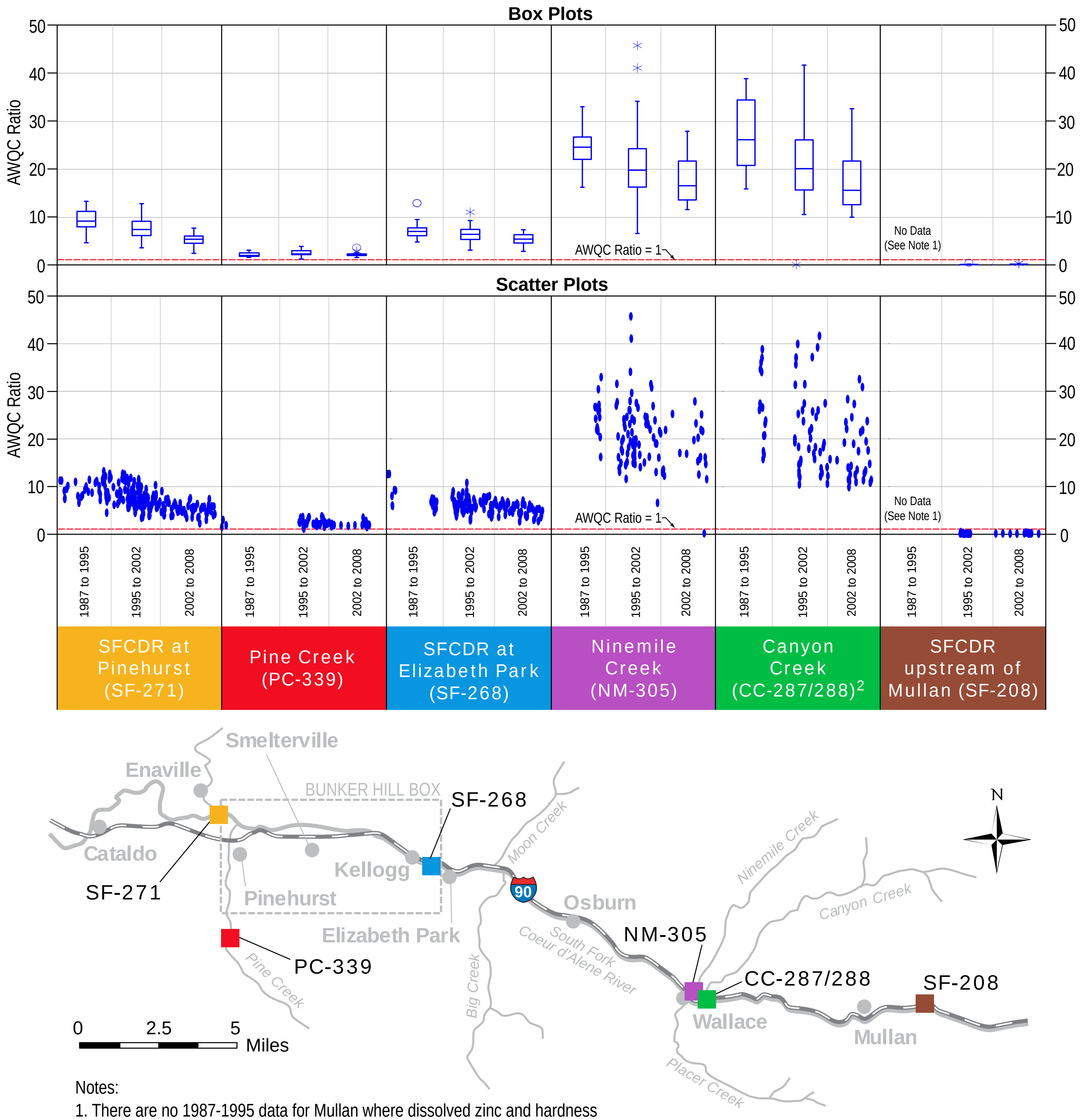
● Surface Water Monitoring Location

These locations have been systematically monitored as part of the Basin Environmental Monitoring Program (BEMP) for Operable Unit 3, the Environmental Monitoring Program (EMP) for Operable Unit 2, and the Coeur d'Alene Basin Remedial Action Monitoring Program. Sampling locations for specific studies (for example, high-flow and low-flow studies) that are not part of ongoing monitoring are not shown in this figure; however, results for those studies are shown in subsequent figures.

Figure 5-2
Surface Water Monitoring Locations in the Upper Basin
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

How to Read the Box Plots

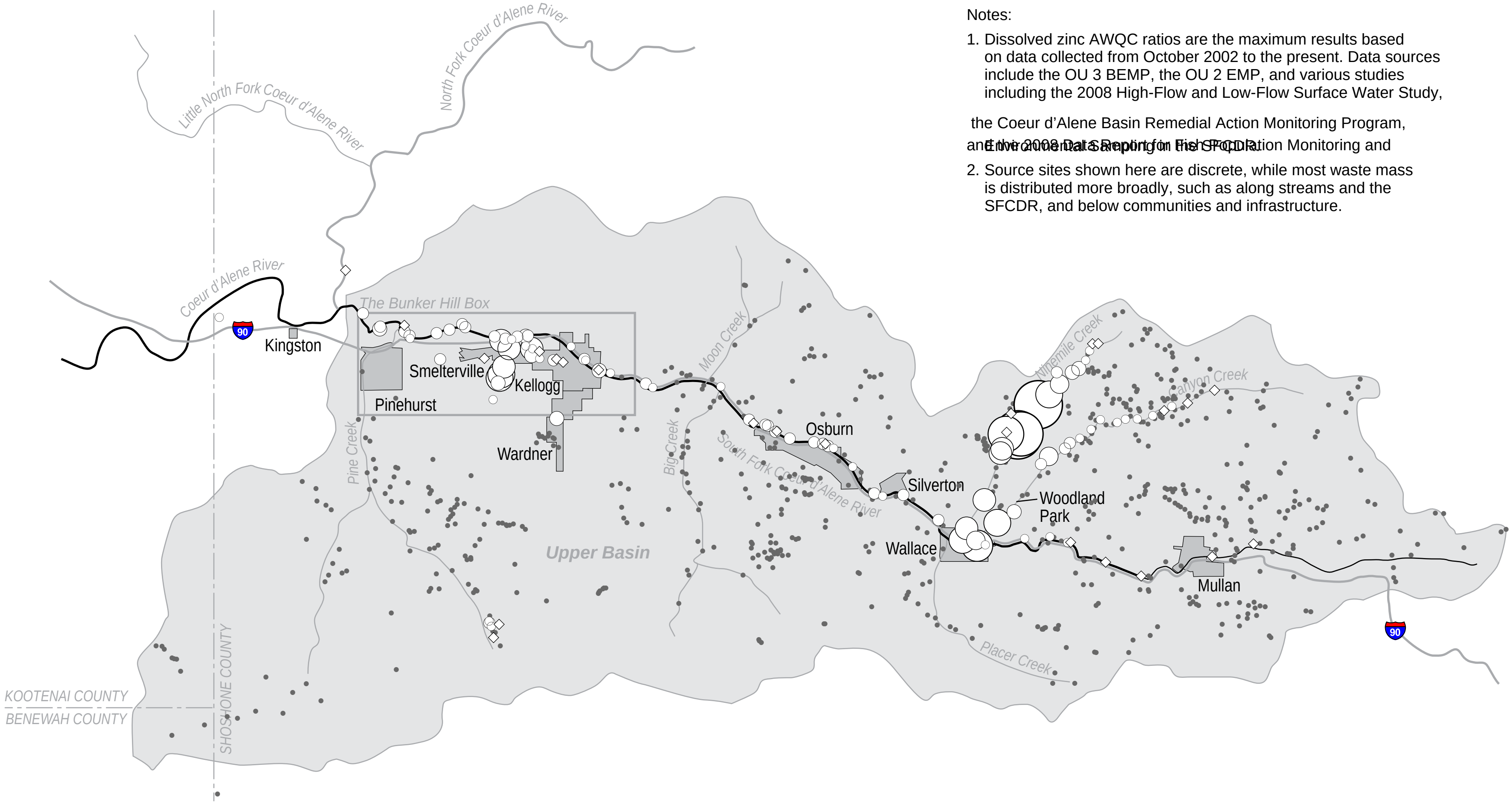
The box plot shows the median or 50th percentile (the line in the middle of the box), along with the 25th and 75th percentiles (the top and bottom of the box), and the range (the extreme spread) of the data. The circles and stars are statistical outliers. Box plots provide a way to see the overall distribution and variability associated with the data, and they help when looking at trends between datasets. For example, if just the median values were compared, trends might appear to be more significant. The boxes show there is often a fair degree of overlap between data from different time periods and locations.



Notes:
1. There are no 1987-1995 data for Mullan where dissolved zinc and hardness data are available, both of which are needed to calculate the AWQC ratio.
2. The 1987-1995 data are from CC-287, while the post-1995 data are from CC-288.

AWQC = Ambient Water Quality Criteria
SFCDR = South Fork Coeur d'Alene River
1987 to 1995 = 9/15/1987 to 9/15/1995
2002 to 2008 = Monitoring conducted between September 2002 through 2008

Figure 5-3
Zinc AWQC Ratio Distribution in Surface Water at Selected Sites
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site



Notes:

1. Dissolved zinc AWQC ratios are the maximum results based on data collected from October 2002 to the present. Data sources include the OU 3 BEMP, the OU 2 EMP, and various studies including the 2008 High-Flow and Low-Flow Surface Water Study,

the Coeur d'Alene Basin Remedial Action Monitoring Program,
and the 2008 Data Report for Fish Population Monitoring and
Environmental Sampling in the SFCDR.

2. Source sites shown here are discrete, while most waste mass is distributed more broadly, such as along streams and the SFCDR, and below communities and infrastructure.

AWQC Ratios

< 1
5
20
50
75

Representative Values

AWQC = Ambient Water Quality Criteria
BEMP = Basin Environmental Monitoring Program
EMP = Environmental Monitoring Program
OU = Operable Unit
SFCDR = South Fork Coeur d'Alene River

• Source Site

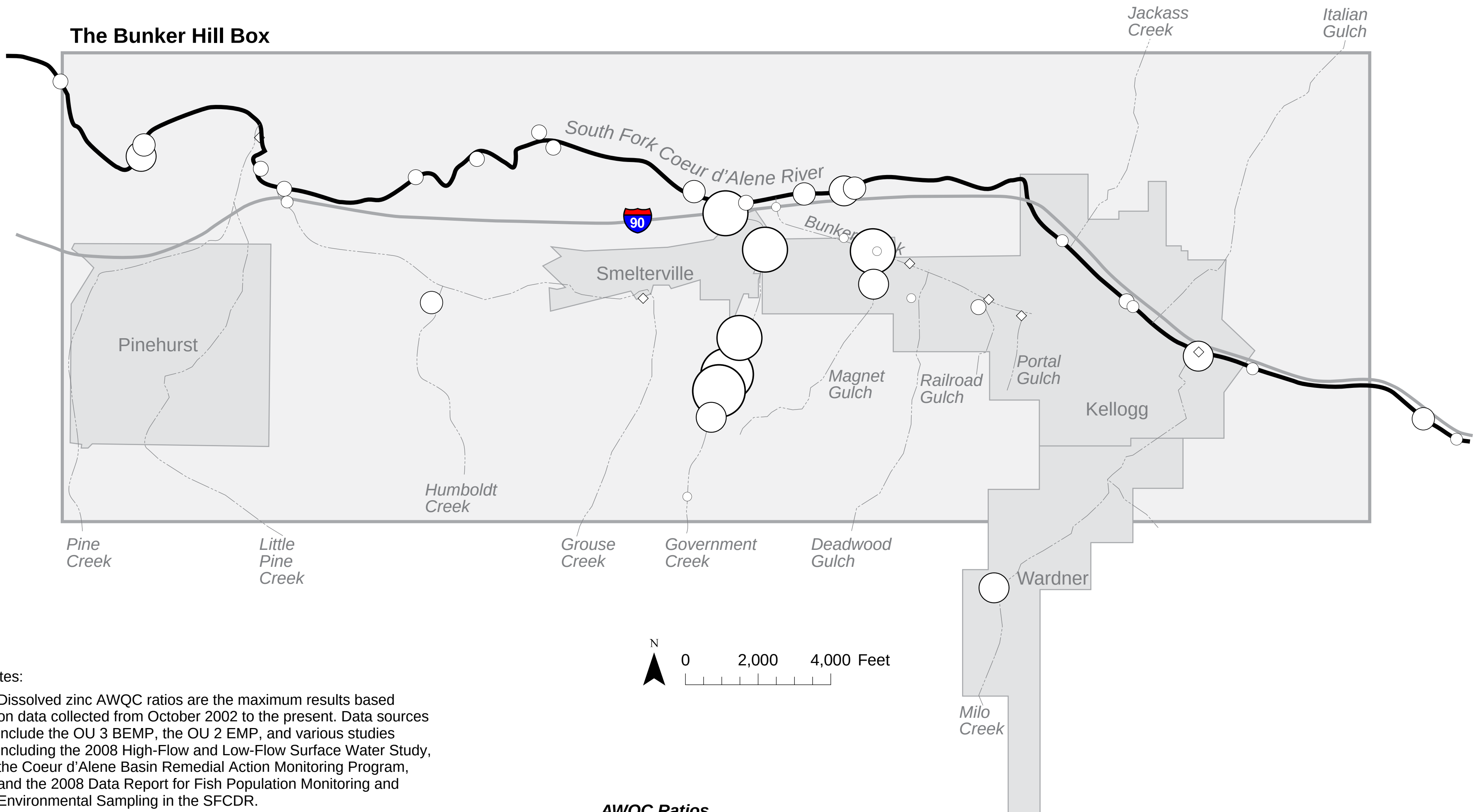
N

0 1 2 4 Miles

Figure 5-4
Maximum Zinc AWQC Ratios in Upper Basin Surface Water, 2002 to 2008
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

382081.TA.07.01.01.04_BunkerHill_ES031812185638SEA . Fig 5-4 Max Zinc AWQC Ratios Upper Basin Surface Water Post-2002 v4 1aug12.ai . gr

The Bunker Hill Box



Notes:

1. Dissolved zinc AWQC ratios are the maximum results based on data collected from October 2002 to the present. Data sources include the OU 3 BEMP, the OU 2 EMP, and various studies including the 2008 High-Flow and Low-Flow Surface Water Study, the Coeur d'Alene Basin Remedial Action Monitoring Program, and the 2008 Data Report for Fish Population Monitoring and Environmental Sampling in the SFCDR.
2. Source sites shown here are discrete, while most waste mass is distributed more broadly, such as along streams and the SFCDR, and below communities and infrastructure.

AWQC = Ambient Water Quality Criteria
BEMP = Basin Environmental Monitoring Program
EMP = Environmental Monitoring Program
OU = Operable Unit
SFCDR = South Fork Coeur d'Alene River

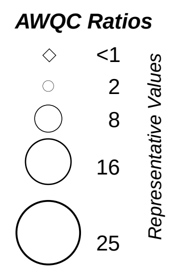
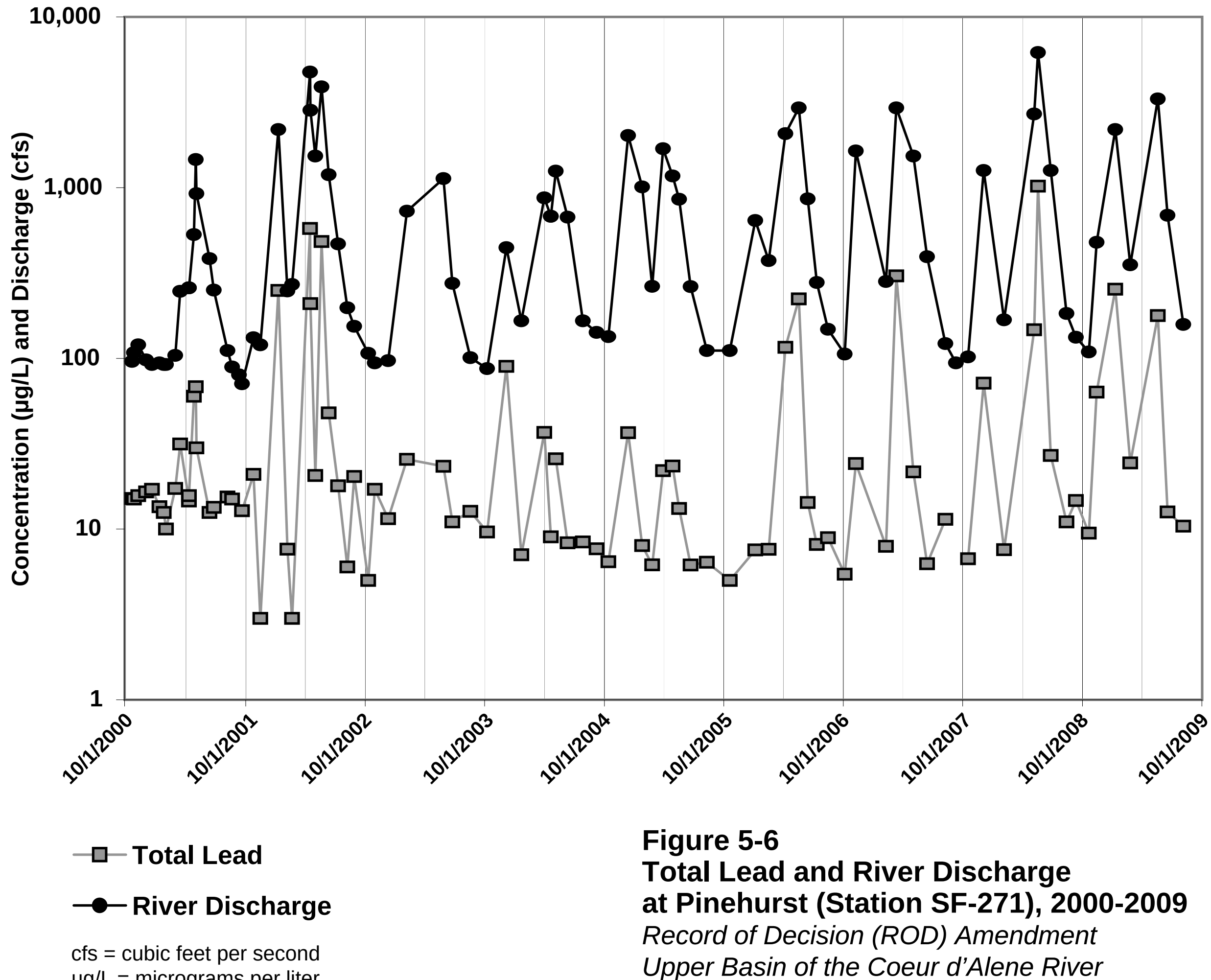


Figure 5-5
Maximum Zinc AWQC Ratios in Bunker Hill Box Surface Water, 2002 to 2008
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA

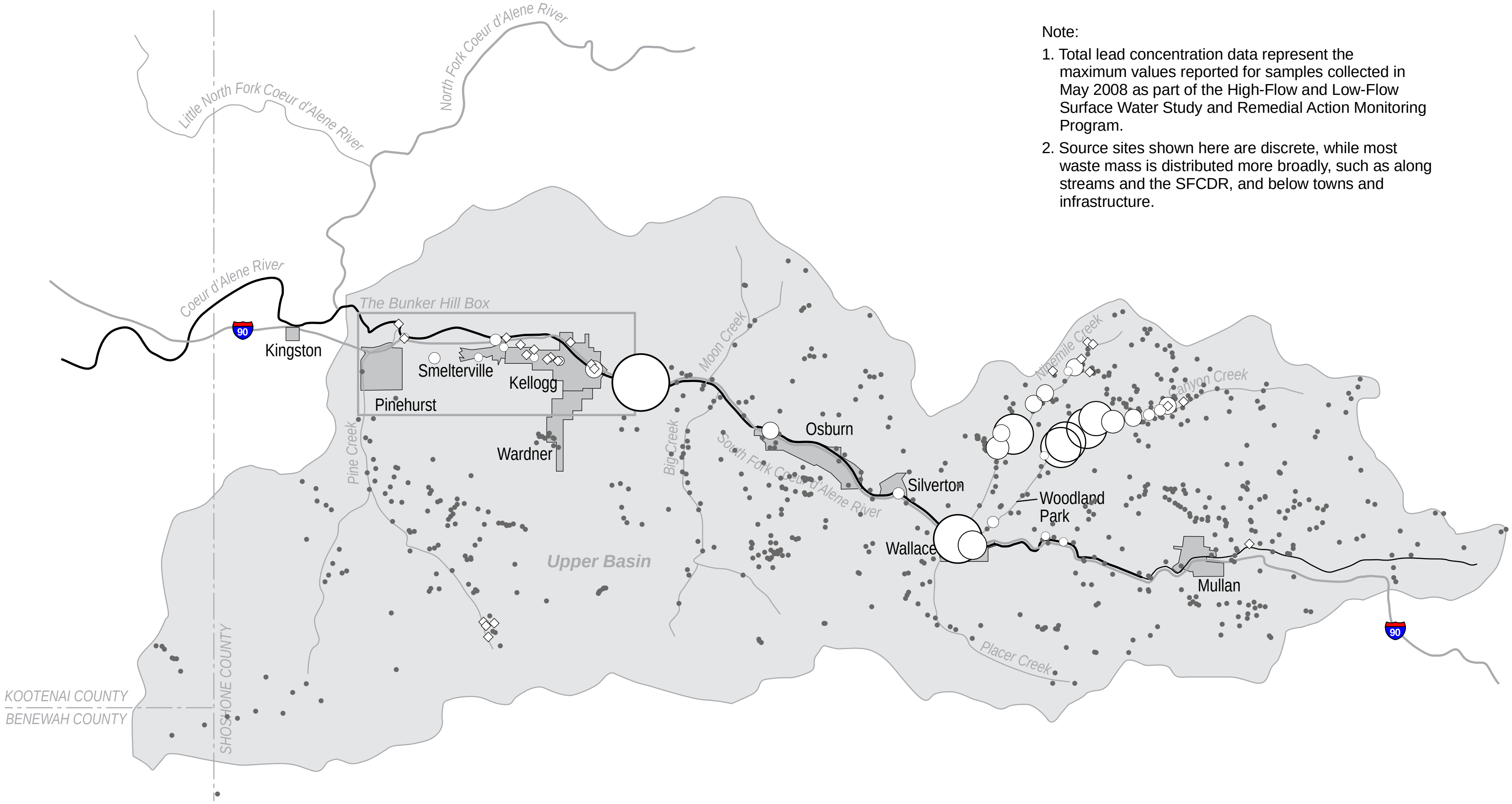


cfs = cubic feet per second
µg/L = micrograms per liter

Figure 5-6
Total Lead and River Discharge at Pinehurst (Station SF-271), 2000-2009
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

Note:

1. Total lead concentration data represent the maximum values reported for samples collected in May 2008 as part of the High-Flow and Low-Flow Surface Water Study and Remedial Action Monitoring Program.
2. Source sites shown here are discrete, while most waste mass is distributed more broadly, such as along streams and the SFCDR, and below towns and infrastructure.



Total Lead Concentration

Symbol	Representative Values (µg/L)
◇	<=15
○	25
○	75
○	150
○	500
○	1200

SFCDR = South Fork Coeur d'Alene River
µg/L = micrograms per liter

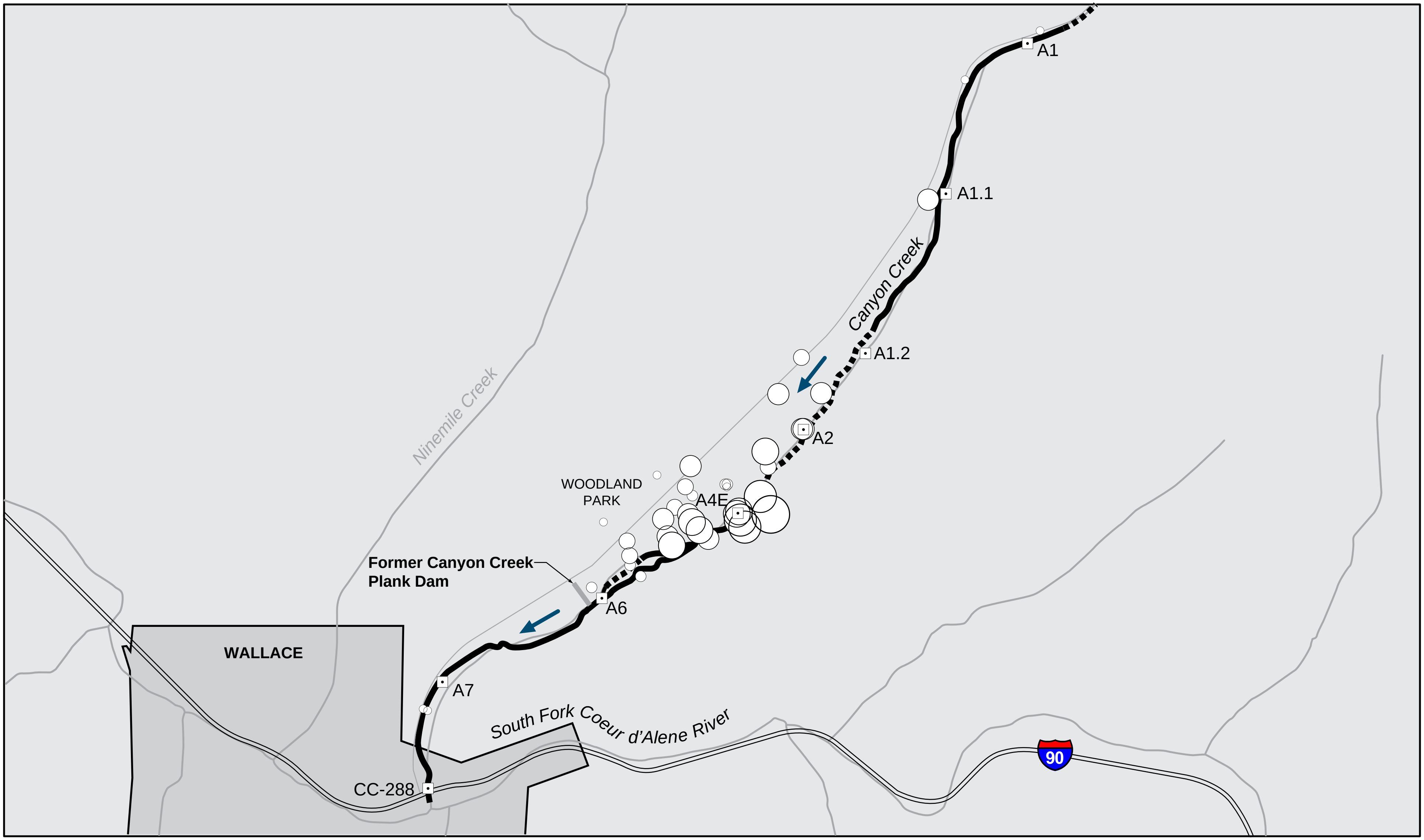
• Source Site

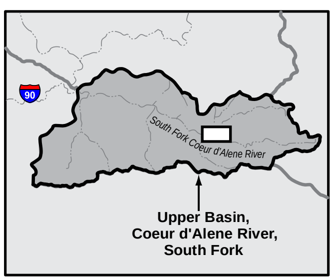
N 0 1 2 4 Miles

Figure 5-7
Total Lead Concentrations in Upper Basin Surface Water, May 2008
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA

382081.TA.07.01.01.04_BunkerHill_ES062411140516SEA . Fig 5-7 Total Lead Concentrations in Upper Basin Surface Water May 2008 20mar12.ai . gr





Dissolved Zinc Concentrations (mg/L)

○	1
○	4
○	8
○	25
○	120

Representative Values

A7 ▣ Surface Water Monitoring Location

Canyon Creek Primarily Gaining Reach

Canyon Creek Primarily Losing Reach

Former Canyon Creek Plank Dam (Approximate Historical Location)

Approximate Groundwater Flow Direction, Base-Flow Conditions

mg/L = milligrams per liter

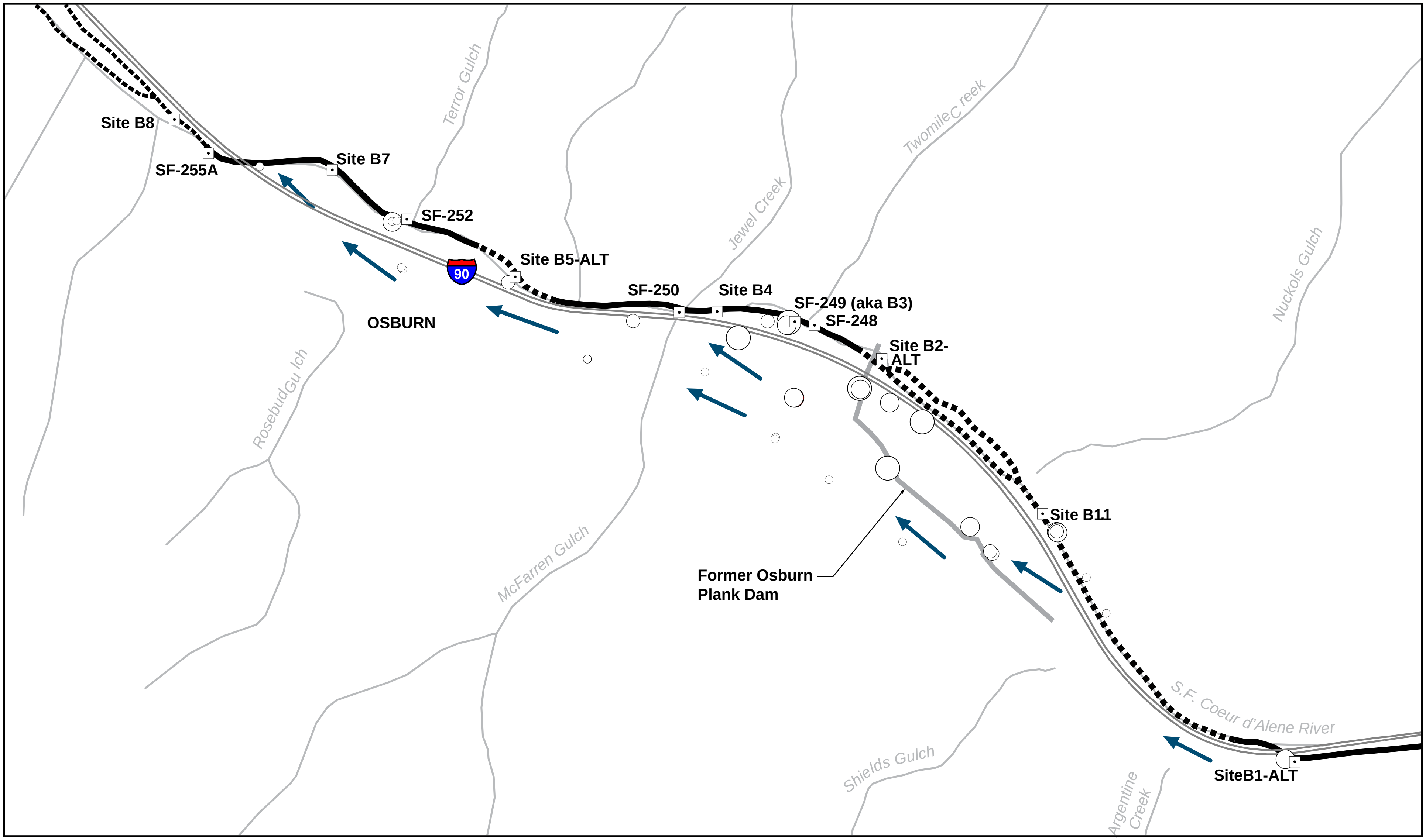
Note:
Gaining and losing reaches were determined from low-flow numerical simulation results, and are presented as approximate conditions during low-flow conditions.

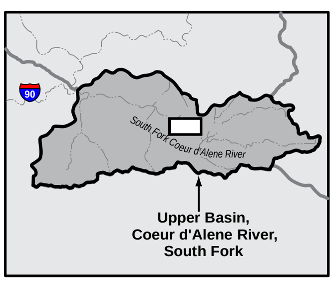
N

0 1,000 2,000 Feet

Figure 5-8
General Groundwater Flow Conditions and Dissolved Zinc Concentrations in Groundwater at Woodland Park, October 2008
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA





Dissolved Zinc Concentrations (mg/L)

0.5
1
2
3

Representative Values

Surface Water Monitoring Location
SFCDR Primarily Gaining Reach
SFCDR Primarily Losing Reach
Former Osburn Plank Dam (Approximate Historical Location)
Approximate Groundwater Flow Direction, Base-Flow Conditions

mg/L = milligrams per liter
SFCDR = South Fork Coeur d'Alene River

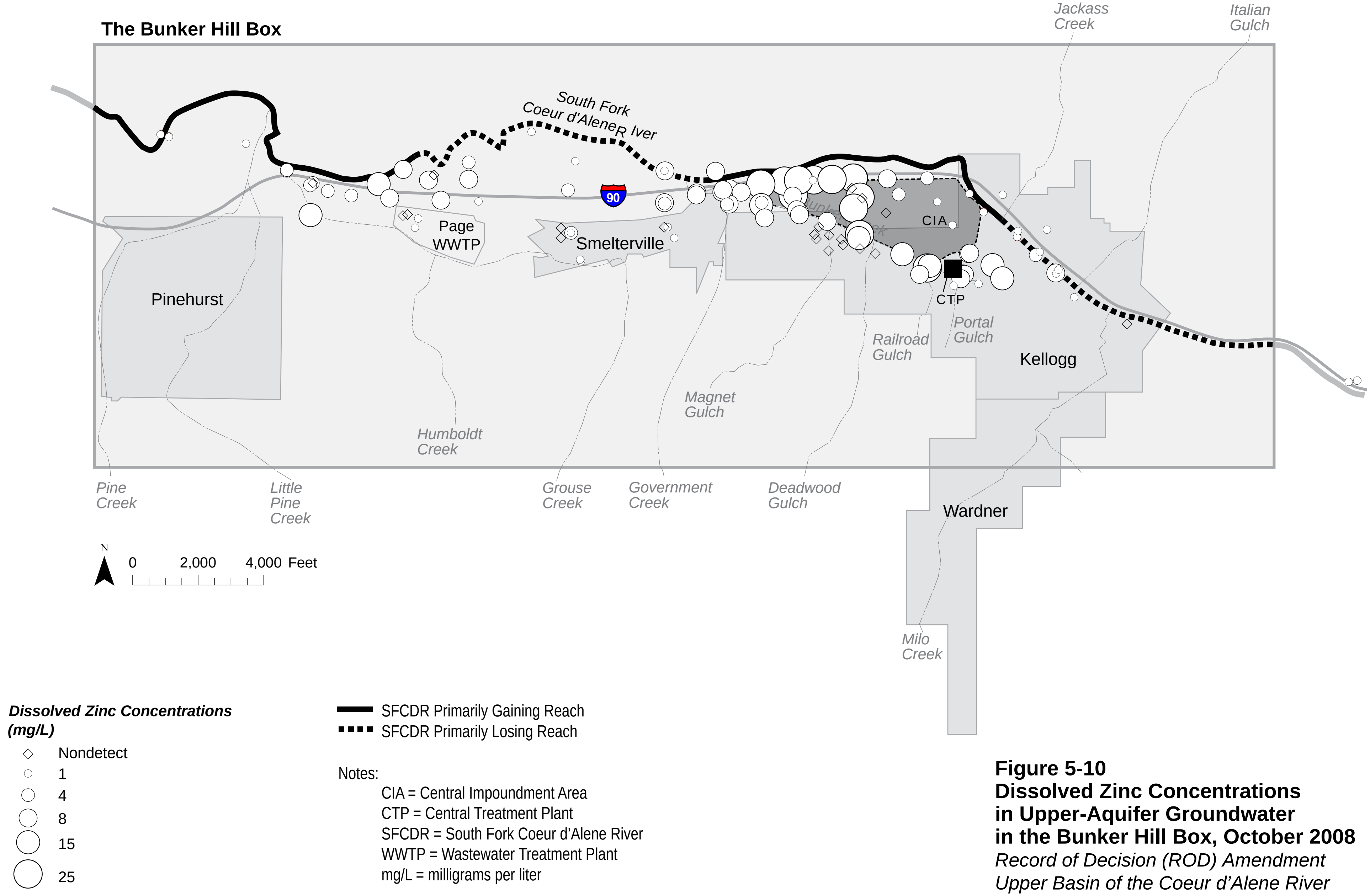
N

0 1,000 2,000 Feet

Figure 5-9
General Groundwater Flow Conditions and Dissolved Zinc Concentrations in Groundwater at Osburn Flats, October 2008
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA

382081.TA.07.01.01.04_BunkerHill_ES031812185638SEA . Fig 5-9 Gen Groundwater Flow Cond Dissolved Zinc Conc Groundwater Osburn Flats v3 16mar12.ai . gr

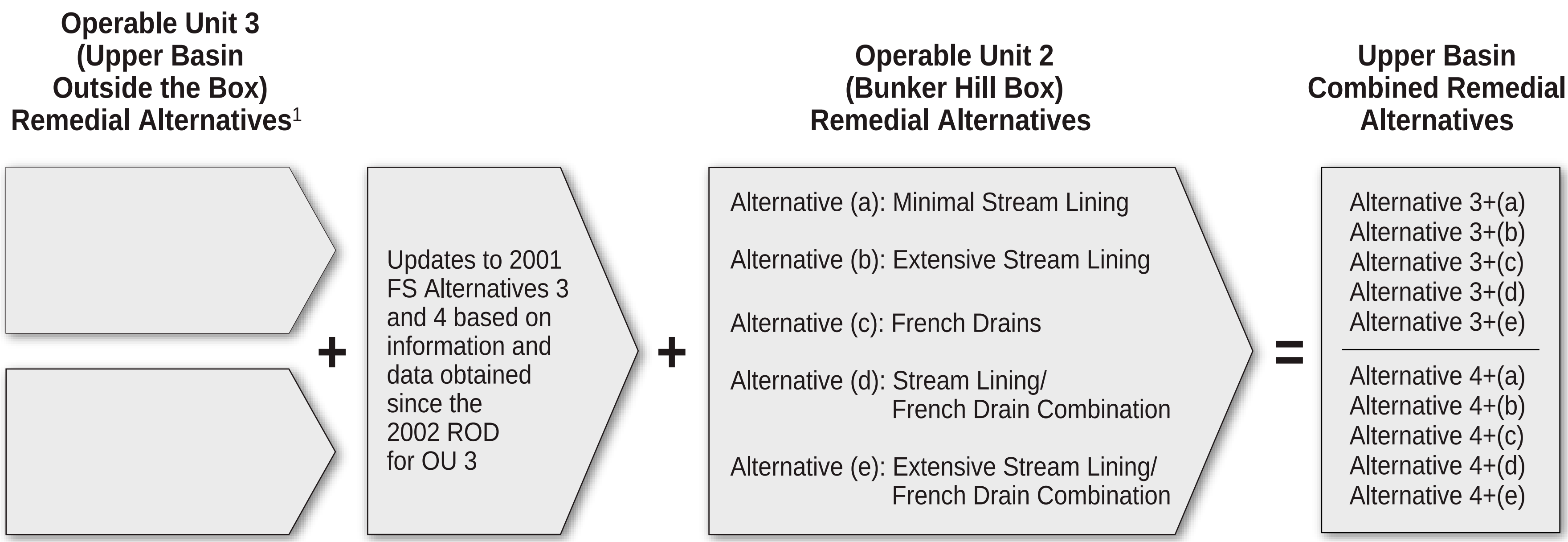


Notes:

CIA = Central Impoundment Area
CTP = Central Treatment Plant
SFCDR = South Fork Coeur d'Alene River
WWTP = Wastewater Treatment Plant
mg/L = milligrams per liter

Figure 5-10
Dissolved Zinc Concentrations in Upper-Aquifer Groundwater in the Bunker Hill Box, October 2008
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

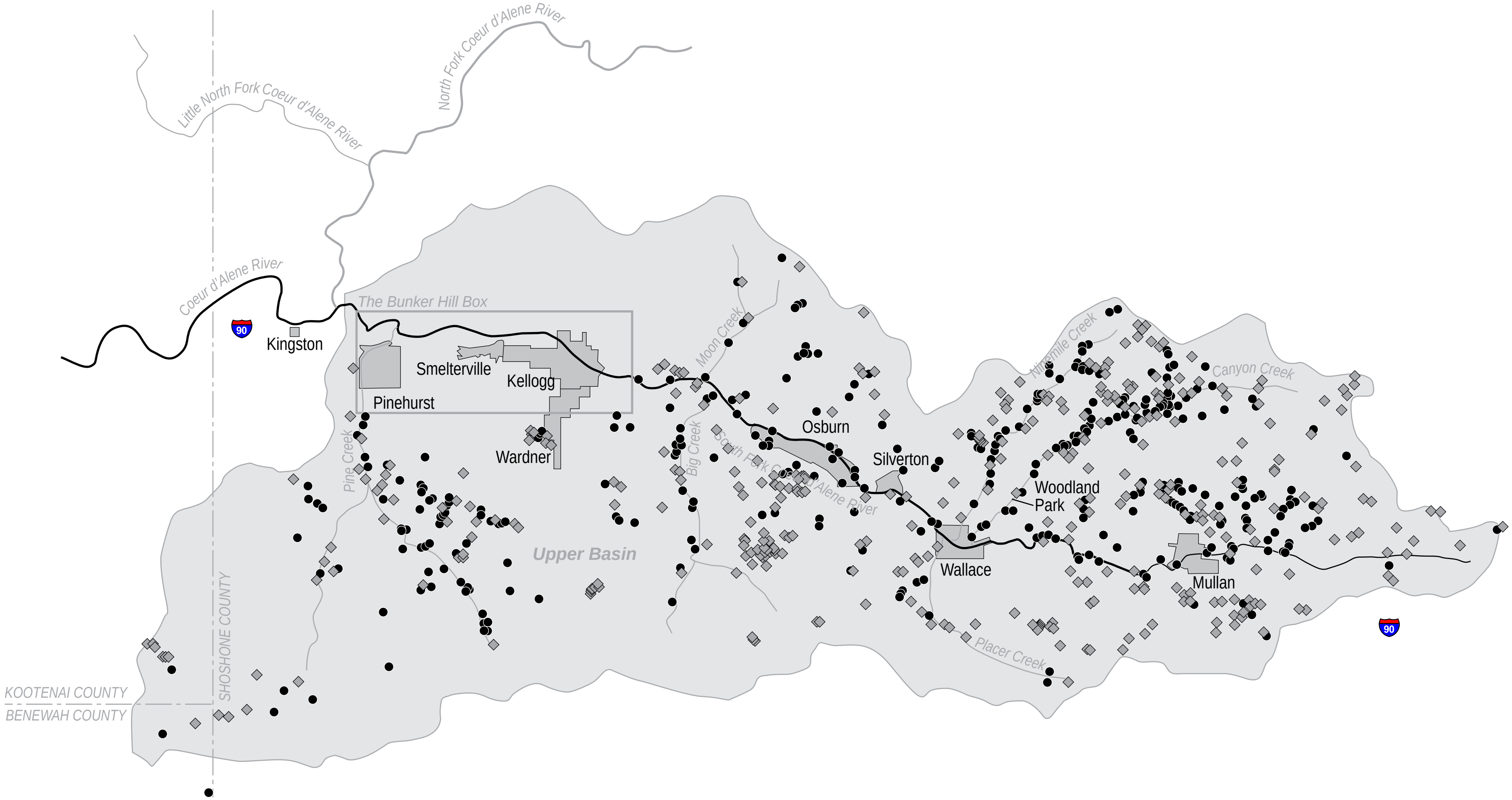
EPA



[1] Alternatives 3 and 4 are Ecological Alternatives from the 2001 Feasibility Study Report (U.S. Environmental Protection Agency, 2001c).

FS = Feasibility Study
OU = Operable Unit
ROD = Record of Decision

Figure 9-1
Development of Remedial Alternatives
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site



- Source site with remedial action(s) included in both Alternatives 3+ and 4+
- Additional source site with remedial action(s) included in Alternative 4+ only

N

0 1 2 4 Miles

Figure 9-2
Source Sites Included in Remedial Alternatives 3+ and 4+
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA

382081.TA.07.01.01.04_BunkerHill_ES072211183311 . 9-2 Source Sites Remedial Alts 3+ 4+_v5_12oct11.ai . gr

Criterion	Alternative 3+(a)	Alternative 3+(b)	Alternative 3+(c)	Alternative 3+(d)	Alternative 3+(e)	Alternative 4+(a)	Alternative 4+(b)	Alternative 4+(c)	Alternative 4+(d)	Alternative 4+(e)
Threshold Criteria										
Overall Protectiveness of Human Health and the Environment evaluates the overall protectiveness of the alternatives and describes how risks posed are eliminated, reduced, or controlled through treatment, engineering, or institutional controls.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) evaluates whether an alternative meets federal, state, and tribal environmental statutes, regulations, and other requirements that pertain to the site, and/or whether a waiver is justified.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Primary Balancing Criteria										
Long-Term Effectiveness and Permanence considers an alternative's ability to protect human health and the environment over time.	Medium	Medium	Medium	High	High	High	High	Highest	Highest	Highest
Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.	Low	Medium	High	Highest	Medium	Low	Low	High	High	Medium
Short-Term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.	High	High	High	High	Medium	Medium	Medium	Medium	Medium	Low
Implementability considers the technical and administrative feasibility of implementing an alternative, including factors such as the availability of goods and services.	Medium	Medium	Highest	High	Low	Low	Low	Low	Low	Lowest
Cost includes estimated present worth capital and operation and maintenance (O&M) costs. O&M costs are estimated for a 30-year period using a discount rate of 7 percent.	High	High	High	High	Medium	Lowest	Lowest	Lowest	Lowest	Lowest
Modifying Criteria										
State, Tribe, and Federal Natural Resource Trustee Acceptance considers whether the local states and Tribes and the federal Natural Resource Trustees agree with the U.S. Environmental Protection Agency's (EPA's) analyses and recommendations presented in the Proposed Plan for the project.	Evaluated for EPA's Preferred Remedial Alternative for the Upper Basin in Section 10.1.8.									
Community Acceptance considers whether the local community agrees with EPA's analyses and recommendations presented in the Proposed Plan for the project.	Evaluated for EPA's Preferred Remedial Alternative for the Upper Basin in Section 10.1.9.									

✓ Alternative meets this Threshold Criterion.

Comparative Ranking Symbols:

Highest – The alternative is either the most favorable, compared to the other alternatives, or is equally favorable among the alternatives ranked highest.

High – The alternative is highly favorable in regard to this criterion, but at least one other alternative is ranked higher.

Medium – The alternative is moderately favorable (i.e., other alternatives are more or less favorable for this criterion).

Low – The alternative is somewhat favorable for this criterion, but at least one alternative is ranked lower.

Lowest – The alternative is either the least favorable, compared to other alternatives, or does not meet the criterion.

Figure 10-1
Overview of Comparative Analysis of Remedial Alternatives
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

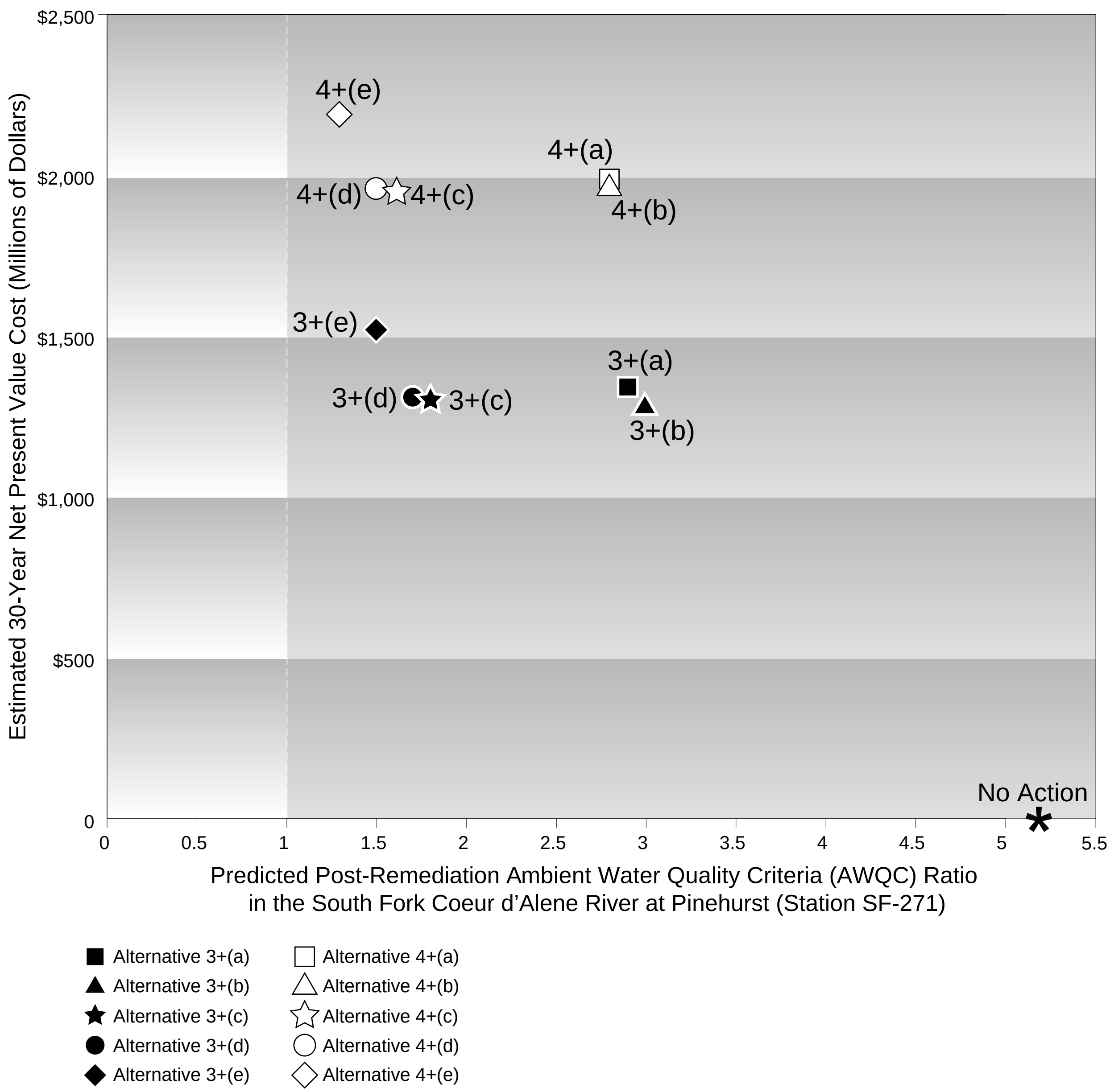


Figure 10-2
Cost Versus Predicted Post-Remediation AWQC Ratios at Pinehurst
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

Criterion	Alternative RP-1	Alternative RP-2
Threshold Criteria		
Overall Protectiveness of Human Health and the Environment evaluates the overall protectiveness of the alternatives and describes how risks posed are eliminated, reduced, or controlled through treatment, engineering, or institutional controls.	✓	✓
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) evaluates whether an alternative meets federal, state, and tribal environmental statutes, regulations, and other requirements that pertain to the site, and/or whether a waiver is justified.	✓	✓
Primary Balancing Criteria		
Long-Term Effectiveness and Permanence considers an alternative's ability to protect human health and the environment over time.	●	●
Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.	○	○
Short-Term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.	●	●
Implementability considers the technical and administrative feasibility of implementing an alternative, including factors such as the availability of goods and services.	●	●
Cost includes estimated present worth capital and operation and maintenance (O&M) costs. O&M costs are estimated for a 30-year period using a discount rate of 7 percent.	●	●
Modifying Criteria		
State, Tribe, and Federal Natural Resource Trustee Acceptance considers whether the local states and Tribes and the federal Natural Resource Trustees agree with the U.S. Environmental Protection Agency's (EPA's) analyses and recommendations presented in the Proposed Plan for the project.	Evaluated for EPA's Preferred Remedy Protection Alternative for the Upper Basin in Section 10.2.8.	
Community Acceptance considers whether the local community agrees with EPA's analyses and recommendations presented in the Proposed Plan for the project.	Evaluated for EPA's Preferred Remedy Protection Alternative for the Upper Basin in Section 10.2.9.	

✓ Alternative meets this Threshold Criterion.

Comparative Ranking Symbols:

● **Highest** – The alternative is either the most favorable, compared to the other alternatives, or is equally favorable among the alternatives ranked highest.

● **High** – The alternative is highly favorable in regard to this criterion, but at least one other alternative is ranked higher.

● **Medium** – The alternative is moderately favorable (i.e., other alternatives are more or less favorable for this criterion).

● **Low** – The alternative is somewhat favorable for this criterion, but at least one alternative is ranked lower.

○ **Lowest** – The alternative is either the least favorable, compared to other alternatives, or does not meet the criterion.

Figure 10-3
Overview of Comparative Analysis of Remedy Protection Alternatives
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

WHAT THIS FIGURE SHOWS

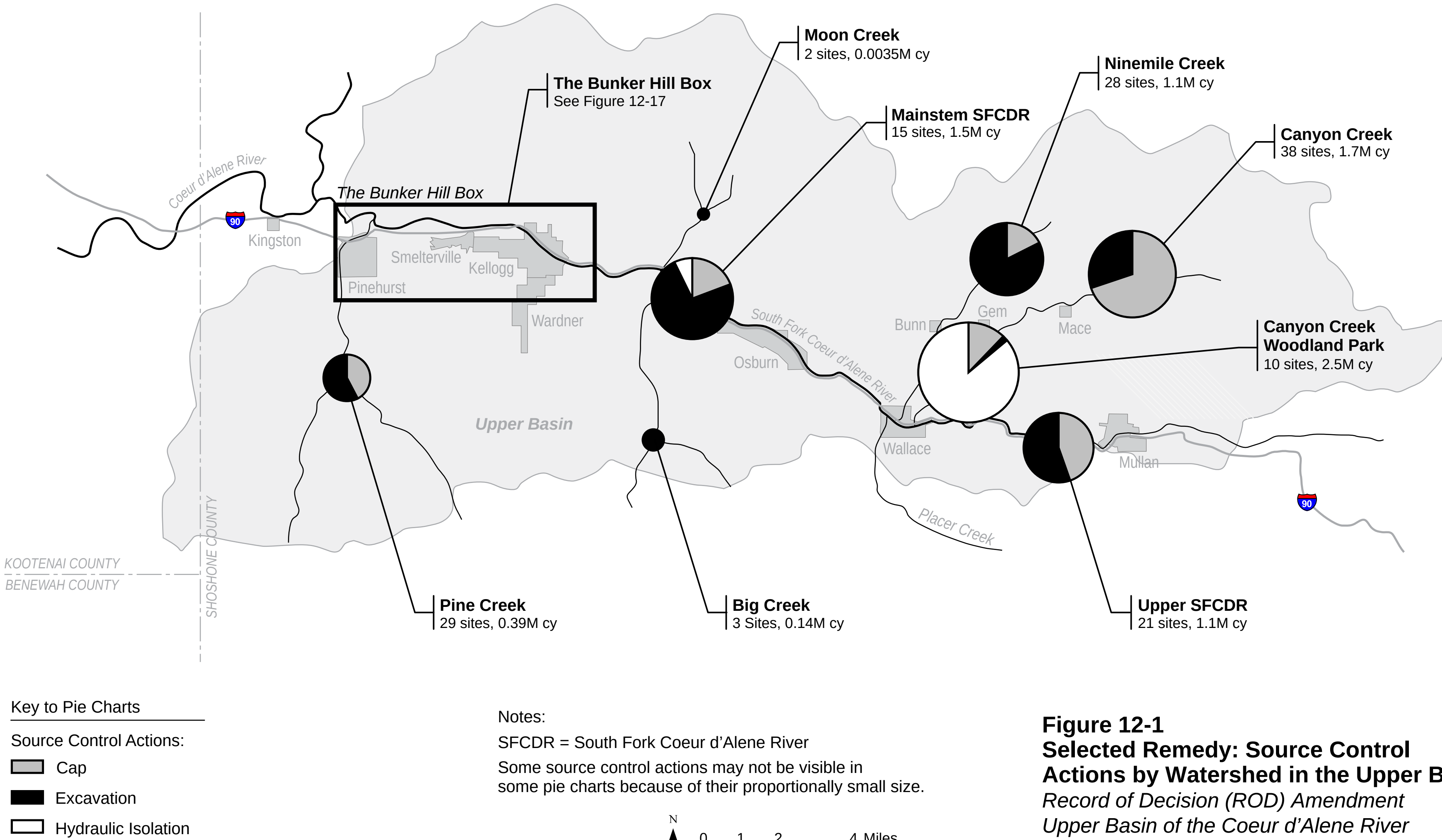
For the main and upper parts of the South Fork Coeur d'Alene River and major creeks, this figure shows the number of individual locations where remedial actions have been planned and the amount of material, such as contaminated tailings, waste rock, and floodplain sediments, that would be cleaned up. The "pie charts" for each portion of the river and creeks show the general breakdown by type of remedial action for the Selected Remedy. The volume (cubic yards) listed for each watershed includes all material addressed by the Selected Remedy.

The bigger the pie chart, the more contaminated materials are planned to be addressed.

Cap – Includes engineered or soil covers, or regrading and planting.

Excavation – Includes removing materials and either consolidating locally or transporting to a separate repository.

Hydraulic Isolation – Includes preventing contaminated water (seeps, adit drainage, or groundwater) from entering the river and creeks.

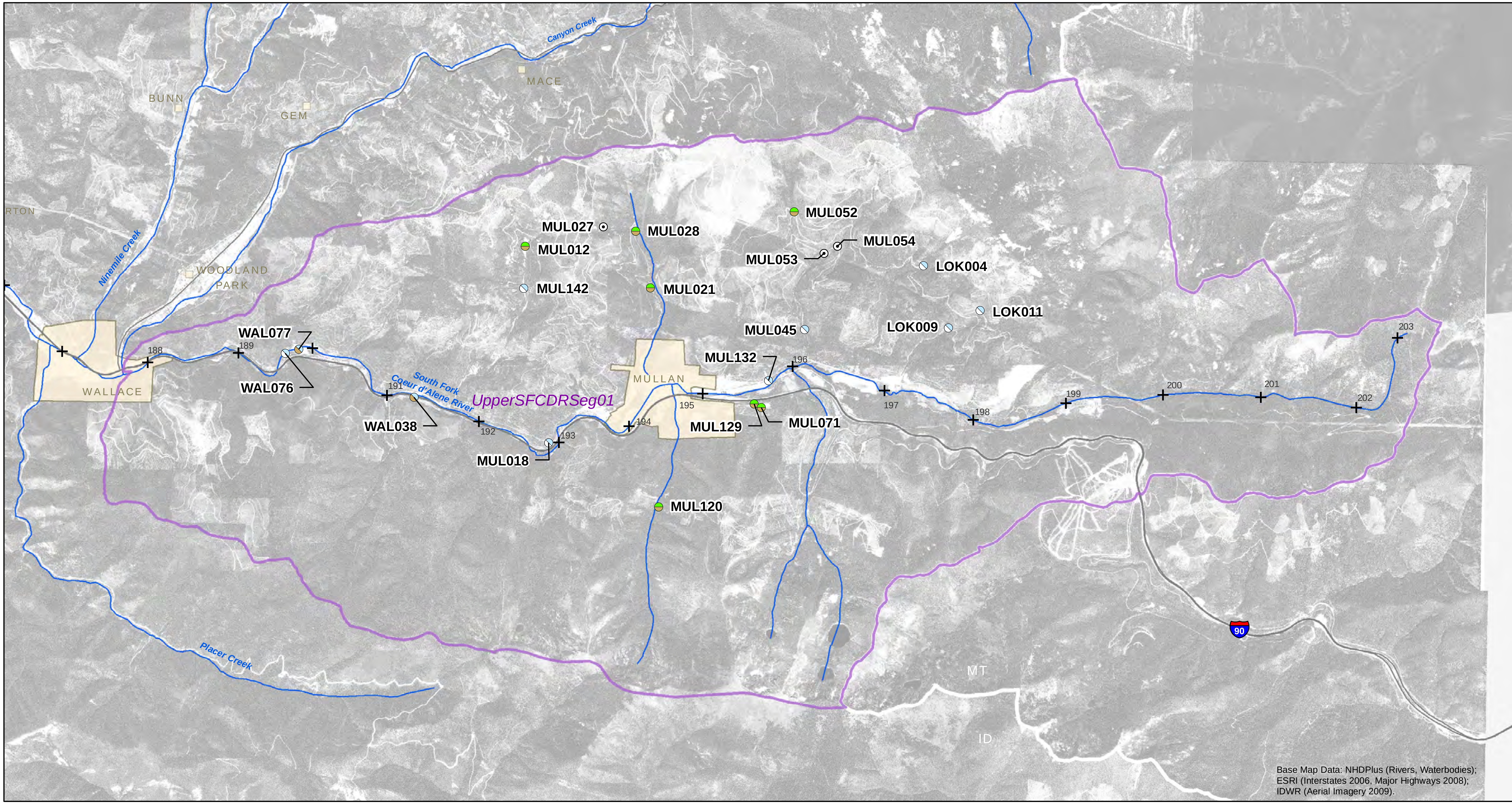


Notes:

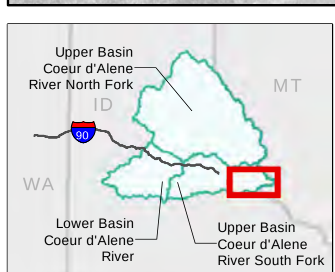
SFCDR = South Fork Coeur d'Alene River

Some source control actions may not be visible in some pie charts because of their proportionally small size.

Figure 12-1
Selected Remedy: Source Control Actions by Watershed in the Upper Basin
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site



203



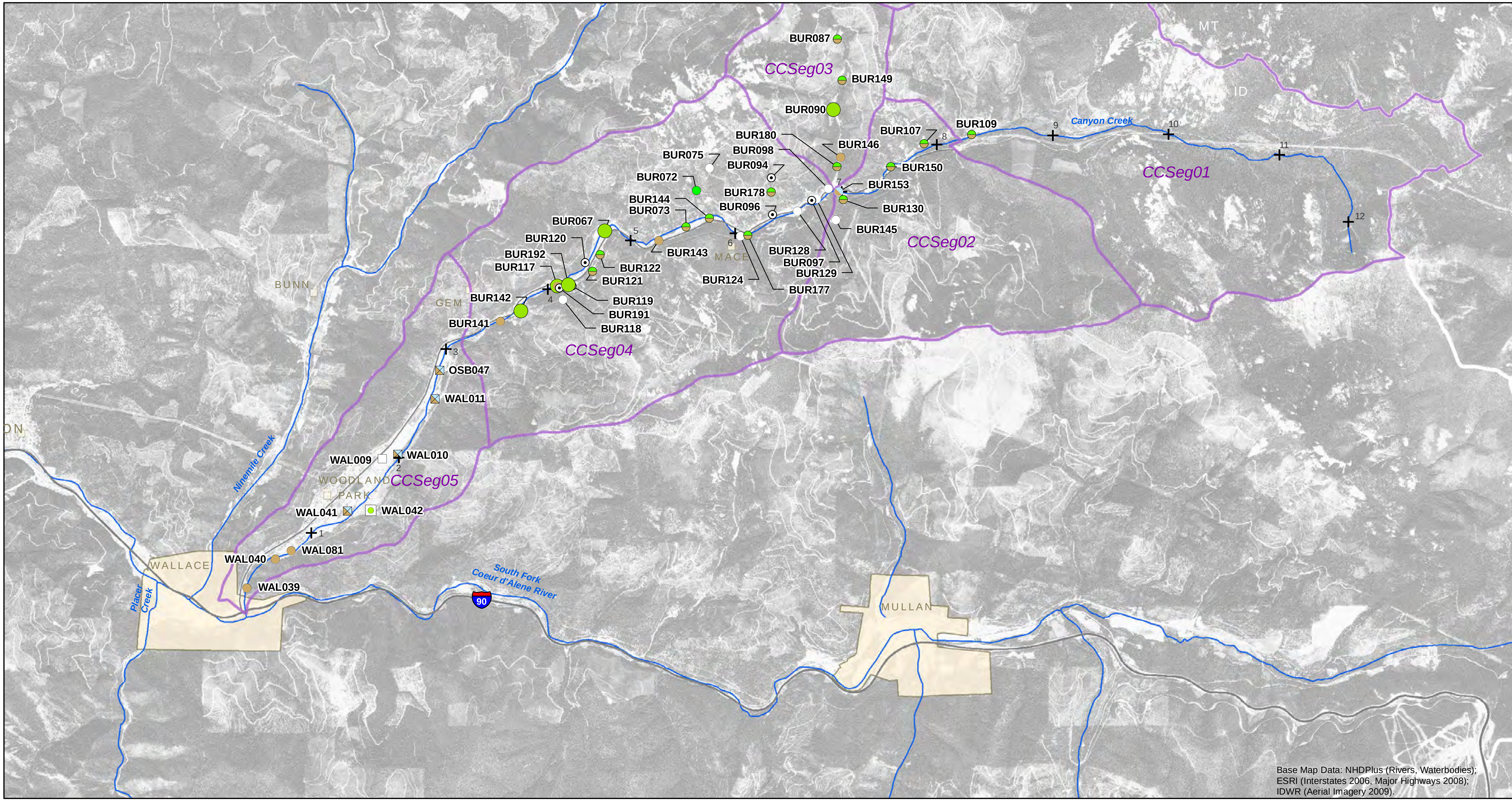
Remedial Action Type
- Excavation/Cap
- Excavation
- Excavation/Repository
- Regrade/Consolidate/Revegetate

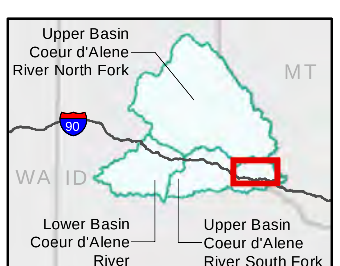
- River Mile
- River/Creek
- Watershed Segment
- City Limit
- State Boundary
- **MUL043(SiteID)**

N
0 0.5 1 Miles

Figure 12-2
Selected Remedy:
Overview of Source Control Actions,
Upper SFCDR Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA





Remedial Action Type

- Cap
- Cap/Hydraulic Isolation
- Excavation/Cap
- Excavation/Cap/Waste Consolidation Area
- Excavation/Waste Consolidation Area
- Excavation/Repository
- Excavation/Repository; Hydraulic Isolation
- Hydraulic Isolation
- Regrade/Consolidate/Revegetate
- 4 River Mile
- River/Creek
- Watershed Segment
- City Limit
- State Boundary
- **BUR187 (Site ID)**

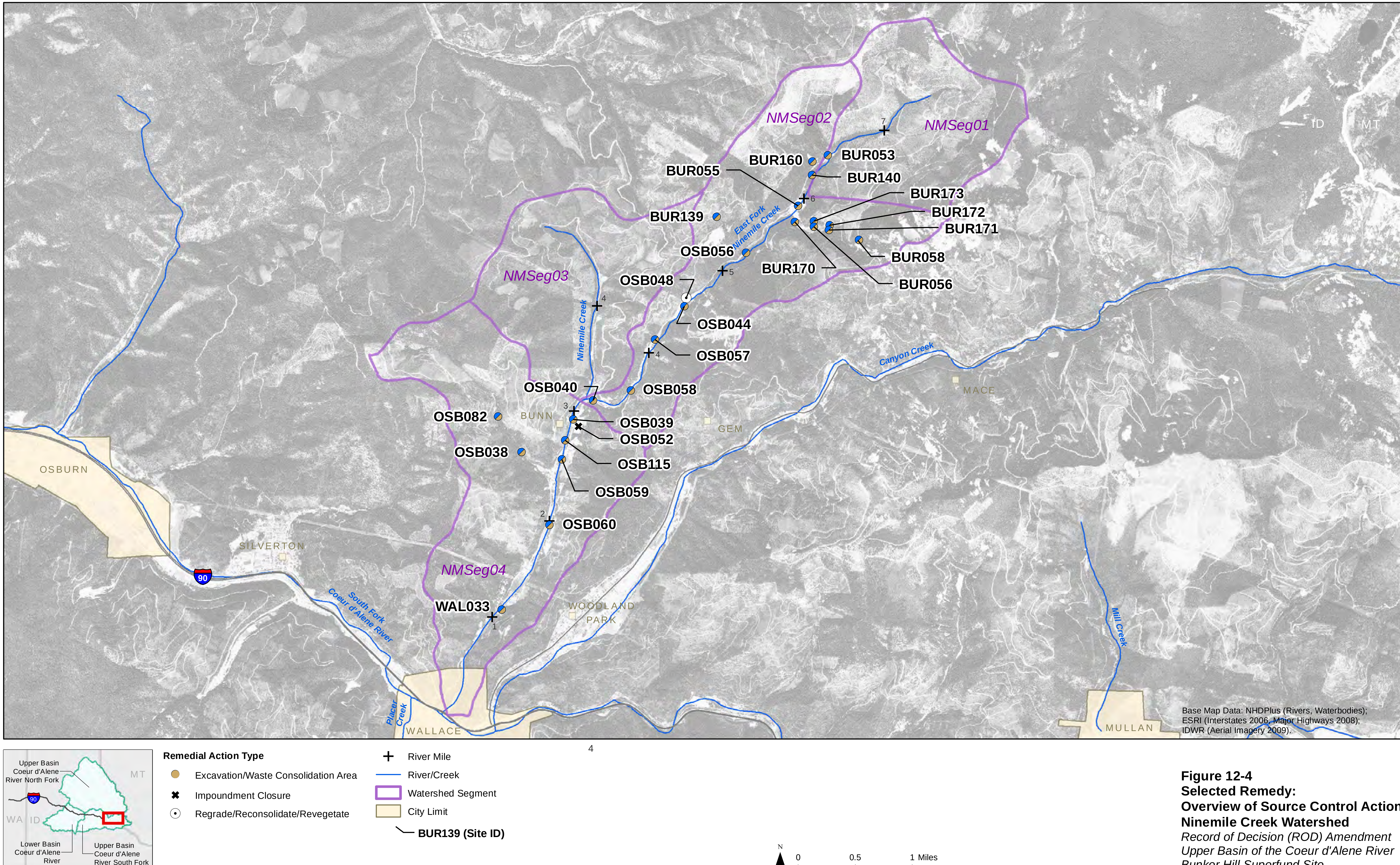
NOTE: Hydraulic isolation actions refer to stream liner and groundwater collection drains in Woodland Park.

N 0 0.5 1 Miles

Figure 12-3
Selected Remedy:
Overview of Source Control Actions,
Canyon Creek Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA

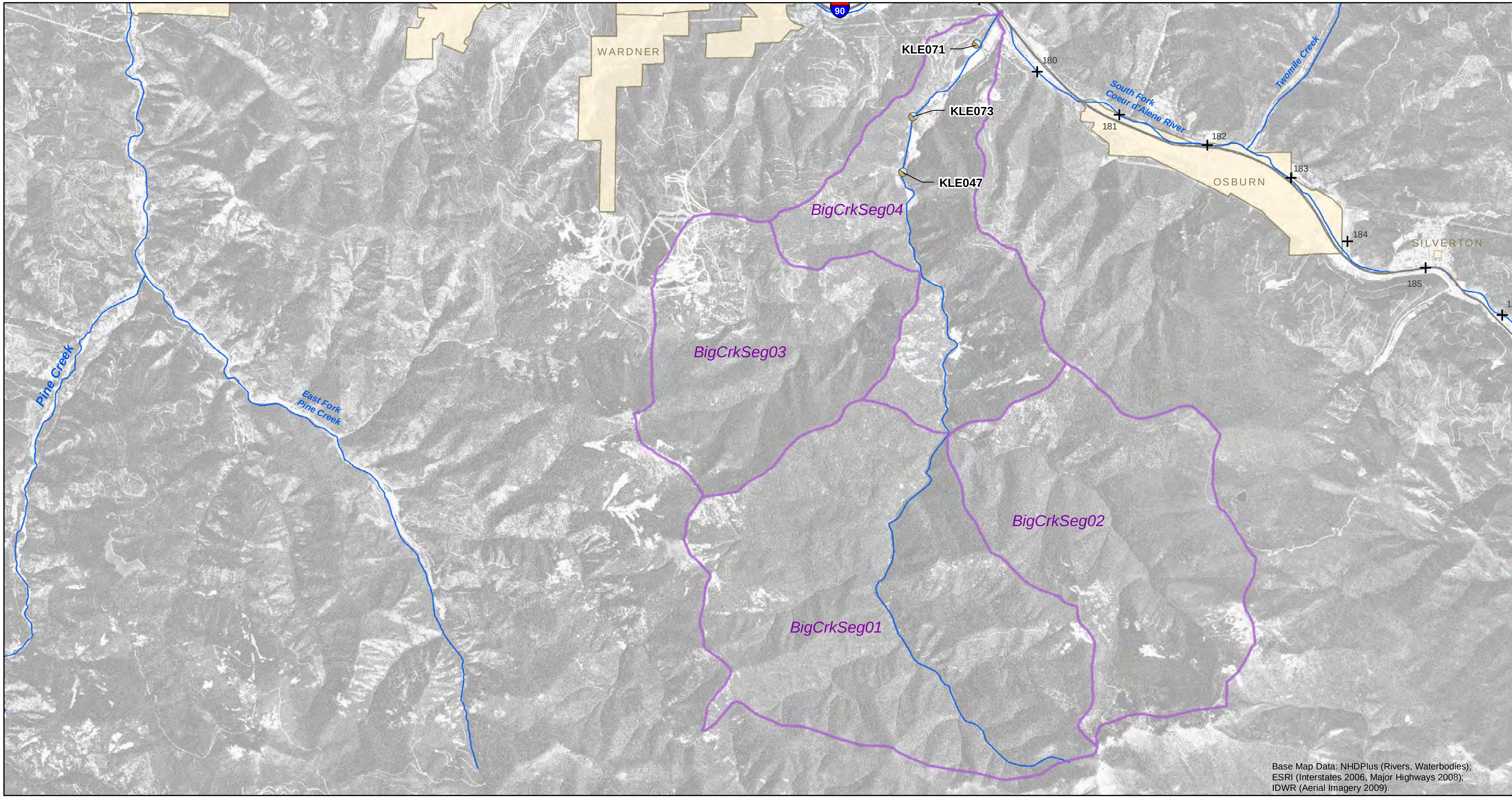
E:\DATA\CH2M\ROD_MXDS\REMEDY\REMEDY_CANYONCREEK.MXD RLEONARD 3/20/2012 9:41:15 AM

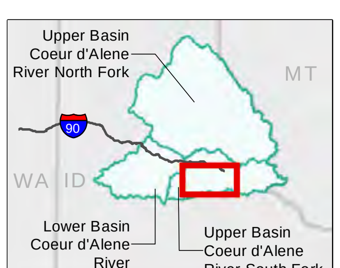


4

Figure 12-4
Selected Remedy:
Overview of Source Control Actions,
Ninemile Creek Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA





Remedial Action Type

Excavation/Repository

184 River Mile

River/Creek

Watershed Segment

City Limit

POL010(SiteID)

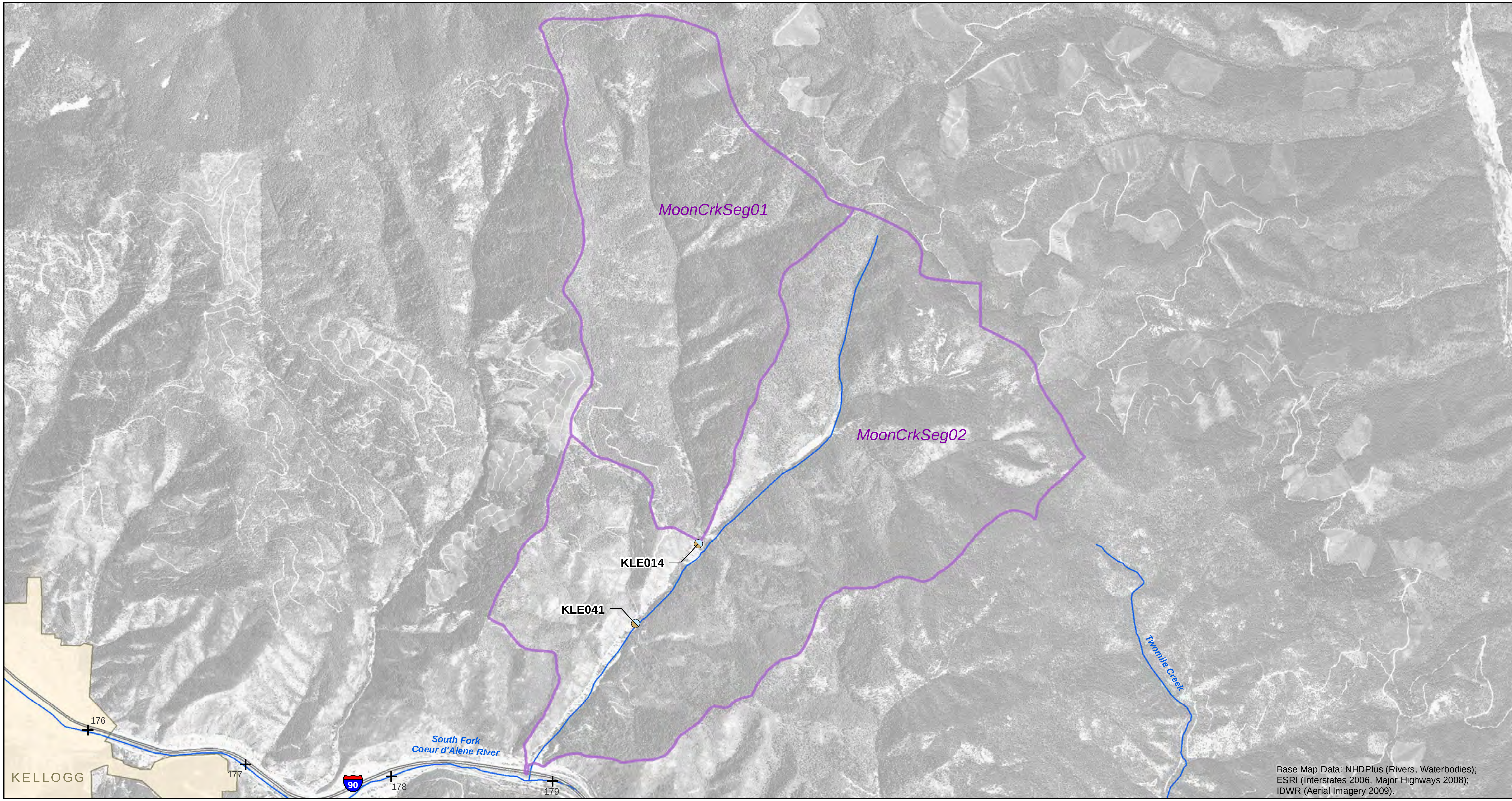
N

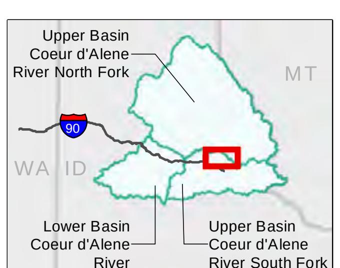
0 0.5 1 Miles

Figure 12-5
Selected Remedy:
Overview of Source Control Actions,
Big Creek Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA

E:\DATA\CH2M\ROD_MXDS\REMEDY\REMEDY_BIGCREEK.MXD RLEONARD 3/20/2012 9:42:42 AM





Remedial Action Type

Excavation/Repository

179

River Mile

River/Creek

Watershed Segment

City Limit

KLE063 (Site ID)

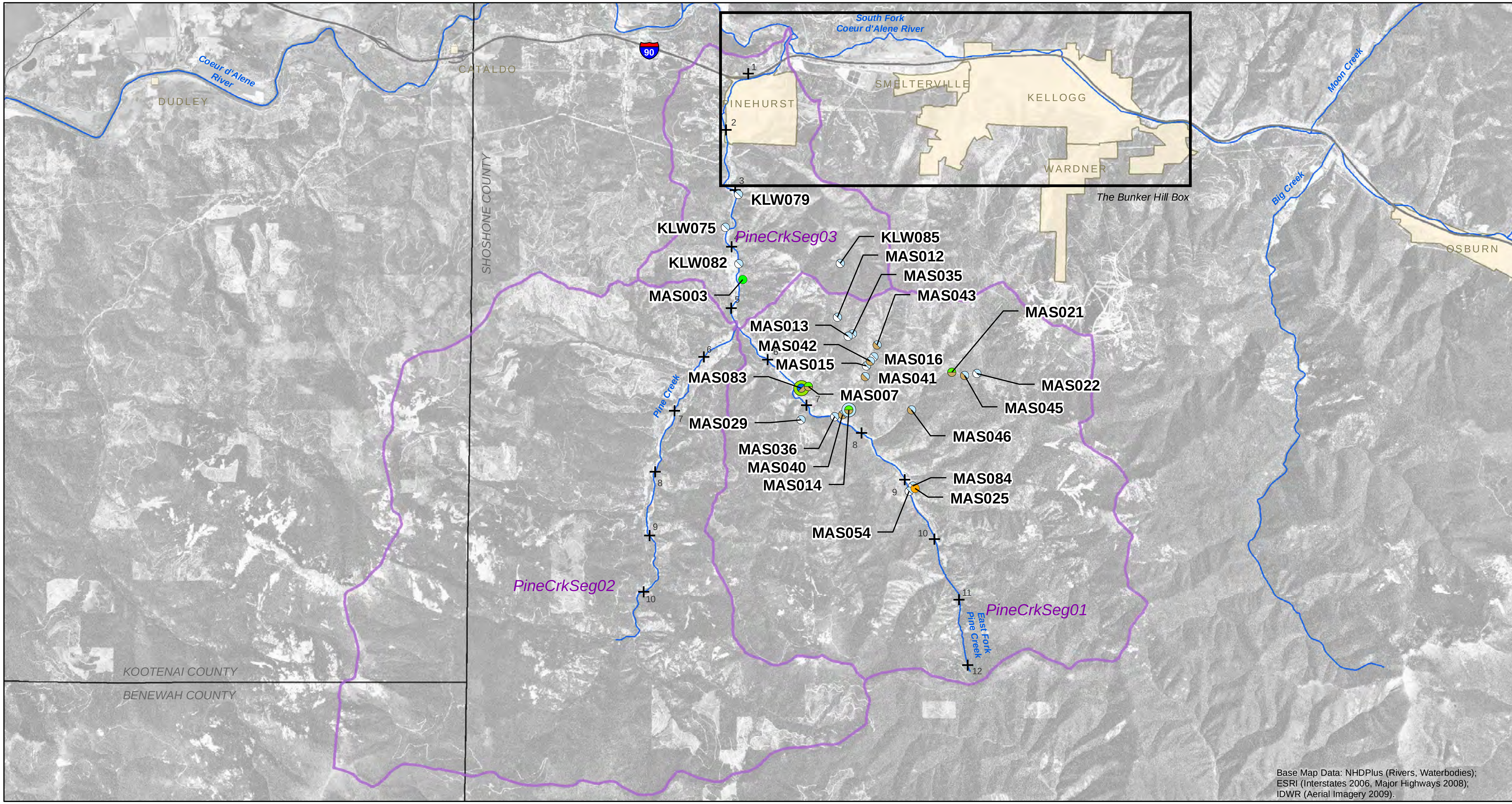
N

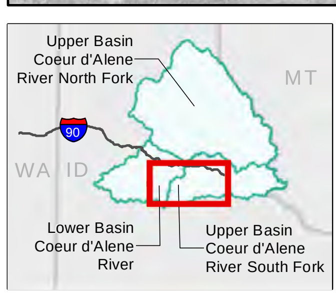
0 0.5 1 Miles

Figure 12-6
Selected Remedy:
Overview of Source Control Actions,
Moon Creek Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA

E:\DATA\CH2M\ROD_MXDS\REMEDY\REMEDY_MOONCREEK.MXD RLEONARD 3/20/2012 9:38:22 AM





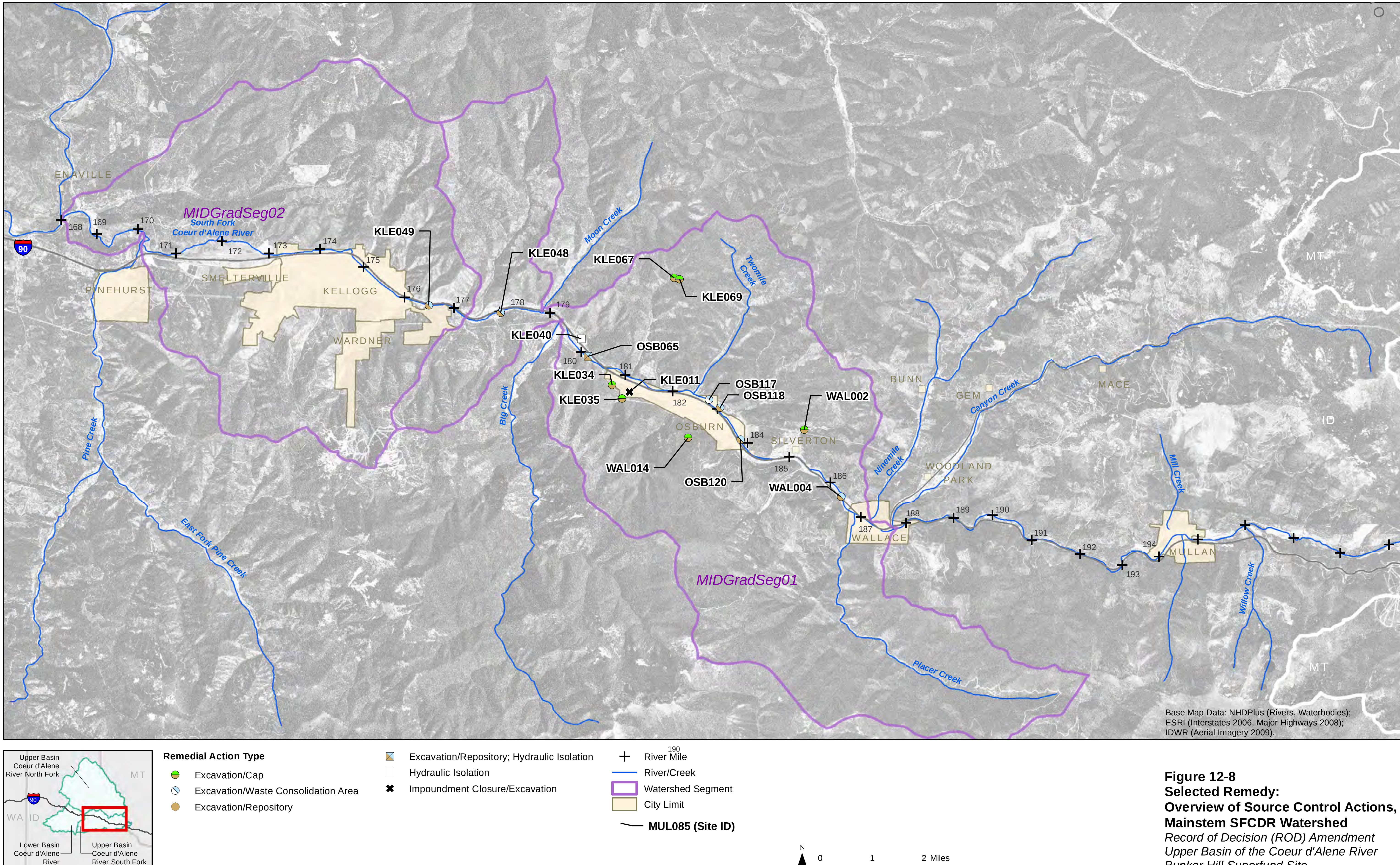
Remedial Action Type

- Cap
- Excavation
- Excavation/Cap
- Excavation/Cap/Waste Consolidation Area
- Excavation/Cap/Repository
- Excavation/Waste Consolidation Area
- Excavation/Repository
- 4 River Mile
- River/Creek
- Watershed Segment
- City Limit
- County Boundary
- **MAS023 (Site ID)**

N 0 1 2 Miles

Figure 12-7
Selected Remedy:
Overview of Source Control Actions,
Pine Creek Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA



Remedial Action Type

- Excavation/Cap
- Excavation/Waste Consolidation Area
- Excavation/Repository
- Excavation/Repository; Hydraulic Isolation
- Hydraulic Isolation
- Impoundment Closure/Excavation
- 190 River Mile
- River/Creek
- Watershed Segment
- City Limit
- **MUL085 (Site ID)**

N 0 1 2 Miles

Figure 12-8
Selected Remedy:
Overview of Source Control Actions,
Mainstem SFCDR Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA

WHAT THIS FIGURE SHOWS

For the main and upper parts of the South Fork Coeur d'Alene River and major creeks, this figure shows the number of individual locations where water treatment remedial actions have been planned. The "pie charts" for each portion of the river and creeks show the general breakdown by type of water treatment action for the Selected Remedy.

The bigger the pie chart, the larger the flow of contaminated water that will be treated by the Selected Remedy. This figure also shows the approximate location of the water conveyance pipeline to the Central Treatment Plant in Kellogg. The size of the arrow represents the approximate amount of flow for the pipeline.

CTP Treatment – Includes collection of groundwater or adit discharge and active water treatment in Kellogg.

Onsite Treatment – Includes collection of groundwater or adit discharge and semi-passive treatment at the source site.

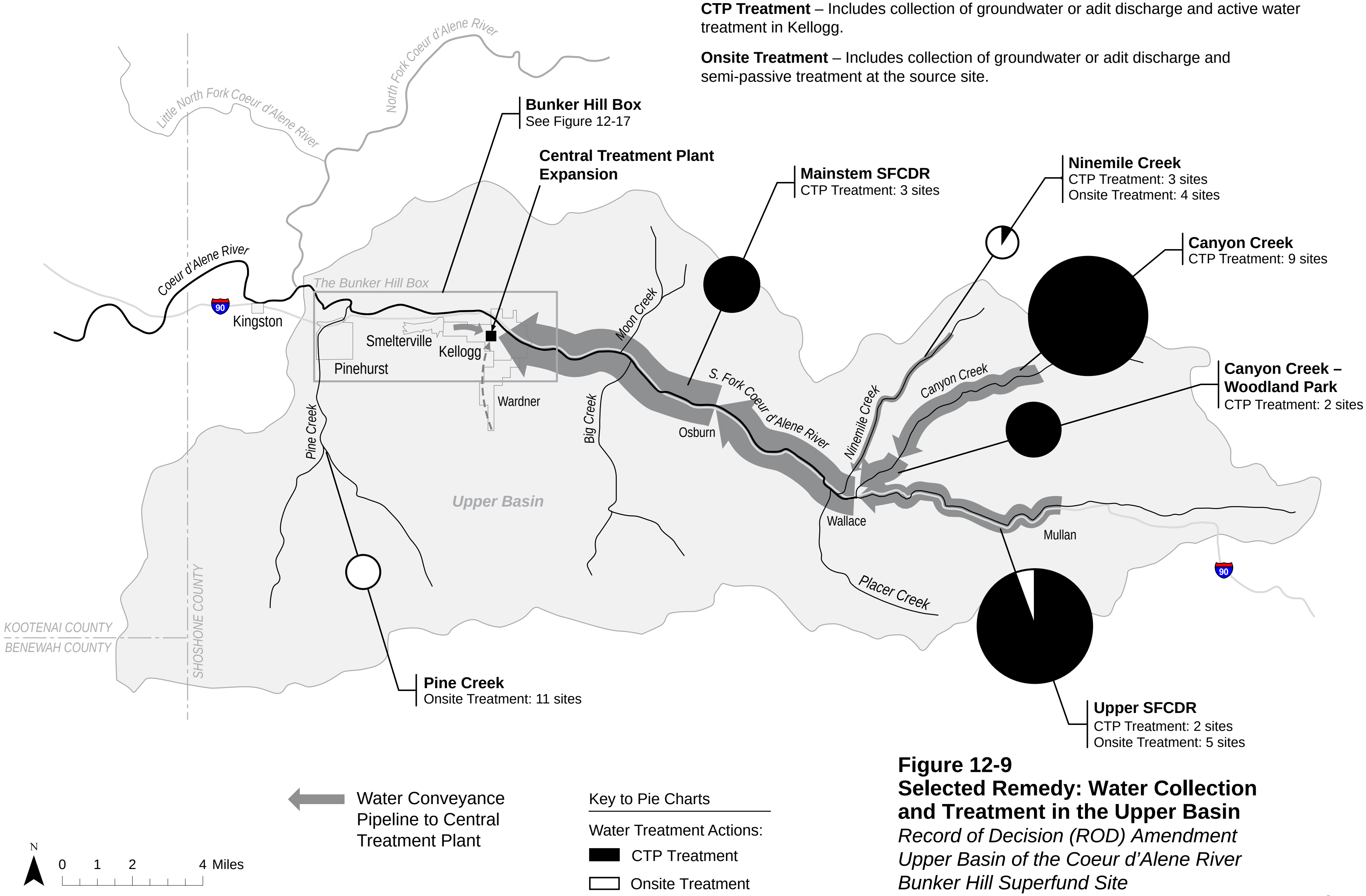
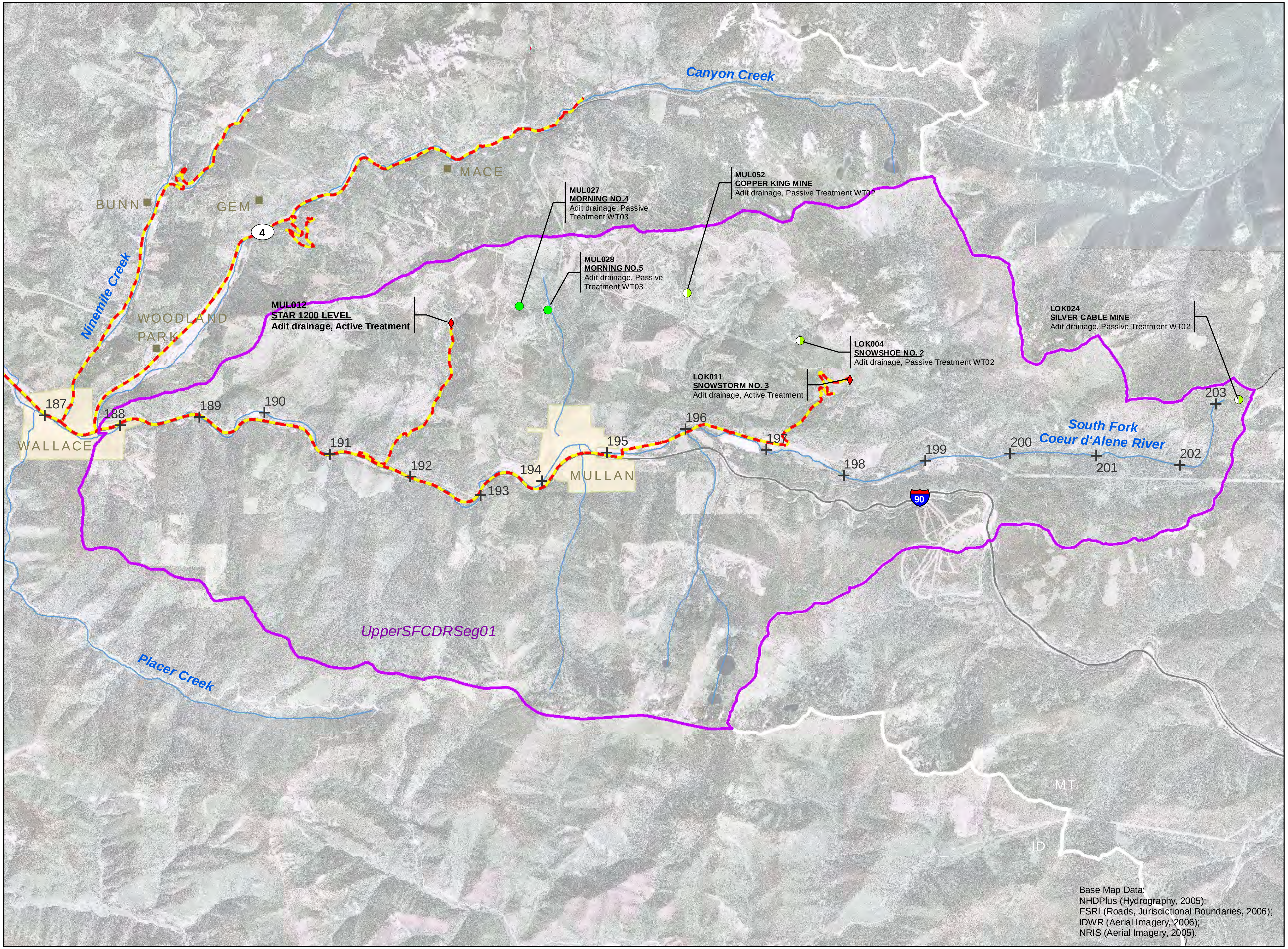
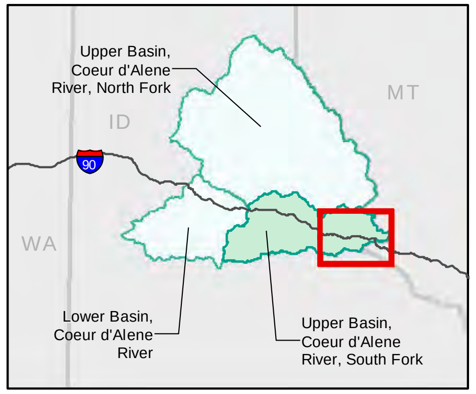


Figure 12-9
Selected Remedy: Water Collection and Treatment in the Upper Basin
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site





203 River Mile

River/Creek

Gravity Pipeline to CTP

Selected Remedy Water Treament Actions

Active Treatment

Passive Treatment WT02

Passive Treatment WT03

LOK024 (Site ID)
SILVER CABLE MINE (Site Name[1])
Adit drainage, Passive Treatment WT02 (Water Source Type, Water Treatment Typical Conceptual Design [TCD])

Watershed Segment

City Limit

State Boundary

CTP = Central Treatment Plant in Kellogg, Idaho

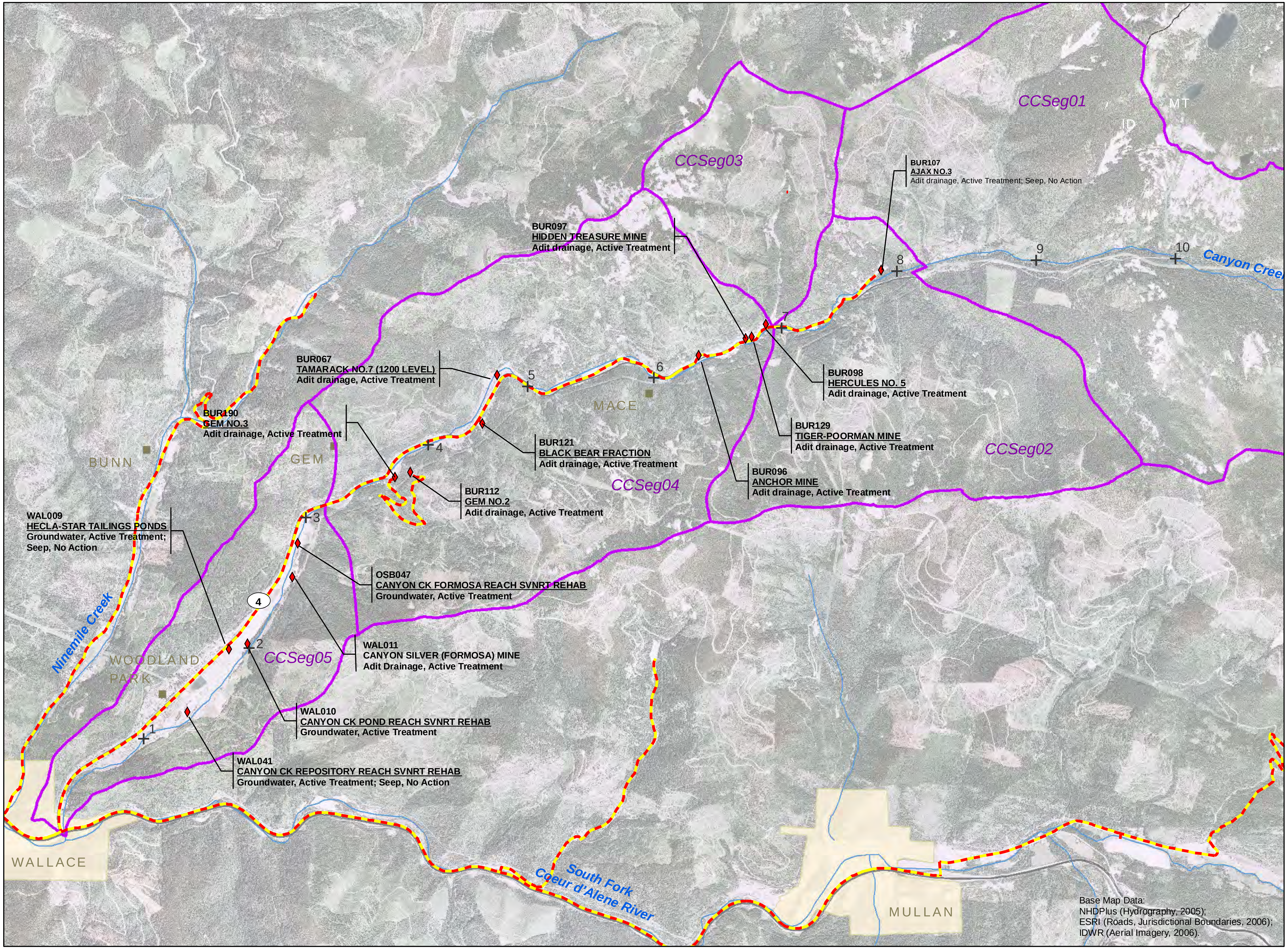
N

0 2,000 4,000 8,000 Feet

Figure 12-10
Selected Remedy: Water Collection and Treatment, Upper SFCDR Watershed

Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA



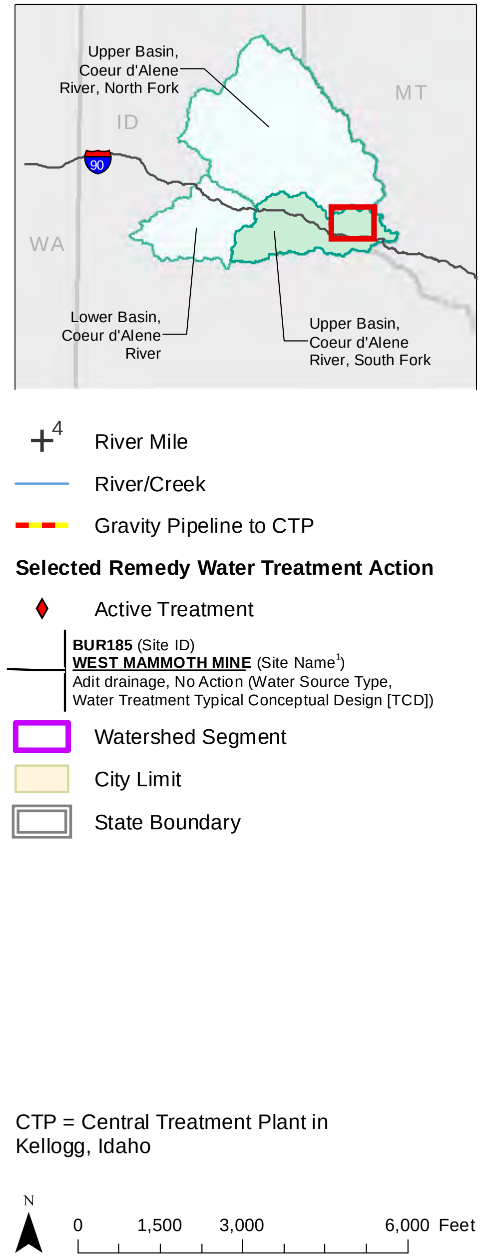
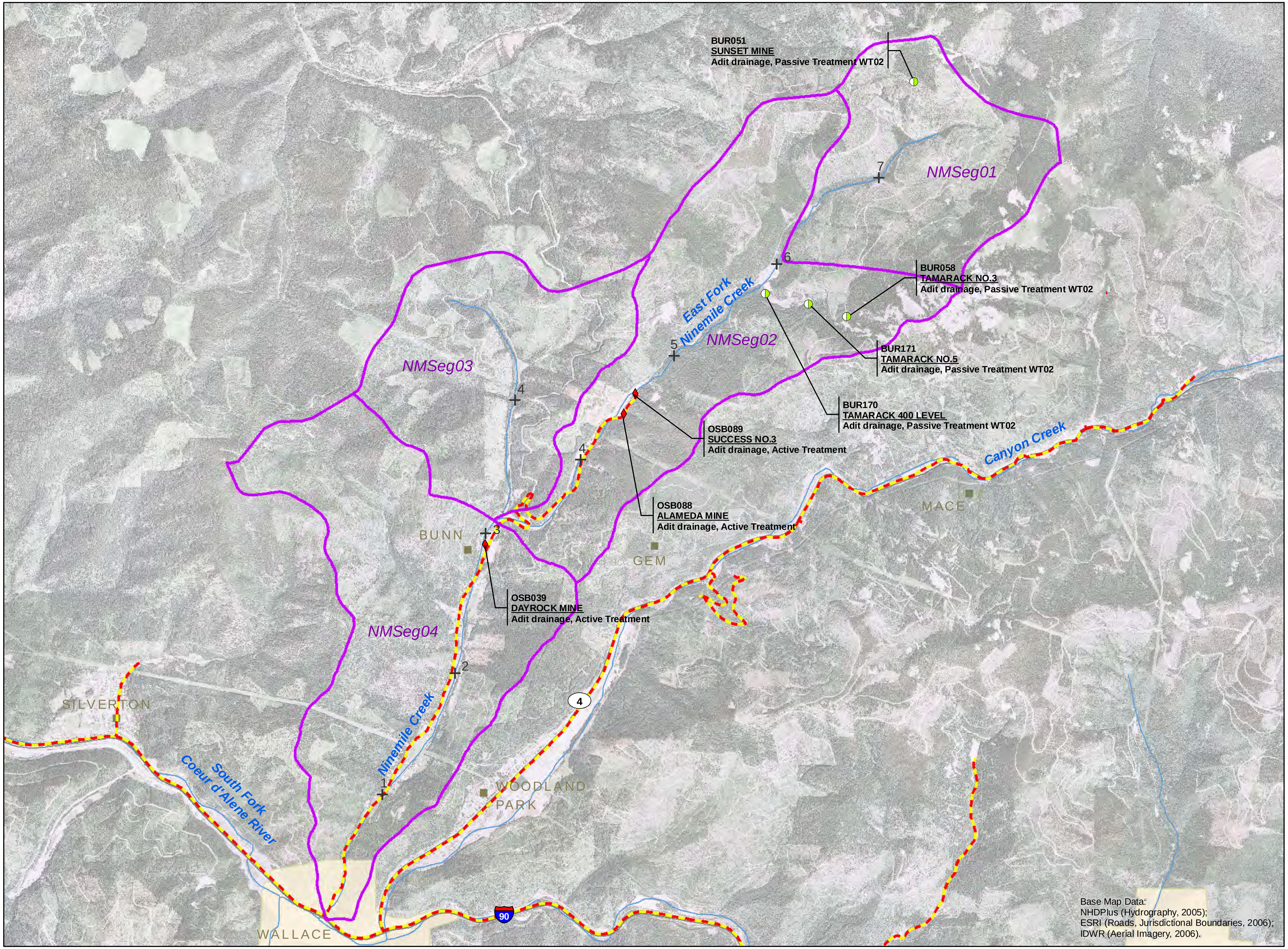
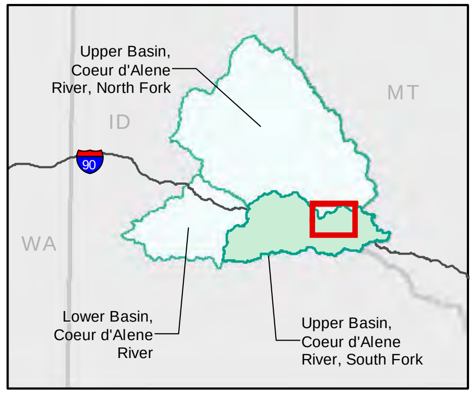


Figure 12-11
Selected Remedy: Water Collection and Treatment, Canyon Creek Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site





River Mile
River/Creek
Gravity Pipeline to CTP

Selected Remedy Water Treatment Actions

Active Treatment
Passive Treatment WT02

BUR058 (Site ID)
TAMARACK NO. 3 (Site Name[1])
Adit drainage, Passive Treatment WT02 (Water Source Type, Water Treatment Typical Conceptual Design [TCD])

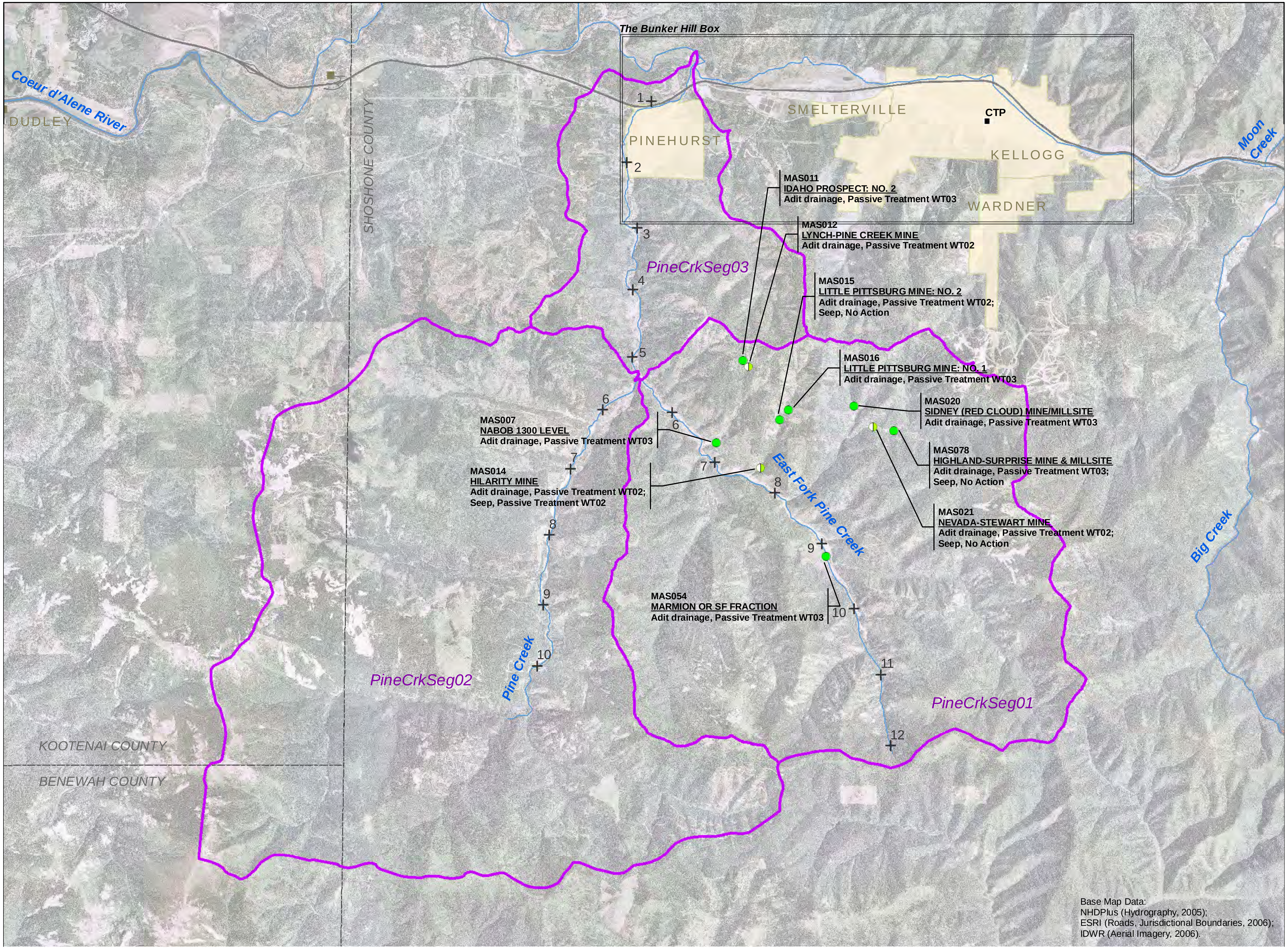
Watershed Segment
City Limit

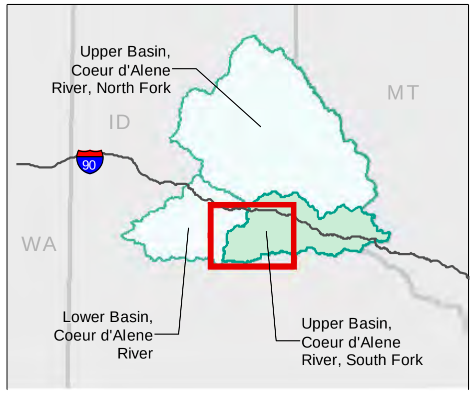
CTP = Central Treatment Plant in Kellogg, Idaho

N
0 1,500 3,000 6,000 Feet

Figure 12-12
Selected Remedy: Water Collection and Treatment, Ninemile Creek Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA





River Mile
Central Treatment Plant (CTP) in Kellogg, Idaho
River/Creek

Selected Remedy Water Treatment Action

Passive Treatment WT02
Passive Treatment WT03

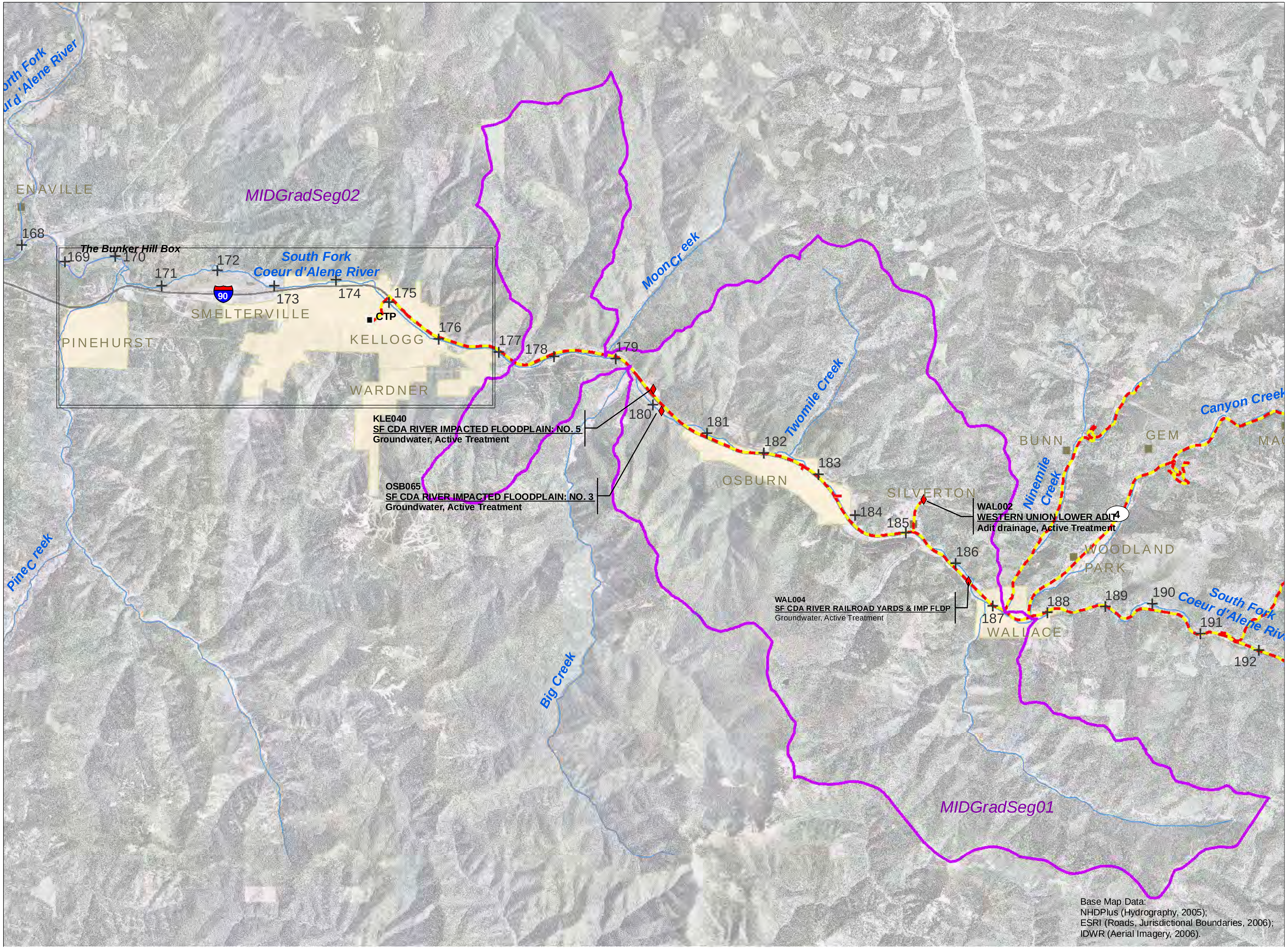
MAS012 (Site ID)
LYNCH-PINE CREEK MINE (Site Name[1])
Adit drainage, Passive Treatment WT02 (Water Source Type, Water Treatment Typical Conceptual Design [TCD])

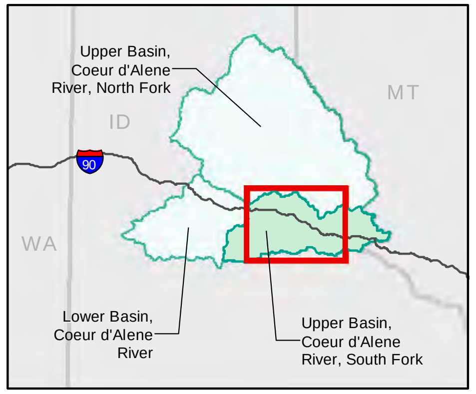
Watershed Segment
City Limit
County Boundary

N
0 2,000 4,000 8,000 Feet

Figure 12-13
Selected Remedy: Water Collection and Treatment, Pine Creek Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA





186 River Mile

Central Treatment Plant (CTP) in Kellogg, Idaho

River/Creek

Gravity Pipeline to CTP

Selected Remedy Water Treatment Actions

Active Treatment

OSB074 (Site ID)
ST. JOE NO. 1 (Site Name[1])
Adit drainage, Passive Treatment WT02 (Water Source Type, Water Treatment Typical Conceptual Design [TCD])

Watershed Segment

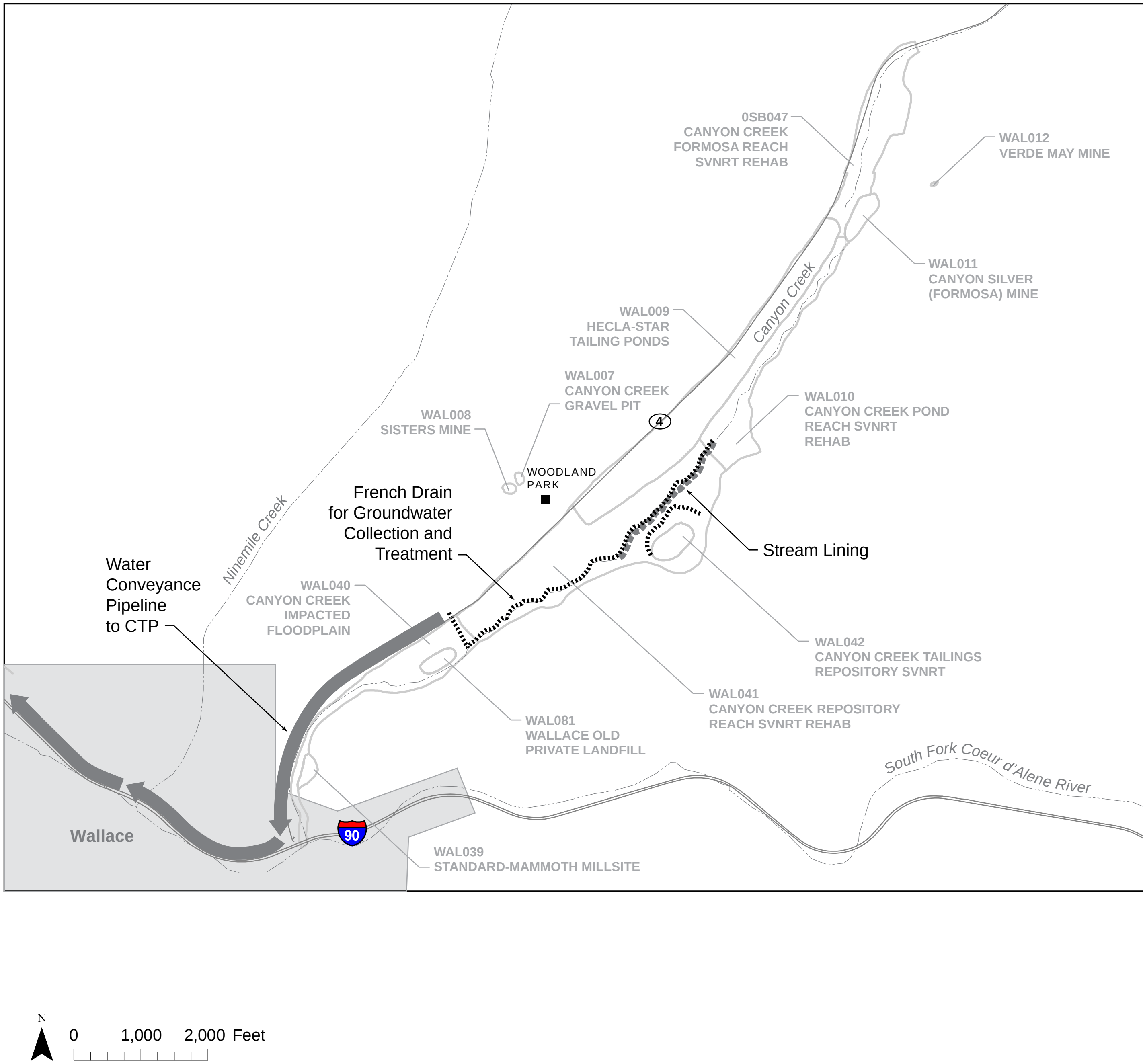
City Limit

N

0 2,500 5,000 10,000 Feet

Figure 12-14
Selected Remedy: Water Collection and Treatment, Mainstem SFCDR Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA

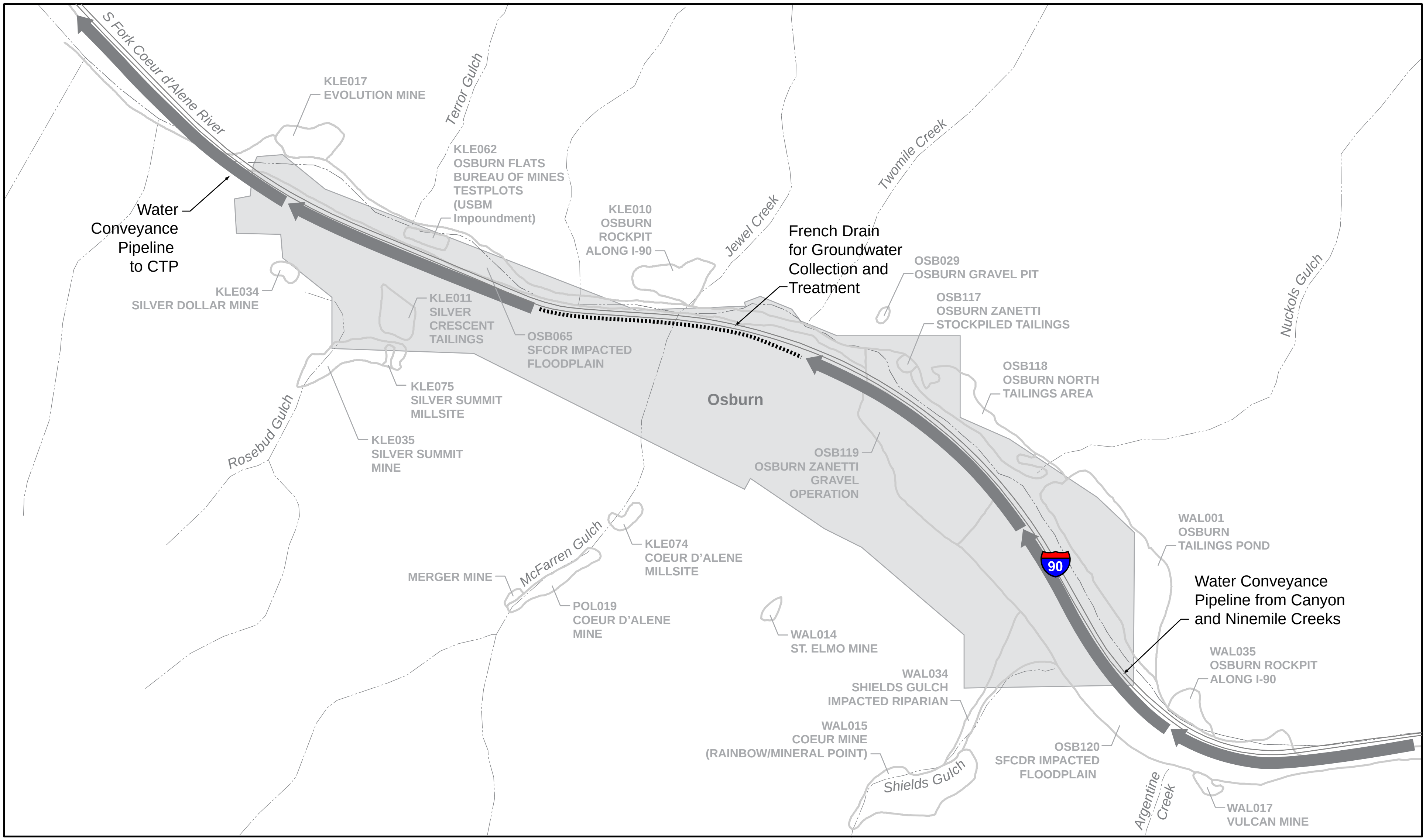


Source Area
WAL012 (Source ID)
VERDE MAY MINE (Source Name)

Note:

CTP = Central Treatment Plant

Figure 12-15
Selected Remedy: Groundwater Collection in Woodland Park
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site



Note:

CTP = Central Treatment Plant

Source Area

WAL012 (Source ID)

VERDE MAY MINE (Source Name)

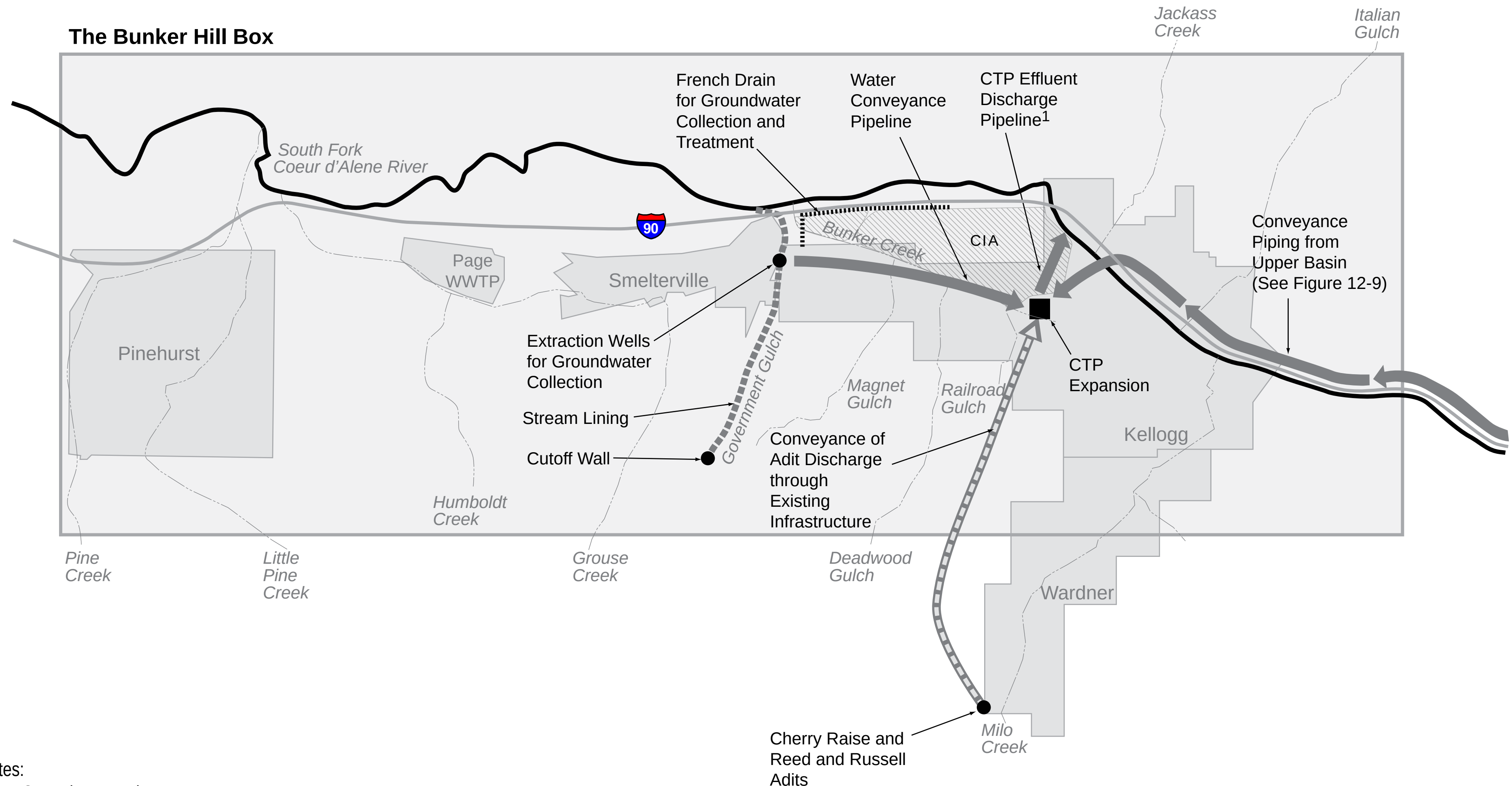
N

0 1,000 2,000 Feet

Figure 12-16
Selected Remedy: Groundwater Collection in Osburn Flats
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA

382081.TA.07.01.01.04_BunkerHill_ES031812185638SEA . 12-16_Selected_Remedy_GW_Collection_Osburn_Flats_v6_16mar12.ai . gr

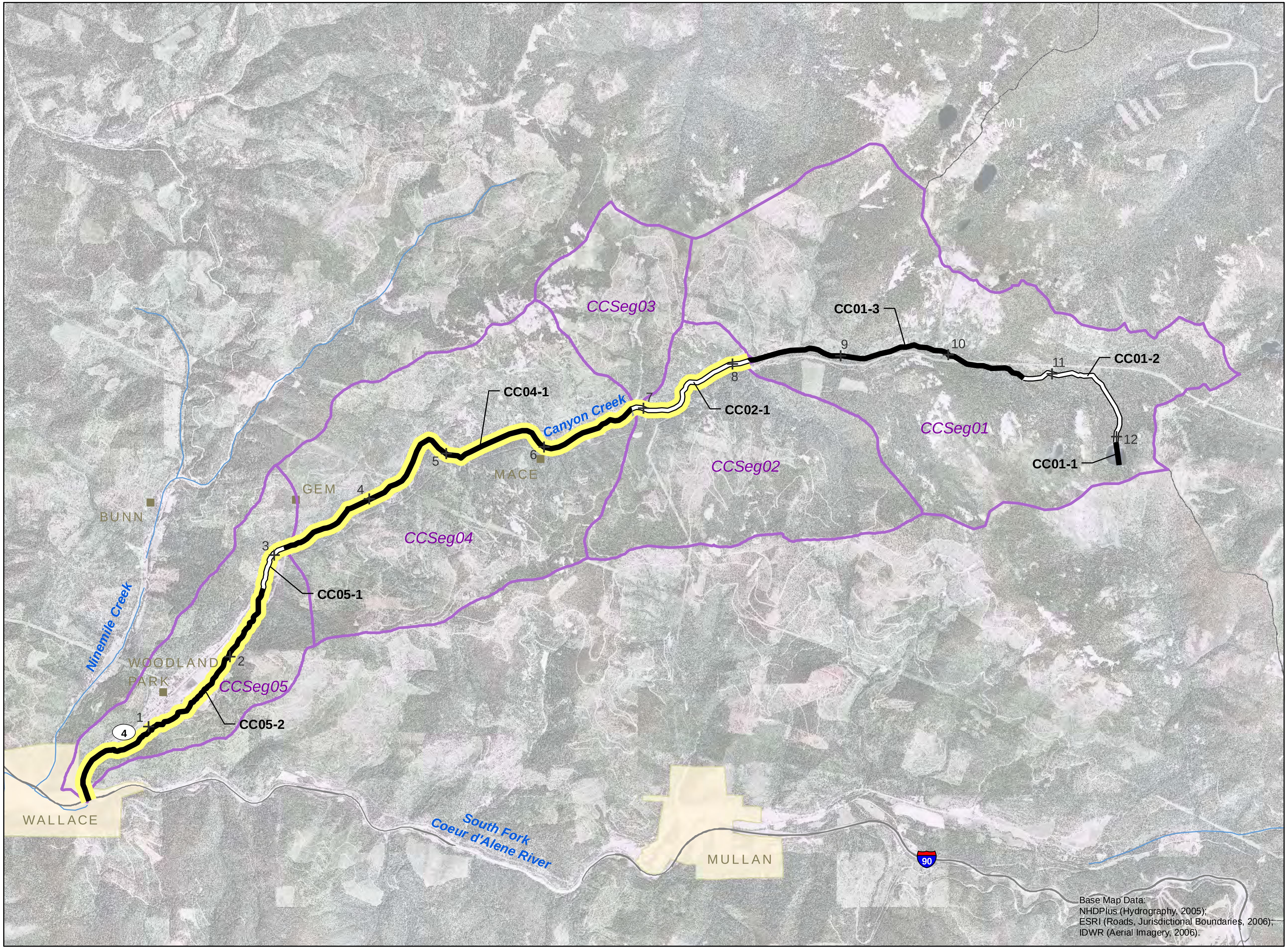


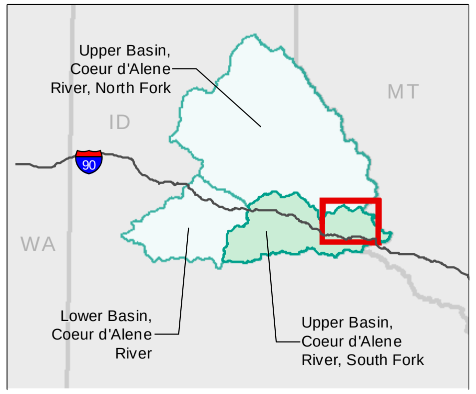
Notes:
CIA = Central Impoundment Area
CTP = Central Treatment Plant

[1]CTP effluent discharge pipeline may be conveyed to the SFCDR on the east side of the CIA (as pictured above) or along Bunker Creek.

N
0 2,000 4,000 Feet

Figure 12-17
Selected Remedy: Bunker Hill Box Remedial Actions
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site





+4 River Mile

River/Creek

Stream and Riparian Reach

CC01-1 (Stream and Riparian Reach ID)

City Limit

Watershed Segment

State Boundary

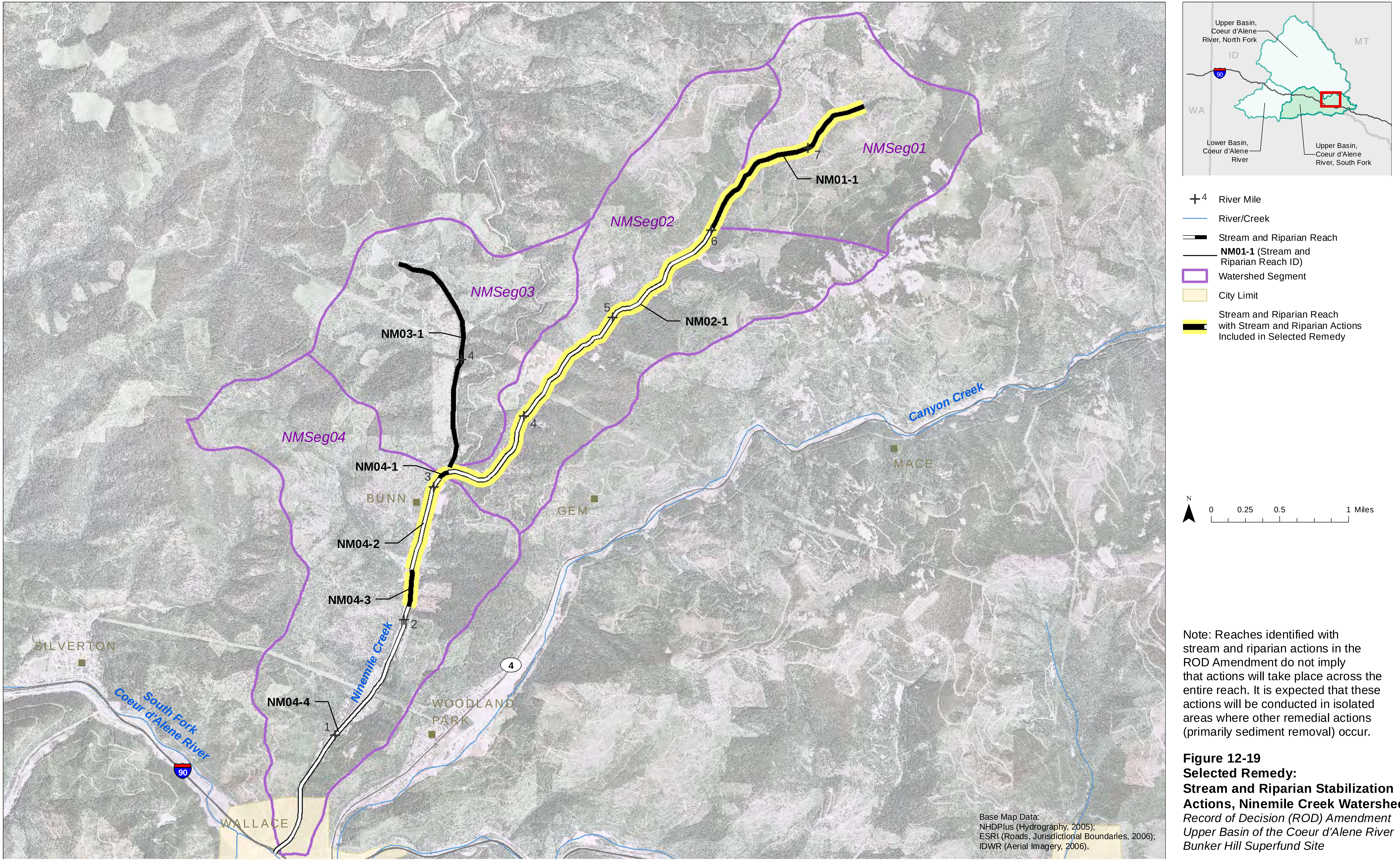
Stream and Riparian Reach with Stream and Riparian Actions Included in Selected Remedy

N

0 0.25 0.5 1 Miles

Note: Reaches identified with stream and riparian actions in the ROD Amendment do not imply that actions will take place across the entire reach. It is expected that these actions will be conducted in isolated areas where other remedial actions (primarily sediment removal) occur.

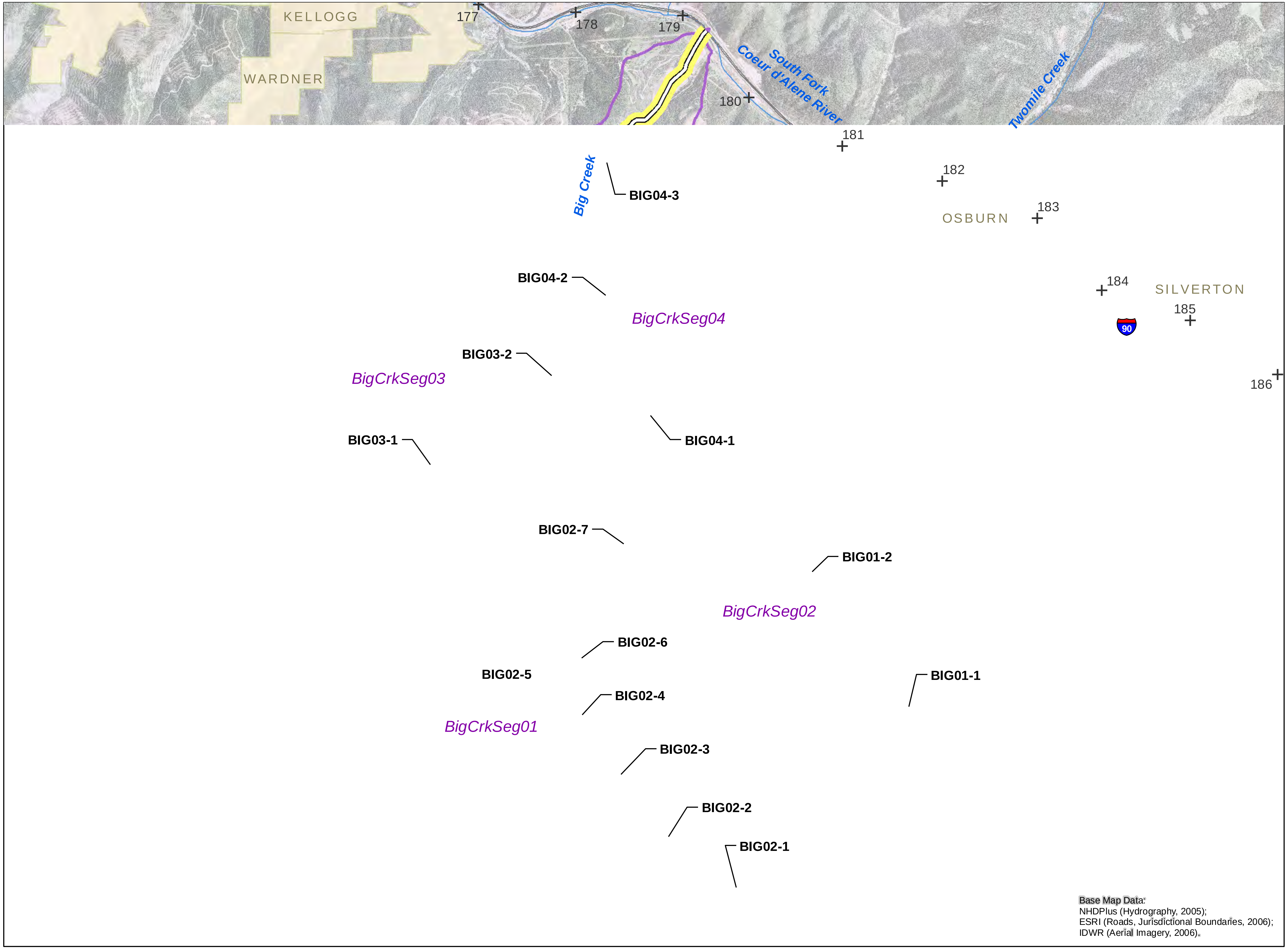
Figure 12-18
Selected Remedy:
Stream and Riparian Stabilization Actions, Canyon Creek Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

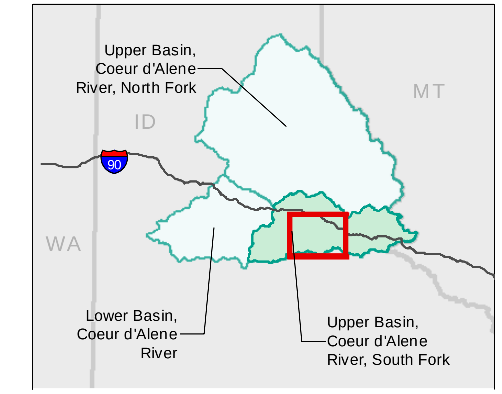


Base Map Data:
NHDPlus (Hydrography, 2005);
ESRI (Roads, Jurisdictional Boundaries, 2006);
IDWR (Aerial Imagery, 2006).

Note: Reaches identified with stream and riparian actions in the ROD Amendment do not imply that actions will take place across the entire reach. It is expected that these actions will be conducted in isolated areas where other remedial actions (primarily sediment removal) occur.

Figure 12-19
Selected Remedy:
Stream and Riparian Stabilization Actions, Ninemile Creek Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site



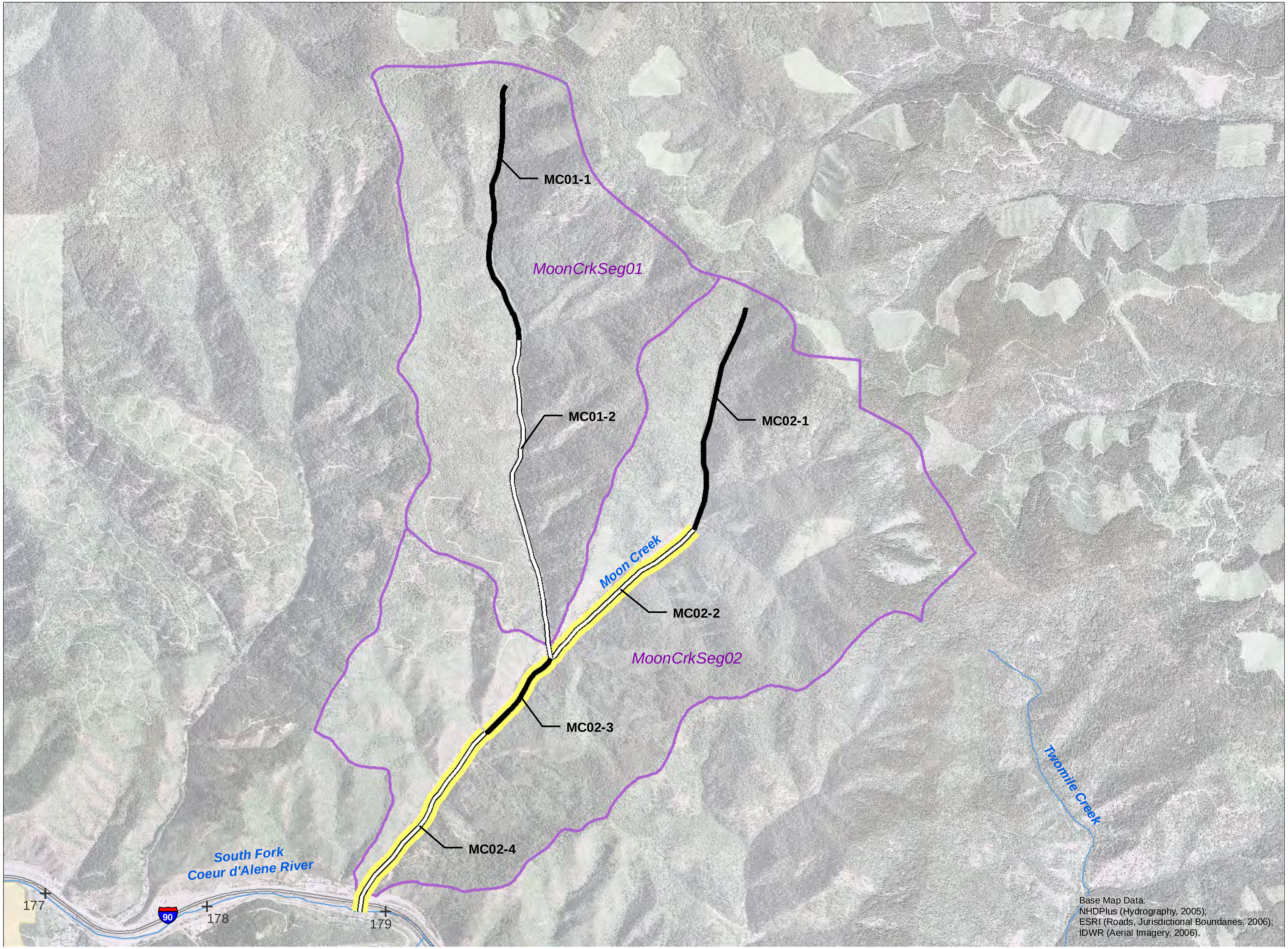


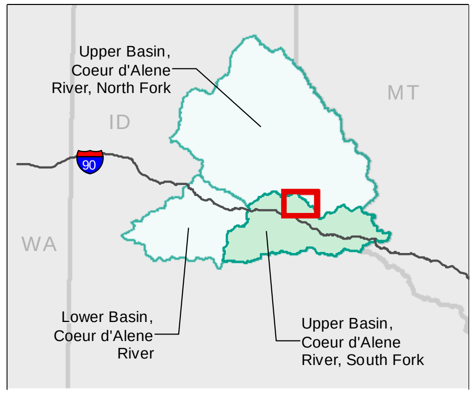
180 River Mile
River/Creek
Stream and Riparian Reach
BIG01-1 (Stream and Riparian Reach ID)
Watershed Segment
City Limit
Stream and Riparian Reach with Stream and Riparian Actions Included in Selected Remedy

N
0 0.25 0.5 1 Miles

Note: Reaches identified with stream and riparian actions in the ROD Amendment do not imply that actions will take place across the entire reach. It is expected that these actions will be conducted in isolated areas where other remedial actions (primarily sediment removal) occur.

Figure 12-20
Selected Remedy:
Stream and Riparian Stabilization Actions, Big Creek Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site





179 River Mile

River/Creek

Stream and Riparian Reach

MC01-1 (Stream and Riparian Reach ID)

Watershed Segment

Stream and Riparian Reach with Stream and Riparian Actions Included in Selected Remedy

N

0 0.125 0.25 0.5 Miles

Note: Reaches identified with stream and riparian actions in the ROD Amendment do not imply that actions will take place across the entire reach. It is expected that these actions will be conducted in isolated areas where other remedial actions (primarily sediment removal) occur.

Figure 12-21
Selected Remedy:
Stream and Riparian Stabilization Actions, Moon Creek Watershed
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

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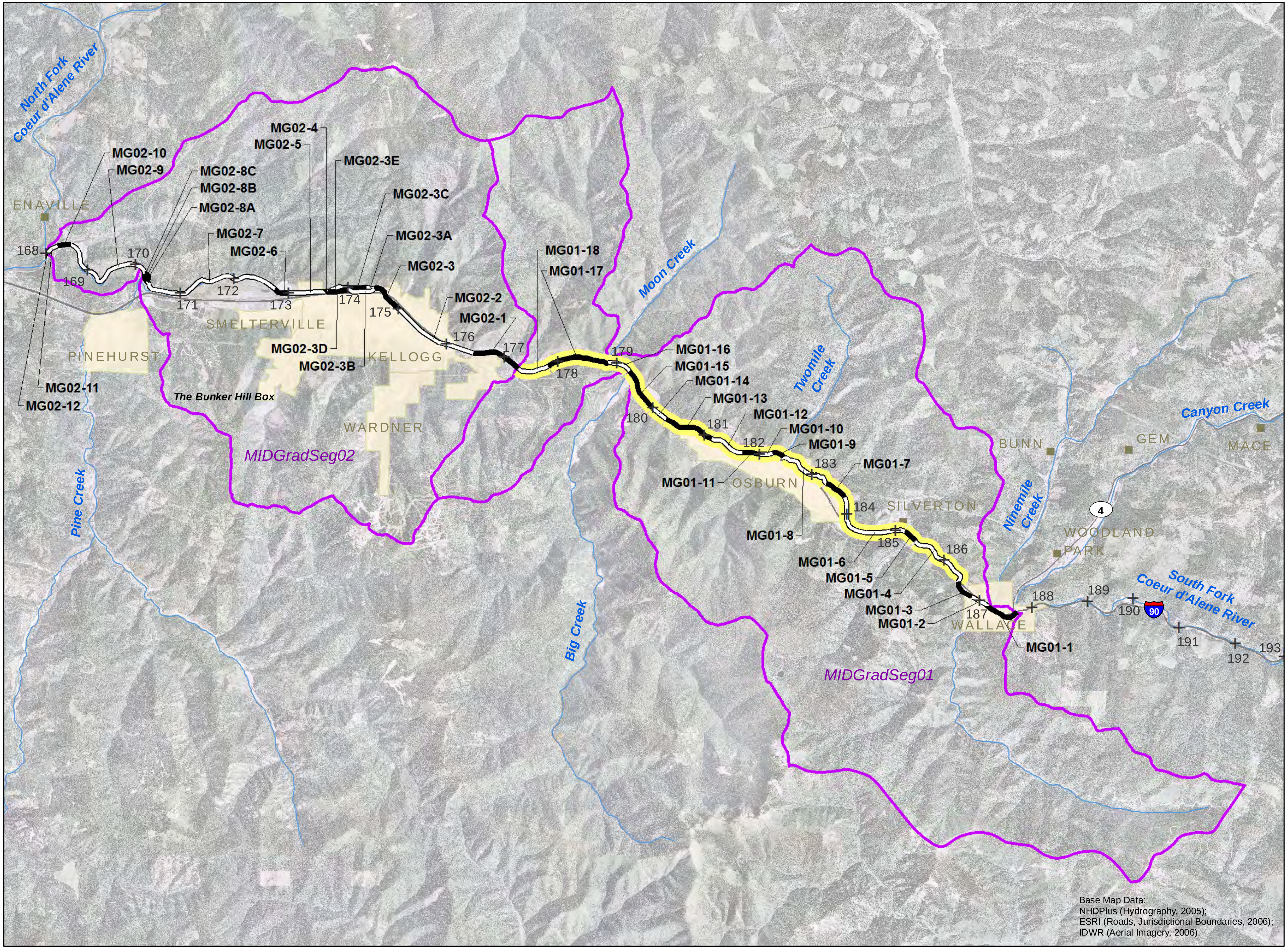
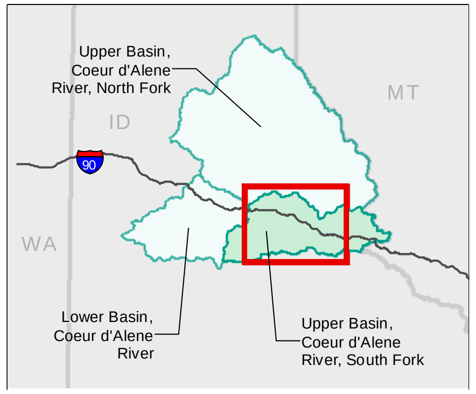
EPA





187 River Mile

River/Creek

Stream and Riparian Reach

MG01-1 (Stream and Riparian Reach ID)

Watershed Segment

City Limit

Stream and Riparian Reach with Stream and Riparian Actions Included in Selected Remedy

N

0 0.5 1 2 Miles

Note: Reaches identified with stream and riparian actions in the ROD Amendment do not imply that actions will take place across the entire reach. It is expected that these actions will be conducted in isolated areas where other remedial actions (primarily sediment removal) occur.

Figure 12-22
Selected Remedy: Stream and Riparian Stabilization Actions, Mainstem SFCDR Watershed

Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

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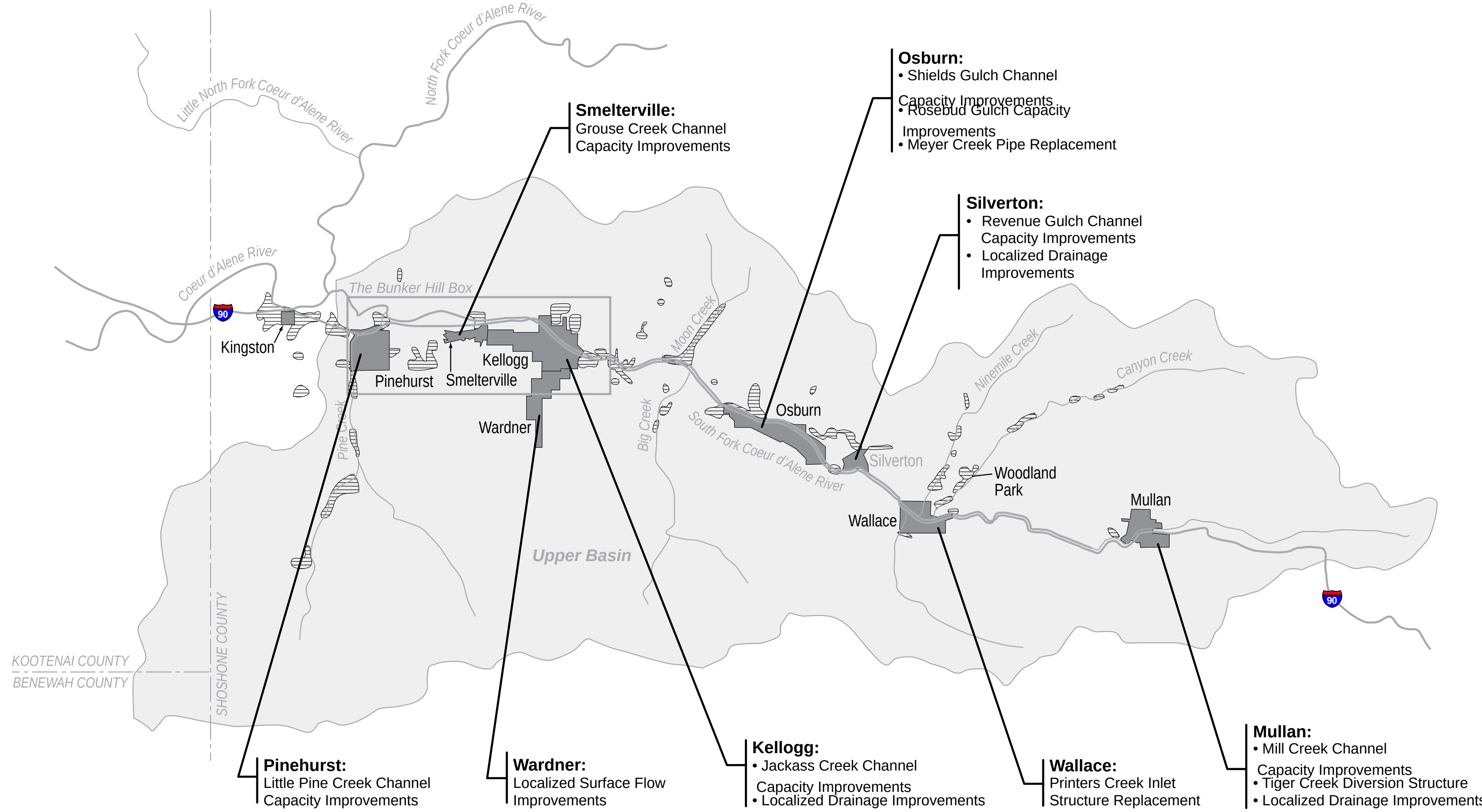

Approximate Remedy Protection Study Area

Approximate Area of Existing Remedies in Side Gulches

N 0 1 2 4 Miles

Figure 12-23
Selected Remedy: Remedy Protection Actions
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

EPA

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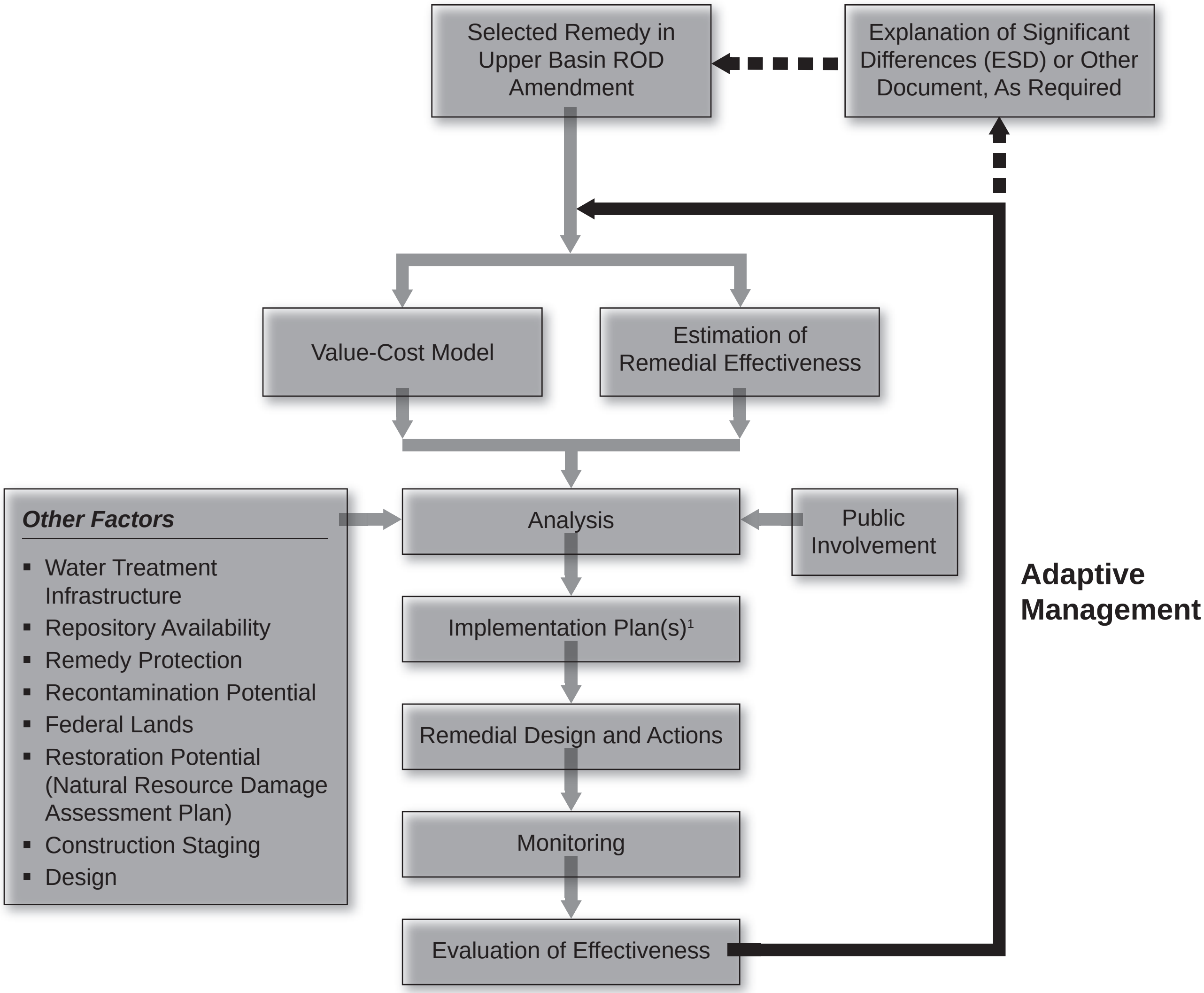

Note:
[1]The Implementation Plan will be routinely updated in collaboration with the Upper Basin Project Focus Team (PFT) and other stakeholders.

Figure 12-24
Adaptive Management Process
Record of Decision (ROD) Amendment
Upper Basin of the Coeur d'Alene River
Bunker Hill Superfund Site

Tables for Part 2

TABLE 2-1
Summary of Cleanup Actions in the ROD for OU 1
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Type of Action	Cleanup Actions[1]
Removal/ Replacement of Soils	If the 0-to-1-inch or 1-to-6-inch depth intervals exceed the threshold level, 6 inches of contaminated material will be excavated and replaced. In addition, if the 6-to-12-inch interval exceeds the threshold level, another 6 inches (total of 12 inches) will be removed and replaced. If the 6-to-12-inch interval does not exceed the threshold level, the property will have a 6-inch excavation and replacement.
	In the case where the 6-to-12-inch depth interval exceeds the threshold level but the 0-to-1-inch and 1-to-6-inch intervals do not, 12 inches of material will be excavated and replaced.
	If the 0-to-1-inch or 1-to-6-inch and the 6- to-12-inch depth intervals do not exceed the threshold level, the property will not be remediated.
	All produce garden areas in every yard will receive 24 inches of clean material. Clean soil for produce gardens will be made available to residents whose yards do not require remediation.
	If existing property grades permit, it is possible that no excavation of residential soils would be necessary and the cover material could be placed and revegetated without exceeding the height of the foundation.
	Areas immediately associated with the residential properties will not require topsoil, but will require replacement will clean material in kind or a permanent cover. Any steep hillside areas located immediately adjacent to yards and with a soil lead concentration greater than the threshold level will be stabilized as part of this action to prevent runoff and recontamination.
Visual Markers	For residential yards that require excavation to 12 inches, if the results of sampling in the 12-to-18-inch interval exceed the threshold level, a visual marker will be placed prior to backfilling with clean fill.
Revegetation	During the excavation process, all existing sod and soil coverings will be removed and disposed of along with the soil. Larger trees and shrubs will be left in place but subject to pruning. After spreading, compaction, and grading, clean fill will be revegetated. The land areas of remediated yards will generally be revegetated with sod. Steep hillsides and other remediated areas not currently planted with lawns will be stabilized and hydroseeded with native grasses. If preferred by a property owner, hydroseeding with native grasses could be substituted for the sod. Vacant lots will be hydroseeded with native grasses after remediation. To the extent practicable, all yard landscaping will be returned to its original condition.
Dust Suppression	Dust suppression will include, but not be limited to watering of residential yard areas prior to excavation activities, continued watering during excavation (as necessary), placement of tarps or covers over excavated materials, use of tarps or covers over truck beds to reduce blowing dust and spillage during transportation to the waste repository, and daily cleanup of all spilled or tracked soils from sidewalks, roadways, etc.

TABLE 2-1
Summary of Cleanup Actions in the ROD for OU 1
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Type of Action	Cleanup Actions[1]
Disposal of Contaminated Materials	The analysis of applicable or relevant and appropriate requirements (ARARs) associated with the disposal of contaminated residential soils assumed that the soils repository would be located within the Bunker Hill Superfund Site. It is recommended that Page Ponds be used for the disposal repository because it has adequate volume, is within the Bunker Hill Superfund Site, and the action will reduce the contaminated windblown dust originating from the Page Ponds area.
	The use of Page Ponds as the repository will require that it be capped to minimize airborne contaminant migration and reduce the threat of direct-contact exposure. The cap surface area will be compacted and graded to prevent ponding and minimize infiltration; it will also be vegetated for stabilization and moisture adsorption. Access to the area will be restricted by fencing, locked gates, and warning signs. Future use of the repository will be limited and subject to institutional controls.
Institutional Controls	Physical Program Requirements include the implementation of planning, zoning, and subdivision controls through local ordinances. When a barrier is broken, contaminated soils that are removed must be handled to minimize exposure, collected for disposal, and transported to a proper disposal site. Also, a program will be implemented to provide a centrally located supply of clean replacement soils.
	Administrative Program Requirements include coordination of public institutions, deed notices, educational programs, permitting and inspection procedures, and monitoring and health surveillance programs.
Monitoring	The effectiveness of the institutional controls program will be evaluated periodically. Appropriate air monitoring will be conducted to indentify the occurrence of contaminant migration during remedial activities. Any exceedances of the standards will result in immediate implementation of additional dust suppression measures or a shutdown of construction activities.
	Since contaminated materials will be left onsite, both in populated and non-populated areas, ongoing monitoring of fugitive dust and residential yards is necessary to ensure that the clean barriers are maintained.

[1] Source: Section 9.2 in the Record of Decision for Operable Unit 1 (U.S. Environmental Protection Agency, 1991a).

TABLE 2-2
Summary of Cleanup Actions in the ROD, ROD Amendments, and ESDs for OU 2
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Area	Cleanup Actions
1992 ROD for OU 2[1]	
Hillsides	Revegetation of eroding hillsides; installation of terraces; repair of riparian habitat and stream corridors; and installation of containment facilities at selected mine dumps.
Smelterville Flats	Removal of contaminated alluvium and jig tailings for constructed wetland systems and floodway construction; placement of permanent barrier to cover remaining jig tailings/alluvium mixtures, and revegetation; treatment of collected water and groundwater through constructed wetland; and revegetation of accessible areas not otherwise remediated.
Central Impoundment Area (CIA)	Placement of low-permeability cap and clean soil, with revegetation; collection and treatment of seepages from CIA closure; and excavation of material accumulations in the east cell to the Smelter Closure Area.
Page Ponds	Placement of jig tailing accumulations from West Page Swamps; excavation and revegetation of creek channels; regrading and capping of Page Tailing Impoundment with residential yard soil; and revegetation after placement of clean soil.
Smelter Complex and Mine Operations Area (MOA)	Removal of PCB- and asbestos-containing equipment and materials; treatment of principal threat material (PTM) accumulations and soil; channelization and lining of Government and Bunker Creeks with diversion and treatment of base flows; Upper Milo Creek excavation and channelization; construction of cutoff walls and surface water treatment at upper and lower Government Gulch; surface water treatment of Bunker Creek; closure of mill settling pond and gypsum ponds; closure of existing solid waste landfills; and demolition of Zinc Plants and Lead Smelter.
Rights of Way	Capping in non-populated areas, and removal and replacement in the Smelter Complex and MOA.
Commercial Buildings and Lots	Protective barrier on surface soil with lead concentrations exceeding 1,000 parts per million (ppm).
Residential Interiors	All homes with house dust lead concentrations greater than or equal to 1,000 ppm will have one-time cleaning.
1996 OU 2 ESD[2]	
Smelter Closure Area (SCA), A-1 Gypsum Pond, Zinc Plant, and Solid Waste Landfill	Placement of specific waste and demolition materials in the SCA rather than in onsite disposal cells.
1996 OU 2 ROD Amendment[3]	
Contaminated Soil	Containment of non-mercury-contaminated PTM rather than stabilization.
1998 OU 2 ESD[4]	
OU 2	Differences associated with the stabilization and removal of contaminated materials located in the tributary gulches within OU 2; the EPA financial contribution to the lower Milo Creek/Wardner/Kellogg pipeline system; placement of mine wastes from outside OU 2 into the CIA; and other components of the Selected Remedy for OU 2.

TABLE 2-2
Summary of Cleanup Actions in the ROD, ROD Amendments, and ESDs for OU 2
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Area	Cleanup Actions
2001 OU 2 ROD Amendment[5]	
Source Control	Identifies specific actions to reduce surface water infiltration into the Bunker Hill Mine.
Acid Mine Drainage (AMD) Collection within the Bunker Hill Mine	Continue to use the existing approach of collection of AMD by gravity flow from the upper workings, pumping from the lower workings, and drainage through the Kellogg Tunnel.
AMD Conveyance from Kellogg Tunnel to Central Treatment Plant (CTP)	Use of new pipeline constructed in 1999 to convey AMD from the Kellogg Tunnel to the lined storage pond; construction of a pipeline segment to bypass the lined pond and directly feed AMD to the CTP.
AMD Storage	**Surface Storage:** Use of the existing 7-million-gallon lined storage pond. **In-Mine Storage:** New gravity diversion system to route water from the upper workings into the mine pool during those times when the CTP is shut down for maintenance, or when the mine water flow exceeds treatment capacity. Upgrade of existing mine pool pumping system to pump diverted water back up from storage to the 9 level where it gravity-flows to the CTP.
AMD Treatment	An alternative to the wetlands treatment system identified in the 1992 ROD, which includes updating and upgrading the existing lime neutralization/high-density sludge treatment plant and adding tri-media filters. AMD and other sources of water currently treated at the CTP to be treated at the upgraded CTP, along with other Site waters identified in the 1992 ROD if treatment is determined to be necessary.
Sludge Management at the CIA	Maximized use of the existing unlined disposal area located in the CIA; capping of the existing unlined disposal area when capacity is reached; construction of a new lined disposal bed on the southeast corner of the CIA if cost-effective regional disposal capacity does not become available.
Remediation Goals/Discharge Limits	Discharge limits for the upgraded CTP are based on current Idaho water quality standards and national recommended water quality criteria for the contaminants of concern (aluminum, arsenic, cadmium, copper, iron, lead, mercury, manganese, selenium, thallium, silver, and zinc), as well as the CTP total maximum daily load (TMDL) limits for cadmium, lead, and zinc. Since there is no mixing zone for the CTP, the discharge limits are expected to be met where the CTP discharges into Bunker Creek and are based on the expected hardness of the effluent.

[1] Source: Record of Decision (ROD) for Operable Unit 2 (U.S. Environmental Protection Agency [EPA], 1992).

[2] Source: Explanation of Significant Differences for Revised Remedial Actions at the Bunker Hill Superfund Site (EPA, 1996a).

[3] Source: Table 2 in the 1996 ROD Amendment for OU 2 (EPA, 1996b).

[4] Source: Explanation of Significant Differences for Revised Remedial Actions at the Bunker Hill Superfund Site OU 2 (EPA, 1998b).

[5] Source: Table 1 in the 2001 ROD Amendment for OU 2 (EPA, 2001d).

TABLE 2-3
Summary of Cleanup Actions in the ROD for OU 3
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Medium/Area	Cleanup Actions[1]
Selected Remedy for Human Health Protection in Community and Residential Areas	
Soil and House Dust	Partial removal and replacement of residential soil with lead concentrations above 1,000 milligrams per kilogram (mg/kg); vegetative barriers to control or limit migration of soil between 700 and 1,000 mg/kg; and a combination of removals, barriers, and access restrictions at commercial and undeveloped properties and recreation areas.
	Reduction of individual house dust lead concentrations and loadings using information and intervention, vacuum loan program/dust mats, and interior source removals.
	Management of contaminated material by protecting barriers, disposal areas, and clean fill sources through institutional controls.
Drinking Water	Public information program and multiple alternative drinking water sources provided.
Aquatic Food Sources	Public information program, intervention, and monitoring of ingestion of aquatic food sources.
Selected Remedy for Ecological Protection in the Upper and Lower Coeur d'Alene Basins	
Upper Basin	Stabilization of stream beds and banks subject to erosion; implementation of runon/runoff controls; and construction of sediment traps.
	Construction of improvements to sewer and storm drain systems to reduce infiltration of contaminated groundwater.
Canyon Creek	Pilot and demonstration projects for treatment of creek water and groundwater near the mouth of Canyon Creek; implementation of water treatment or other technology based on the outcome of the demonstration project.
	Stabilization of stream banks and dumps.
	Remediation of mine/mill sites with human health exposures using a combination of access controls, capping, and removals.
Ninemile Creek	Removal of significant loading sources of metals to surface water.
	Metals-contaminated sediments and tailings placed in onsite or regional repository.
	Low-permeability caps constructed on tailings impoundments.
	Waste rock subject to erosion or leaching consolidated and contained above floodplain.
	Treatment of metals-contaminated water from seeps and five adits.
	Hydraulic controls/treatment as needed for metals loads to the environment that are not controlled by removal or containment.
	Bioengineering to stabilize stream beds and banks to mitigate mining impacts on riverine and riparian zones.
	Remediation of Day Rock mine and mill site using a combination of access controls, capping, and removals.

TABLE 2-3
Summary of Cleanup Actions in the ROD for OU 3
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Medium/Area	Cleanup Actions[1]
Pine Creek	Bank and bed stabilization, riparian zone revegetation, and removal of remaining localized areas with high metals concentrations.
	Stream improvements to mitigate environment impacts from mining, including regrading of stream reaches that go dry in the summer months.
South Fork Coeur d'Alene River (SFCDR) above Elizabeth Park	Stabilization and bioengineering of stream channel and banks to protect riverine and riparian receptors, with associated hot spot removals in upper floodplain.
	Remediation of mine/mill sites with human health exposures using a combination of access controls, capping, and removals.
SFCDR (Elizabeth Park to Confluence with the North Fork Coeur d'Alene River, including the Bunker Hill Box)	Hydrogeologic investigation: surface water and groundwater interaction monitoring and modeling.
	Coordination with remedial activities within the Box; includes actions such as controlling loads to surface water from the Central Impoundment Area (CIA) and upgrading the central treatment plant (CTP).
Lower Basin Stream Banks and Beds, including the Harrison Delta (Riparian and Riverine)	Goal is to implement complete removal of contaminated bank wedges from highly erosive areas. Where complete removal is not feasible, partial removal may be followed by capping with clean topsoil to enhance vegetation establishment and isolate contaminants from receptors.
	Stabilization of banks and revegetation of removal areas to protect riparian zone ecological receptors and humans.
	Construction and operation of sediment traps at four splay areas where the river overflows its banks during high-flow conditions, following a pilot study in one area.
	Periodic removal of river bed sediments in Dudley reach or other natural depositional areas identified during remedial design.
Lower Basin Floodplain	Reduction of exposure using a combination of removals, capping, and soil amendments in areas of high waterfowl use, high lead, road access, and relatively low recontamination potential. Human health concerns also to be addressed in identified areas.
	Identification of agricultural and other areas with lower levels of lead for cleanup to provide additional clean feeding areas.

[1] Source: Tables 12.1-2 and 12.2-1 in the Record of Decision for Operable Unit 3 (U.S. Environmental Protection Agency, 2002).

TABLE 2-4
Summary of Previous Investigations and Studies in the Upper Basin, 2001 through 2011
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Location	Study Name	Responsible Party	Date	Description	Key Conclusions	Reference
Bunker Creek						
Bunker Creek	Bunker Creek Pilot Study	U.S. Environmental Protection Agency (EPA)	2008	The purposes of the Bunker Creek Pilot Study were to collect data required (1) to evaluate the effectiveness of a potential Phase II remedial action (i.e., lining Bunker Creek) towards improving water quality, and (2) for Bunker Creek remedial design. The Bunker Creek Pilot Study focused on simulating conditions in the Bunker Creek area that would be anticipated to occur if the Bunker Creek channel were lined.	During the study, it became apparent that it would not be possible to conduct the pilot study for a sufficient amount of time for the relatively large hydrologic system in the area to reach steady-state conditions. Therefore, the purpose became collecting the data necessary to evaluate the effectiveness of the remedial action (i.e., lining Bunker Creek) using a transient numerical groundwater flow model to estimate conditions at steady state. A more in-depth evaluation of the potential water quantity and quality impacts resulting from lining the Bunker Creek channel will be presented in future documents that will detail the groundwater modeling results, predicted water quality impacts, and remedial action alternatives analyses. Key findings of data collection: • The diversion of the Central Treatment Plant (CTP) effluent from Bunker Creek resulted in no discharge being present in Bunker Creek from the CTP outfall downstream to approximately 500 feet above the confluence with Magnet Gulch. The discharge measured in Bunker Creek below Magnet Gulch was predominantly from the A-4 Gypsum Pond French drain in Magnet Gulch. • Elevated metals detected in Bunker Creek channel sediments likely serve as the source of dissolved metals contamination to the underlying alluvial aquifer when infiltration of surface water occurs. • Dissolved metals concentrations significantly increased from Monitoring Station BH-MG-0001 to the mouth of Magnet Gulch at Bunker Creek, likely from contaminated groundwater from the French drain at the toe of the A-4 Gypsum Pond. Dissolved metals from Magnet Gulch may be the largest source of dissolved metals in Bunker Creek surface water under low-flow conditions. • The simulated lining of Bunker Creek did not hydrologically affect the shallow alluvial aquifer. • The simulated lining of Bunker Creek did not appear to affect dissolved metals concentrations in groundwater. • Hardness declined in groundwater in the Bunker Creek corridor, potentially indicating (1) the losing sections of Bunker Creek and (2) groundwater flow pathways from the Bunker Creek corridor to the South Fork Coeur d'Alene Basin (SFCDR). The change in hardness may also be indicative of large-scale processes within the aquifer. • Dissolved cadmium and dissolved zinc concentrations measured from the three SFCDR monitoring stations appeared unaffected by the Bunker Creek lining simulation, while dissolved lead concentrations declined.	Bunker Creek Pilot Study Summary Tech. Memo. (CH2M HILL, 2009b)
Canyon Creek						
Canyon Creek	Canyon Creek Hydrologic Study	EPA	2006	This study was designed to gain a better understanding of the hydrologic system within Canyon Creek from 2006-2007. The study encompassed stream stage installation, aquifer testing, groundwater sampling, groundwater flow modeling, and remedial action strategy evaluations.	To improve the understanding of the hydrologic conditions of the Canyon Creek area, additional monitoring wells and stream stage gauging devices were installed to collect information regarding groundwater levels, aquifer properties, horizontal and vertical hydraulic gradients, the extent of surface water/groundwater interaction, and the spatial distribution of groundwater quality. From this information, a groundwater modeling tool was developed for the site and used to evaluate the reduction in metals loading to Canyon Creek that would be achieved by implementation of various water management options. These treatment options generally fell into three categories: passive water collection, active water collection, and passive water collection with stream lining. Fifteen simulations with different treatment options were made. Those that resulted in the greatest simulated reduction to the zinc loading of Canyon Creek were Creek Lining A1-A6; French Drain A1-A6 with A1 & A6 Cut-offs (High Flow); French Drain A1-A6 with A6 Cut-off (High Flow); and French Drain A2-A6 with A6 Cut-off (High Flow).	Canyon Creek Hydrologic Study Report (CH2M HILL, 2007a)

TABLE 2-4
Summary of Previous Investigations and Studies in the Upper Basin, 2001 through 2011
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Location	Study Name	Responsible Party	Date	Description	Key Conclusions	Reference
Canyon Creek	Canyon Creek Water Treatment Technology Evaluation	EPA	2005	This memorandum summarizes water treatment work to date for Canyon Creek and provides recommendations for future treatability testing.	Only technologies appropriate for the low-flow/high-concentration scenario are recommended for evaluation in the Phase II Treatability Study, because this scenario represents the most promising approach for achieving the Record of Decision (ROD) benchmark in the most cost-effective manner. Technologies proposed for testing as part of the Phase II Treatability Study include *ex situ* reactive media (limestone, dolomite, brucite, periclase, di-calcium silicate, and possibly others), an *ex situ* sulfate-reducing bioreactor (SRB), and the high-density sludge (HDS) process. Data gaps related to surface water/groundwater interactions at the site remain, and there is some uncertainty as to the corresponding reduction in dissolved metals concentrations in surface water that would be achieved by treating nearby groundwater.	Canyon Creek Water Treatment Technology Evaluation Tech. Memo. (CH2M HILL, 2005)
Canyon Creek	Canyon Creek Groundwater Metal Source Characterization	Idaho National Laboratory (INL)	2006	This document presents the findings of the metal speciation study conducted in Canyon Creek. The purpose of this study was to develop the capability to predict leaching rates from Canyon Creek alluvium.	This project was designed as a preliminary study of metal speciation in and metal releases from Canyon Creek sediments in an effort to help understand the factors that affect metal mobility (with focus on zinc, cadmium, and lead). Three groups of experiments were conducted: (1) sequential extraction tests to determine the operational speciation of the metals in the sediment, (2) leaching tests to determine the rate of release of metals under various chemical conditions, and (3) column leaching tests to provide insight into the time scales for removal of the metals from the sediments. • Results of the sequential extraction tests showed that approximately 40 percent of the Zn, Cd, and Pb removed during the sequential extractions came from fractions considered easily leached, 20 percent from fractions considered very difficult to leach, and the remaining 40 percent from fractions for which leachability depends on the pH of the system. • Leaching tests were conducted to determine how ionic strength and pH affected the rates of leaching and the concentration of leached metals. The concentrations of Zn, Cd, and Pb were fairly constant during the time period of the extraction experiments. The leaching rate of Pb and Zn appeared to decrease over time, while Cd appeared to increase over time. • The column was operated for 41 days, over which time the concentrations of Zn, Cd, and Pb declined monotonically by more than a factor of 10. Study recommendations are to (1) determine the spatial variability of metal fractions in the alluvium, (2) develop better measurements and models for groundwater/surface water interactions, and (3) establish a sound conceptual/quantitative model for the groundwater hydrology.	Canyon Creek Groundwater Metal Source Characterization (INL, 2007)
Canyon Creek	Canyon Creek Lime Neutralization Pilot Study	Rust	2003 - 2006	Rust's August 2003 memo described treatment of Canyon Creek water by conventional lime neutralization followed by settling ponds. Clean Water Act (CWA) funding was obtained to prepare the design of a pilot-scale system.	Pioneer Technical Services (Pioneer) was contracted to prepare a pilot-scale design of the system. The design was composed of three treatment cells, the first two with 2 days of retention time, and the third with 3 days of retention time. The design flow rate to the system was 300 gallons per minute (gpm). The total pilot system area was 15 acres. System effluent was discharged through infiltration. Due to funding uncertainties, the schedule for this study is not known at this time.	Canyon Creek Water Treatment Memorandum (Rust, 2003); Canyon Creek Pilot-Scale Lime Lagoon Treatment System Presentation (Pioneer, 2006); 100% Conceptual Design for the Canyon Creek Pilot-Scale Lime Lagoon Treatment System (Pioneer, 2007).

TABLE 2-4
Summary of Previous Investigations and Studies in the Upper Basin, 2001 through 2011
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Location	Study Name	Responsible Party	Date	Description	Key Conclusions	Reference
Canyon Creek	Canyon Creek Preliminary Design Data Review	EPA	2006	This memorandum summarizes historical analytical data collected from the lower Canyon Creek drainage area and outlines pertinent aspects of the data set. Collected data have been categorized and incorporated into a database and will be used to support the development of the remedial design for Canyon Creek.	This memorandum summarizes the data sources available for the following matrices: groundwater; surface water; surface soil; subsurface soil; sediment; and rock, gravel, and cobbles.	Canyon Creek Preliminary Design Data Review Tech. Memo. (CH2M HILL, 2006c)
Canyon Creek Gem Portal Pilot	Gem Portal Pilot Study	Bureau of Land Management (BLM), Silver Valley Natural Resources Trust (SVNRT), EPA	2000 - 2008	A pilot system was created by Asarco (10 gpm) for treatment of drainage from the Gem Portal. Evaluation of the Gem Portal Pilot Water Treatment System in the context of Canyon Creek water treatment continued until BLM removed the pilot system in 2008. This report presents the findings of pilot-and bench-scale water treatment tests conducted at the Gem Portal drainage. The treatment systems included a pilot-scale anaerobic biological treatment system, a bench-scale lime precipitation system, and a pilot-scale floating sand filter.	The treatment systems tested did not achieve the degree of metals removal needed to meet water quality discharge objectives in the effluent.	Engineering Evaluation/Cost Analysis for the Gem Portal Drainage (Asarco, 2004)
Canyon Creek Water Treatment Pilot Study	Phase I Pilot Test	EPA	2004	Bench-scale testing was conducted to evaluate the effectiveness of lime addition for metal precipitation in various combinations with pH adjustment and addition of iron coagulants for iron co-precipitation. Solids/liquid separation testing was also conducted on the resulting solution using flocculants and ballasted microsand.	The results of the study confirmed that lime addition is effective for precipitation of metals.	Canyon Creek Treatability Study Phase I Report (URS, 2005)
Canyon Creek Water Treatment Pilot Study	Phase II Pilot Test	EPA	2005 - 2006	The Canyon Creek Phase II treatability study consisted of two main components. The first component was a laboratory screening of reactive media bed (RMB) and SRB treatment of Canyon Creek groundwater. The second component was a field pilot test of HDS treatment of Canyon Creek groundwater, HDS treatment of Canyon Creek groundwater combined with Bunker Hill Mine water, and SRB treatment of Canyon Creek groundwater (using two different SRB media mixtures). The laboratory screening indicated that the RMB technology did not produce favorable results. The SRB results were favorable, and continued in the pilot study. The pilot test resulted in favorable results using the HDS treatment. Based on pilot test results, larger, longer-term pilot testing of the SRB treatment is recommended.	The HDS-A1 pilot plant, treating Canyon Creek groundwater only, developed a moderately dense sludge, but the percent solids concentration was limited by the relatively low concentrations of influent metals (compared to other HDS systems). The system reached an equilibrium sludge concentration of 10 to 12 percent solids at final dilution within about 2 weeks of operation. While this percent solids level is low compared to other HDS plants, it is considerably higher than in conventional lime neutralization systems (typically ~1 to 3 percent solids) and, therefore, represents a marked reduction in waste sludge volumes generated compared to that type of process. The modest difference between the percent solids of thickener underflow and sludge at final dilution, as well as the major amount of amorphous material found by x-ray diffraction (XRD) analysis, suggest that the HDS-A1 sludge was only partially characteristic of true high-density sludge. The HDS-B pilot plant, treating a combination of Canyon Creek groundwater and Bunker Hill AMD (in a 2:1 volume ratio), developed dense sludge within 1 week of operation. The equilibrium sludge solids were about 25 percent at final dilution. The relatively large difference between the percent solids of thickener underflow and at final dilution indicates the more free-draining nature typical of high density sludge. The major amount of poorly crystalline material found via XRD analysis of HDS-B sludge provided additional evidence of high density sludge characteristics. Both HDS-A1 and HDS-B achieved high removal efficiencies for dissolved Zn and Cd (>99 percent). The HDS-B pilot results indicate that treatment of Canyon Creek groundwater in conjunction with Bunker hill AMD at the CTP is feasible.	Canyon Creek Phase II Treatability Study Draft Report (CH2M HILL, 2006b)

TABLE 2-4
Summary of Previous Investigations and Studies in the Upper Basin, 2001 through 2011
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Location	Study Name	Responsible Party	Date	Description	Key Conclusions	Reference
Ninemile Creek						
Ninemile Creek	Ninemile Creek Pre-Design Investigation	Asarco Trust	2011	This investigation made use of Light Detecting and Ranging (LIDAR) topographical data combined with onsite observations and measurements to refine the estimates of waste volumes for selected sites within the Ninemile Creek Watershed and to identify a location to be used as a local waste consolidation area.	As a result of data collected during this effort, the estimated volumes of waste at some sites within the Ninemile Creek Watershed were refined. In addition, a location was identified within the watershed that was deemed to be suitable for a waste consolidation area. Therefore, where the TCD for disposal in a regional repository had been applied to sites within the Ninemile Creek Watershed in the Proposed Plan, the TCD was modified for the Selected Remedy to reflect disposal in the local waste consolidation area.	Focused Feasibility Study (FFS) Report for the Upper Basin (EPA, 2012)
Operable Unit 2						
OU 2	OU 2 Direct-Push Field Investigation	EPA	2008	This study is a summary of the installation of piezometers and metals concentration data in soil within OU 2.	During the OU 2 Direct-Push Investigation, 315 soil samples were collected from 38 soil borings advanced into the upper alluvium of OU 2. These samples were submitted for laboratory analysis for Contract Laboratory Program (CLP) Target Analyte List (TAL) metals. Continuous composite samples for laboratory analysis were collected from each boring that was converted to a temporary piezometer. Conclusions from this sampling include: • The highest cadmium concentrations generally coincided with the tailings-affected soils in the areas from the Silver Mountain Resort parking lot west through the Bunker Creek corridor. The vertical extent of elevated cadmium concentrations was also consistent with lithologic observations of disturbed soils as described previously. Elevated cadmium concentrations were observed in all areas investigated in OU 2. • Lead concentrations exceeded the principal threat material threshold of 84,600 mg/kg in two soil borings located near the CTP and along the lower portion of Bunker Creek. The highest lead concentrations present in subsurface soils coincided with the observed tailings-impacted soils, which are primarily located between the Silver Mountain Resort parking lot west through the Bunker Creek corridor. Elevated lead concentrations were observed in most areas investigated in OU 2. • Elevated zinc concentrations were observed in soil from most soil borings advanced in OU 2. The highest zinc concentrations were observed in soil borings in the lower portion of Bunker Creek and in the Slag Pile area. These concentrations coincide with lithologic observations of tailings-affected soils in this area. Other significant zinc concentrations were measured in the eastern portion of the City of Kellogg, the West End Natural Infiltration (WENI) area, and near the Page wastewater treatment ponds.	OU 2 Direct-Push Field Investigation Summary Tech. Memo. (CH2M HILL, 2009a)
Operable Unit 3, Upper Basin						
OU 3	OU 3 Remedial Investigation	EPA	2001	The Remedial Investigation (RI) Report provides detailed discussion of geologic and hydrogeologic conditions, the nature and extent of contamination, and fate and transport processes. The probabilistic model is introduced and used to estimate discharges of metals from tributaries to the SFCDR. An initial conceptual site model (CSM) for the watershed was developed from the RI. Source areas are identified and characterized.	Beginning in 1997, EPA collected samples of soil, sediment, groundwater, surface water, and other environmental media (e.g., indoor dust, lead-based paint, and garden produce) as part of the RI. To guide field sampling efforts, a generic Field Sampling Plan and Quality Assurance Project Plan were prepared that included descriptions of methods that would be used to collect and analyze samples, conduct field measurements, and manage data. More than 10,000 samples were collected to support the RI. These samples, combined with the 7,000 additional samples collected independently by The Idaho Department of Environmental Quality (IDEQ), the U.S. Geological Survey (USGS), the mining companies, EPA under other regulatory programs (e.g., the National Pollutant Discharge Elimination System [NPDES] program, and others, provide a solid basis to support informed risk management decisions for Coeur d'Alene Basin mining waste contamination. However, the large geographic area of the Basin made it impractical to collect sufficient data to fully characterize each source area or watershed. Further data collection will be necessary to support remedial design for areas identified as requiring cleanup.	Remedial Investigation Report, Coeur d'Alene Basin Remedial Investigation/Feasibility Study (EPA, 2001b)

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Summary of Previous Investigations and Studies in the Upper Basin, 2001 through 2011
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Location	Study Name	Responsible Party	Date	Description	Key Conclusions	Reference
OU 3	Coeur d'Alene Basin Feasibility Study	EPA	2001	The Feasibility Study (FS) Report identifies and screens remedial alternatives based on criteria from the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). A description of how each alternative would be implemented is provided. The FS Report also provides estimates of pre- and post-remediation mass loadings from watersheds within the Upper Basin that were developed using the probabilistic model.	Human health alternatives were developed for residential and community areas of the Upper and Lower Basins. Sets of alternatives were developed for each of the primary potential exposure medium:• Soil: (1) No Action, (2) Information and Intervention, (3) Information and Intervention and Access Modifications, (4) Information and Intervention and Partial Removal and Barriers, and (5) Information and Intervention and Complete Removal.• Drinking Water: (1) No Action, (2) Public Information, (3) Public Information and Residential Treatment, (4) Public Information and Alternative Source, (5) Public Information and Alternative Source, Groundwater, and (6) Public Information and Multiple Alternative Sources.• House Dust: (1) No Action, (2) Information and Intervention and Vacuum Loan Program/Dust Mats, and (3) Information and Intervention, Vacuum Loan Program/Dust Mats, Interior Source Removal, and Capping/More Extensive Cleaning.• Aquatic Food Sources: (1) No Action, (2) Information and Intervention, and (3) Information and Intervention and Monitoring. For the 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 the migration of metals from soil and sediment to surface water, and was retained as a pathway throughout the FS analysis. Six ecological alternatives were developed for remediation of the Upper and Lower Basins: • 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	Feasibility Study Report, Coeur d'Alene Basin Remedial Investigation/Feasibility Study (EPA, 2001c)
OU 3	Dissolved Cadmium, Zinc and Lead Loads from Ground-Water Seepage into the South Fork Coeur d'Alene River System	U.S. Geological Survey (USGS)	1999	The seepage study described and quantified changes in stream flow and metals loading from groundwater in the drainages of the SFCDR. This study provides key hydrogeologic information for watersheds within the Upper Basin.	The Barton study described and quantified changes in stream flow and metals loading from groundwater in the South Fork Coeur d'Alene River environmental system. This study provides key hydrogeologic information, including identification of gaining and losing reaches, for lower Canyon Creek and the SFCDR near Osburn, and quantification of the mass loading associated with each. The study focused on three stream reaches: a 3.3-mile reach of Canyon Creek near Woodland Park, a 4.8-mile reach of the SFCDR near Osburn, and a 6.5-mile reach of the SFCDR near Kellogg. During the July, September, and October seepage studies, gains in zinc and cadmium loads to the three reaches were predominantly from groundwater seepage. Following are additional conclusions: • The overall average gain in dissolved zinc from groundwater seepage to the SFCDR near Kellogg was 730 pounds per day (lb/day). • The net gains in dissolved zinc from groundwater seepage to Canyon Creek near Woodland Park and the SFCDR near Osburn were 150 and 218 lb/day, respectively. • The gain in dissolved cadmium load into the three reaches from groundwater seepage was about two orders of magnitude less than the increase in dissolved zinc. • Canyon Creek at Woodland Park was the only study reach where groundwater seepage contributed to dissolved lead load (a gain of 1.5 lb/day). Dissolved zinc concentration and stream discharge data collected during this study were downloaded from the U.S. Geological Survey website and incorporated into the Upper Basin database.	Dissolved Cadmium, Zinc, and Lead Loads from Ground-Water Seepage into the South Fork Coeur d'Alene River System, 1999 (Barton, 2002)

TABLE 2-4
Summary of Previous Investigations and Studies in the Upper Basin, 2001 through 2011
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Location	Study Name	Responsible Party	Date	Description	Key Conclusions	Reference
OU 3	Soil Amendment Study	IDEQ, EPA, U.S. Fish and Wildlife Service (USFWS)	2001 - 2004	This is a two-pronged collaborative study using both laboratory and field studies to evaluate effectiveness of phosphate-based soil amendments to reduce the bioavailability and leachability of heavy metals.	The field leachability study was implemented by IDEQ. In the study, four 20-foot by 20-foot plots were established at both Black Rock Slough and Bull Run Lake. The plots at each site were subjected to the following applications: amendment with fishbone apatite (ground fish bone); amendment with liquid phosphate fertilizer (phosphoric acid), calcium carbonate, and potassium chloride; amendment with calcium carbonate/lime; and an unaltered control. The soil and pore water or shallow groundwater was sampled by IDEQ for 16 months to assess how the amendments affected the soil and pore water chemistry under field conditions. The pore water analyses and soil leaching data indicate the following chemical changes: • Phosphate amendments reduce the leaching of lead from soil using the toxicity characteristic leaching procedure (TCLP) extraction method; • Because the lime did not completely neutralize the acidity of the phosphate amendment, a short-term increase in soluble cadmium and zinc pore water concentrations was observed; • The amendments caused a short-term increase in soluble arsenic in the treated soils, while arsenic concentrations in pore water returned to pretreatment levels; and • Soluble phosphorus did not increase in soils treated with fishbone apatite but did show an increase in soils treated with liquid phosphate fertilizer, which appears to be decreasing with time. This may be related to the form in which the phosphate was added (e.g., liquid vs. solid). Further study is needed to resolve questions concerning optimal application rates, long-term stability, ecological impacts, and potential seasonal effects. Evaluate findings of follow-up study and, as appropriate, conduct further evaluations of technical feasibility of soil amendments.	Second Five-Year Review Report (EPA, 2005)
OU 3	OU 3 Direct-Push Field Investigation	EPA	2008	This study is a summary of field investigations, including the installation of piezometers and analysis of metals concentration data in soil.	The OU 3 Direct Push Investigation was implemented as planned and has provided needed data, for the development of the groundwater conceptual model for the Osburn Flats area. The lithologic data collected have also been used in the development of the numerical groundwater flow model for the SFCDR watershed, which was used to evaluate remedial options throughout the basin in the 2011 Focused Feasibility Study (EPA, 2012). Conclusions from this investigation are: • Cadmium concentrations in Osburn Flats area soils ranged from nondetect to 144 milligrams per kilogram (mg/kg). The highest cadmium concentrations were typically identified between 0 and 10 feet below ground surface (bgs). • Lead concentrations ranged from 8.9 mg/kg to 24,300 mg/kg, with the highest lead concentrations typically between ground surface and 10 feet bgs. • • Zinc concentrations ranged from 27 mg/kg to 25,200 mg/kg; likewise, the highest concentrations were between ground surface and 10 feet bgs.	OU 3 Direct-Push Field Investigation Summary Tech. Memo. (CH2M HILL, 2009i)
OU 3	Upper Coeur d'Alene Basin Focused Feasibility Study	EPA	2009-2010	This Focused Feasibility Study (FFS) built upon the work in the 2001 FS (EPA, 2001c) to develop and evaluate comprehensive remedial alternatives for the Upper Basin. The analyses contained within the FFS Report supported the Preferred Alternative presented in the Proposed Plan and also support the Selected Remedy presented in this ROD Amendment.	Ten (10) remedial alternatives, plus a no action alternative, were evaluated. These included two alternatives for OU 3 combined with five alternatives for OU 2. The two alternatives for OU 3 were based upon Ecological Alternatives 3 and 4 in the 2001 FS Report (EPA, 2001c). Ecological Alternatives 3 and 4 were updated based on information and data collected since 2002 and combined with the five alternatives for OU 2 to create the 10 remedial alternatives for the Upper Basin. In addition, two remedy protection alternatives were evaluated to provide protection of existing Selected Human Health Remedies that are vulnerable to erosion or recontamination through tributary flooding and high-precipitation events.	FFS Report for the Upper Basin (EPA, 2012)

TABLE 2-4
Summary of Previous Investigations and Studies in the Upper Basin, 2001 through 2011
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Location	Study Name	Responsible Party	Date	Description	Key Conclusions	Reference
OU 3	2011 Upper Coeur d'Alene Basin Focused Characterization Sampling Program	EPA	2011	The objective of the Program was to obtain characterization information on selected mine and mill sites" in the Upper Basin to evaluate whether the sites should be retained in or removed from the Selected Remedy presented in this Record of Decision (ROD) Amendment for the Upper Basin.	Based on arsenic and lead concentrations in soil, the results of the 2011 Focused Characterization Sampling Program indicated that 42 sites and their associated remedial actions were candidates for removal from the Selected Remedy. These sites have been removed from the Selected Remedy, as documented in Section 14.0 of this ROD Amendment.	FFS Report for the Upper Basin (EPA, 2012)
South Fork Coeur d'Alene River						
SFCDR (and Tributaries)	2008 High-Flow and Low-Flow Surface Water Study	EPA	2008	The primary purpose of the 2008 High-Flow and Low-Flow Surface Water Study was to conduct surface water quality monitoring during seasonal high-flow and low-flow conditions in order to characterize impacts on surface water quality, and to determine the relative contribution from major contaminant source areas identified in the RI Report (see above). Surface water monitoring stations were situated upstream and downstream from the source areas, adits, and tailings pile seeps. The data sets collected during this study also provided information to help with the prioritization of sites for remedial action in OU 3.	The high-flow and low-flow surface water study primarily focused on stations along Ninemile Creek and Canyon Creek, and also monitored select stations along the main stem of the SFCDR between Elizabeth Park and Mullan, Idaho. The difference in loading between the upstream and downstream stations for a given stream "reach" was calculated as the net gain or loss from all sources in-between, including the stream bed and the alluvium itself. In some stream reaches, a specific source was identified. In other cases, the net loading contribution was attributed to all sources in-between the upstream and downstream stations. Conclusions from this study include:• East Fork Ninemile Creek: Both dissolved zinc and total lead experienced similar patterns of loading. During high-flow conditions, the primary source of loading was from below the Success Reach, with reduced contributions from the Interstate Millsite Reach. During low-flow conditions, the primary source was the Success site stream segment. Net loading was found for both dissolved zinc and total lead. • Ninemile Creek: The primary contribution of dissolved zinc and total lead was from the East Fork of Ninemile Creek during high flow and low flow. There was a net loss of zinc and lead within the Dayrock Mine Reach for at both flow stages. • Canyon Creek: During high-flow and low-flow conditions, loading of dissolved zinc was primarily from the Woodland Park Reach and the Standard-Mammoth Mine Complex Reach. During high- and low-flow conditions, loading of total lead was highest from the Standard-Mammoth Mine Complex Reach. • South Fork Coeur d'Alene River: For zinc, loading under both flow conditions was highest from Canyon Creek. A net loss was measured between Wallace and the River Station SF-239. Total lead loading was highest from Ninemile Creek during high flow, but under low-flow conditions, Canyon Creek dominated loading. A net loss was also measured for total lead within the same stretch from Wallace to Station SF-239.	2008 High-Flow and Low-Flow Surface Water Study Report, Upper Basin of the South Fork Coeur d'Alene River (CH2M HILL, 2009f)
SFCDR (and Tributaries)	Groundwater Monitoring, Upper Basin Field Studies	EPA	2008	This report presents procedures, field activities, and results for groundwater data from both May and October 2008 sampling in order to support the CSM and groundwater flow model.	Groundwater elevations were measured in May 2008 to assess groundwater table conditions during the spring snowmelt and high-flow surface water conditions in Canyon Creek, including Woodland Park and Ninemile Creek. Groundwater elevations were measured in October 2008 to assess groundwater table conditions during the dry season and low-flow surface water conditions. The 2008 groundwater monitoring activities were implemented as planned and provided valuable groundwater quality and elevation data with which to evaluate potential impacts of metals-laden groundwater on surface water throughout the Upper Basin. Collected data will be used to refine the CSM and support development of the numerical groundwater flow model of the SFCDR watershed and the subsequent evaluation of remedial options.	Groundwater Monitoring Report, Upper Basin Field Studies (CH2M HILL, 2009h)
SFCDR (and Tributaries)	OU 2 Groundwater-Surface Water Interaction Monitoring	EPA	1999; 2003; 2006; 2007; and 2008	The first groundwater-surface water interaction study in OU 2 was conducted in 1999 by USGS. This study was replicated by CH2M HILL in 2003. In 2006, the study became part of the OU 2 EMP and was repeated in 2006, 2007, and 2008. This study was intended to assess the contribution of metals loading from groundwater into receiving surface water in the area,	The key findings below are based on the results of the 2008 study. This 3-day study was conducted during a hydrologic period when the SFCDR discharge was not stable. The key findings below are based mostly on data collected during the third day of the study, and include: • Evaluation of discharge data collected during the 2008 study indicated that the location of the transition between gaining and losing reaches in the western portion of OU 2 have	Dissolved Cadmium, Zinc, and Lead Loads from Ground-Water Seepage into the South Fork Coeur d'Alene River System, 1999 (Barton, 2002); 2008

Location	Study Name	Responsible Party	Date	Description	Key Conclusions	Reference
				and identify source areas.	changed. • Specific conductance profiles collected at SFCDR monitoring locations show lateral variations in specific conductance across the stream profile at Stations BH-SF-LF-0004, BH-SF-LF-0005, and BH-SF-LF-0006. All other stations show little or no change in specific conductance across the channel profile. This lateral stratification of specific conductance at these locations is likely the result of contaminated groundwater discharging to the SFCDR along the southern bank in this gaining reach of the SFCDR. • pH measured at SFCDR monitoring locations was generally lower in gaining reaches in the SFCDR and higher in losing reaches. • Dissolved cadmium and dissolved zinc concentrations in the SFCDR consistently increased in gaining reaches and decreased in losing reaches of the SFCDR, consistent with the discharge of groundwater with elevated concentrations to the SFCDR.• Dissolved lead concentrations in the SFCDR were relatively consistent within OU 2.• Total phosphorus, sulfate, dissolved iron, and dissolved manganese concentrations in the SFCDR increased substantially in the gaining reaches of the SFCDR. • The greatest loads of dissolved cadmium and dissolved zinc to the SFCDR from groundwater occurred in the gaining reach of the SFCDR in the eastern portion of OU 2, between monitoring locations BH-SF-LF-0003 and BH-SF-LF-0006. • Dissolved lead loads were highly variable and resulted in an overall negative load balance. This is a result of the geochemistry of lead in OU 2 surface water and groundwater. The highest load of dissolved lead was from Milo Creek. • AWQC ratios for dissolved cadmium and dissolved zinc exhibited their greatest increase in the gaining reach of the SFCDR in eastern OU 2. AWQC ratios for dissolved lead in the SFCDR and measured tributaries were consistently below 1 with the exception of Milo Creek (AWQC ratio = 15).	High-Flow and Low-Flow Surface Water Study Report, Upper Basin of the South Fork Coeur d'Alene River (CH2M HILL, 2009f)
SFCDR (and Tributaries)	Evaluation of Zinc Loading to the SFCDR	EPA	2007	This study analyzed surface water, seep, adit, and groundwater data in the Upper Basin in order to identify where the primary zinc loading sources originate.	The results of this analysis suggest that, within the Upper Basin area of the SFCDR, the largest source of dissolved metals loading to the river is the discharge from the Canyon Creek drainage. Numerous point sources such as adits and tailing piles, and distributed sources such as contaminated floodplain sediments, exist within the Canyon Creek watershed, and these sources collectively contribute to the overall metals load within Canyon Creek. Available data further suggest that the next largest contributors of dissolved metals to the SFCDR are: (1) the Ninemile Creek drainage; (2) the contaminated floodplain sediments in the vicinity of Osburn Flats (between Shields Gulch and Twomile Creek, Stations SF-241 to SF-249); (3) the contaminated floodplain sediments between Stations SF-249 and SF-254 (approximately 1 mile downstream from Osburn); and (4) the contaminated floodplain sediments between Stations SF-263 and SF-268 (near the confluence with Montgomery Creek).	Evaluation of Zinc Loading to the SFCDR, Upper Basin Analysis (CH2M HILL, 2007d)
Osburn Flats	Osburn Flats Groundwater-Surface Water Interaction Study	EPA	2008	This study is a summary of the groundwater/surface water interaction along the SFCDR near Osburn Flats. This study was intended to replicate a USGS study (Barton, 2002) that was performed in the Box. It assessed metals concentrations in groundwater seeping to surface water in this area, evaluated AWQC ratios, and identified source areas.	The groundwater-surface-water interaction study at the SFCDR at Osburn Flats was performed over 3 days. Conclusions from this study include: • The 3-day average of discharge measurements at each station and vertical hydraulic gradient (VHG) measurements indicates that the SFCDR is generally losing between Stations B-1Alt and B-3, gaining between B-3 and B-4, losing between B-5Alt and B-7, and gaining between B-7 and B-8. • Concentrations of both dissolved cadmium and zinc in surface water increased at each station from downstream (B-8) to upstream (B-1Alt). • Dissolved metal concentrations in the shallow streambed are generally higher in areas with upward VHGs, with the exception of Station B-5Alt.	Osburn Flats Groundwater-Surface Water Interaction Study Technical Report (CH2M HILL, 2009g)

TABLE 2-4
Summary of Previous Investigations and Studies in the Upper Basin, 2001 through 2011
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Location	Study Name	Responsible Party	Date	Description	Key Conclusions	Reference
					• Dissolved metal concentrations and load estimates from the 1999 study (diel-adjusted) are slightly lower than observed during the 2008 study. • Stream reaches around Stations B-3, B-4, and B-8 appear to be the predominant zones where groundwater inflow to the stream and contaminant loading is occurring. This conclusion is based on vertical hydraulic gradients, shallow streambed water chemistry, surface water chemistry, and data and observations from the B-4 seep and the surrounding area. • Surface water sampling conducted on the SFCDR upstream and downstream from these reaches, and at the mouth of Ninemile Creek, suggest that each of these sources contribute a significant quantity of dissolved metals to the SFCDR. Available loading data suggest that the remainder of the potential source areas in the Upper Basin contribute fairly insignificant quantities of dissolved metals loading to the SFCDR.	
Osburn Flats	Osburn Flats Aquifer Testing Summary	EPA	2008	Monitoring wells were installed in the Osburn area in October 2008. These were part of the hydrologic investigation in this area; this study summarizes aquifer testing and results.	Twelve aquifer tests were performed during this study. Four were single-well tests, and eight involved at least one monitoring well in an effort to investigate aquifer heterogeneity, aquifer anisotropy, and groundwater-surface water interaction. The following aquifer properties were determined: • Average transmissivity values for each location ranged from 22,000 to 85,000 square feet per day [ft^2/day], with a median of 31,500 ft^2/day. • Average hydraulic conductivity values ranged from 600 to 4,700 feet per day (ft/d) with a median of 1,300 ft/d. There were no apparent spatial trends in hydraulic conductivity distribution. These values and the lack of a spatial pattern (at the scale observed) are consistent with alluvial deposits of coarse sand and gravel. • Average storage coefficient values for each location ranged from 0.017 to 0.19, with a median value of 0.038. These values are consistent with unconfined to semi-confined alluvial systems.	Osburn Flats Aquifer Testing Summary Tech. Memo. (CH2M HILL, 2009j)
Osburn Flats	Osburn Flats Subsurface Exploration and Well Installation	EPA	2008	This study summarizes field work conducted in the Osburn Flats area, including the installation of wells, performed to support the CSM for the area.	A summary of hydrogeologic conditions determined through this study includes: • On the basis of conditions encountered in boreholes advanced during the September/October 2008 subsurface investigation, the subsurface in the Osburn Valley generally consists of about 30 to 50 feet of alluvium overlying argillite bedrock. The alluvial aquifer is unconfined, with depth to water ranging from about 5 to 20 feet. • The alluvial aquifer appears somewhat stratified. In general, the alluvium consists of poor to well-graded sand (10 to 25 percent) and gravel with varying concentrations of silt, clay, and cobbles (5 to 15 percent). However, the upper sequence of this alluvium generally contains fewer fines (less than 5 percent to 15 percent), with increasing amounts of silt and clay (15 to 25 percent) in the 5 to 10 feet above the argillite bedrock. • The upper few feet of bedrock were weathered and/or fractured. Beneath this weathered zone, the bedrock appeared dry, and the bedrock is not expected to be a significant source of groundwater. • Specific capacity (the ratio of pumping rate to drawdown) data are often used to estimate aquifer properties; however, these calculations and further analysis are reserved for the more robust aquifer testing data collected post-development. They will be included in the technical memorandum titled Osburn Flats Aquifer Testing Program.	Osburn Flats Subsurface Exploration and Well Installation Summary Tech. Memo. (CH2M HILL, 2009e)

TABLE 4-1
Summary of the Upper Basin Selected Remedy by Operable Unit
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Type of Action	Description of Remedial Actions
Operable Unit 1 (OU 1)	
Remedy Protection	Stormwater control actions (i.e., culvert replacement, channel improvements, installation of asphalt ditches) to protect the existing human health remedy in OU 1 against stormwater runoff, tributary flooding, and high-precipitation events.
Operable Unit 2 (OU 2)	
Groundwater Treatment near the Central Impoundment Area (CIA)	French drain installation between the CIA and the South Fork of the Coeur d'Alene River (SFCDR) and extending south to the eastern side of the mouth of Government Creek, to reduce contaminated groundwater flow to the SFCDR. Transport of collected groundwater to the Central Treatment Plant (CTP) in Kellogg for treatment.
Groundwater Treatment near Government Creek	Stream lining and groundwater extraction wells on Government Creek. The stream lining would be accompanied by an upstream clean groundwater cutoff wall that would divert clean groundwater into the lined stream. Groundwater extraction wells at the mouth of Government Creek and an associated conveyance system would intercept and transport contaminated groundwater to the CTP for treatment.
Upgrades to the CTP	Increased treatment capacity at the CTP to allow for increased flows of contaminated water from OU 2 and OU 3.
	Upgrade of CTP components to allow for consistent compliance with discharge requirements, operation in high-density-sludge mode, and reduced volumes of waste sludge requiring disposal.
	Conveyance of the CTP effluent directly to the SFCDR in a pipeline.
Conveyance of Acid Mine Drainage (AMD) from the Bunker Hill Mine to be treated at the CTP	Phased approach to address adit drainage from the Reed and Russell Adits within the Milo Creek Watershed.
Remedy Protection	Stormwater control actions (i.e. culvert replacement, channel improvements, installation of asphalt ditches) to protect the existing human health remedy in OU 2 against stormwater runoff, tributary flooding, and high-precipitation events.
Operable Unit 3 (OU 3)	
Excavation and Secure Placement of Materials	Excavation of waste rock, tailings, and floodplain sediments and placement of excavated materials in waste consolidation area or repository.
Source Stabilization	Capping, regrading, and revegetation of tailings and waste rock areas.
Groundwater Treatment	Actions along portions of stream reaches (in Woodland Park and Osburn Flats) to reduce the flow of contaminated groundwater into the SFCDR and its tributaries.
Collection and Treatment of Contaminated Surface Water	Collection of contaminated adit discharges and seeps, and active treatment at the CTP or passive treatment at the site.
Stream and Riparian Cleanup	Improvement of bank and stream stability, thereby reducing erosion and sediment loading, by installation of current deflectors, vegetative bank stabilization, and sediment traps.

TABLE 4-1
Summary of the Upper Basin Selected Remedy by Operable Unit
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Type of Action	Description of Remedial Actions
Operable Unit 3 (OU 3) (continued)	
Remedy Protection	Stormwater control actions (i.e. culvert replacement, channel improvements, installation of asphalt ditches) to protect the existing human health remedy in OU 3 against stormwater runoff, tributary flooding, and high-precipitation events.

TABLE 4-2
Status of Remedial Actions Included in the ROD for OU 1
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Type of Action	Selected Remedy for Residential Soils[1]	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
Removal/ Replacement of Soils	Excavation and replacement of up to 12 inches of contaminated materials in residential yards.	X				
	Stabilization of steep hillside areas, located immediately adjacent to yards and with soil lead concentrations greater than the threshold level, to prevent runoff and recontamination.		X			
Visual Markers	Placement of visual markers at 12-inch depth prior to backfilling with clean fill where soil lead concentrations exceed the threshold level.	X				
Revegetation	Disposal of all excavated sod and soil coverings. Revegetation of yards with sod. Steep hillsides and other remediated areas not currently planted with lawns stabilized and hydroseeded with native grasses.	X				
Dust Suppression	Dust suppression during excavation and revegetation and daily cleanup of all spilled or tracked soils from sidewalks, roadways, etc.	X				
Disposal of Contaminated Materials	Disposal of contaminated residential soils at Page Ponds.	X				
	Installation and vegetation of a cap at Page Ponds to prevent ponding and minimize infiltration.		X			
Institutional Controls	Implementation of planning, zoning, and subdivision controls through local ordinances. Contaminated soils that are removed must be handled to minimize exposure, collected for disposal, and transported to a proper disposal site.		X			
	Coordination of public institutions, deed notices, educational programs, permitting and inspection procedures, and monitoring and health surveillance programs.		X			

TABLE 4-2
Status of Remedial Actions Included in the ROD for OU 1
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Type of Action	Selected Remedy for Residential Soils[1]	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
Monitoring	Periodic evaluation of the effectiveness of the institutional controls program. Appropriate air monitoring to indentify the occurrence of contaminant migration during remedial activities. Any exceedances of the standards to result in immediate implementation of additional dust suppression measures or shutdown of construction activities.		X			
	Since contaminated material will be left onsite, both in populated and non-populated Areas, ongoing monitoring of fugitive dust and residential yards is necessary to ensure that the clean barrier is maintained.		X			

[1]Source: Section 9.2 in the Record of Decision for Operable Unit 1 (U.S. Environmental Protection Agency, 1991a).

TABLE 4-3

Status of Remedial Actions Included in the ROD, ROD Amendments, and ESDs for OU 2
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Area	Cleanup Actions	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
1992 ROD for OU 2[1]						
Hillsides	Revegetation of eroding hillsides.	X				
	Installation of terraces.	X				
	Repair of riparian habitat and stream corridors.	X				
	Installation of containment facilities at selected mine dumps.	X				
Smelterville Flats	Removal of contaminated alluvium and jig tailings for constructed wetland systems and floodway construction.	X				1.2 million cubic yards of tailings were removed and consolidated in the CIA. Based upon sediment of the SFCDR, excavation goals were soils greater than 3,000 mg/kg lead. Alluvium and tailings removals complete. Constructed wetland treatment system was not found to be implementable.
	Placement of permanent barrier to cover remaining jig tailings/alluvium mixtures, and revegetation.	X				Removals completed and topsoil added to areas as needed. Recontamination of portions of this area has occurred.
	Treatment of collected water and groundwater through constructed wetland.					The constructed wetland treatment system was found to be infeasible and was not implemented. Water quality in the Smelterville Flats area will continue to be monitored and the need for additional actions will be assessed through the Five-Year Review process.

TABLE 4-3

Status of Remedial Actions Included in the ROD, ROD Amendments, and ESDs for OU 2

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Area	Cleanup Actions	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
	Revegetation of accessible areas not otherwise remediated.	X				
Central Impoundment Area (CIA)	Placement of low-permeability cap and clean soil with revegetation.	X				
	Collection and treatment of contaminated groundwater from the CIA.				X	The groundwater collection in the Box that is part of the Selected Remedy is anticipated to capture water from the CIA seeps as well.
	Excavation of material accumulations in the east cell to the Smelter Closure Area.					These materials could not be located during implementation. This action was removed from further consideration in the 1998 ESD for OU 2.
Page Ponds	Placement of jig tailing accumulations from West Page Swamp.	X				
	Excavation and revegetation of creek channels.	X				
	Regrading and capping of Page Tailing Impoundment with residential yard soil.	X				The Page Tailing Impoundment has been turned into an Institutional Controls Program (ICP) repository managed by the State of Idaho.
	Revegetation after placement of clean soil.		X			
Smelter Complex and Mine Operations Area (MOA)	Removal of PCB- and asbestos-containing equipment and materials.	X				
	Treatment of principal threat material (PTM) accumulations and soil.	X				Action amended by 1996 OU 2 ROD Amendment to select containment rather than treatment for PTM.

TABLE 4-3

Status of Remedial Actions Included in the ROD, ROD Amendments, and ESDs for OU 2
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Area	Cleanup Actions	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
	Channelization and lining of Government and Bunker Creeks with diversion and treatment of base flows.				X	The Upper Basin ROD Amendment includes lining Government Creek and diverting CTP effluent away from Bunker Creek to minimize infiltration through contaminated materials.
	Upper Milo Creek excavation and channelization.	X				Reed landing work has been completed.
	Construction of cutoff walls and surface water treatment at upper and lower Government Creek.				X	The Upper Basin ROD Amendment includes groundwater cutoff walls at the top of Government Creek to divert clean groundwater to the lined surface water stream. Contaminated groundwater at the base of Government Gulch will be collected for treatment at the CTP.
	Surface water treatment of Bunker Creek.				X	The Upper Basin ROD Amendment includes diversion of CTP effluent away from Bunker Creek to minimize infiltration through contaminated materials.
	Closure of mill settling pond and gypsum ponds.	X				Ground water monitoring in the vicinity of the A-4 gypsum pond by the responsible party is on-going. Monitoring shows contaminant migration from this area. Will be addressed by the OU2 water treatment actions in

TABLE 4-3

Status of Remedial Actions Included in the ROD, ROD Amendments, and ESDs for OU 2

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Area	Cleanup Actions	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
						this ROD Amendment.
	Closure of existing solid waste landfills.	X				
	Demolition of Zinc Plants and Lead Smelter.	X				
Rights of Way	Capping in non-populated areas, removal and replacement in the Smelter Complex and MOA.		X			
	Removal and replacement in the Smelter Complex and MOA.		X			
Commercial Buildings and Lots	Protective barrier on surface soil with lead concentrations exceeding 1,000 parts per million (ppm).	X				
Residential Interiors	One-time cleaning of all homes with house dust lead concentrations greater than or equal to 1,000 ppm.		X			
1996 OU 2 ESD[2]						
Smelter Closure Area (SCA), A-1 Gypsum Pond, Zinc Plant, and Solid Waste Landfill	Placement of waste and demolition materials in the SCA.	X				
1996 OU 2 ROD Amendment[3]						
Contaminated Soil	Containment of non-mercury-contaminated PTM rather than stabilization.	X				
1998 OU 2 ESD[4]						
OU 2	Stabilization and removal of contaminated materials located in the tributary gulches within OU 2;	X				

TABLE 4-3

Status of Remedial Actions Included in the ROD, ROD Amendments, and ESDs for OU 2

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Area	Cleanup Actions	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
	placement of mine wastes from outside OU 2 into the CIA.					
2001 OU 2 ROD Amendment[5]						
Source Control	Identification of specific actions to reduce surface water infiltration to the Bunker Hill Mine. This includes the diversion of the West Fork of Milo Creek.			X		Diversion of West Fork of Milo Creek still under consideration. The costs and benefits of implementing this action will be weighed against the continued collection and treatment of contaminated water (which would be eliminated if the action were to be implemented).
Acid Mine Drainage (AMD) Collection within the Bunker Hill Mine	Continue to use the existing approach of collection AMD by gravity flow from the upper workings, pumping from the lower workings, and drainage through the Kellogg Tunnel.		X			Many components of the 2001 OU 2 ROD Amendment have not yet been implemented. To date, EPA and the State of Idaho have not concluded negotiations on a State Superfund Contract Amendment that allows for full implementation of this work. Time-critical components were implemented to prevent catastrophic failure. Additional CTP upgrades are included in the Upper Basin ROD Amendment to address additional influent flows.
AMD Conveyance from Kellogg Tunnel to the Central Treatment Plant (CTP)	Use of new pipeline constructed in 1999 to convey AMD from the Kellogg Tunnel to the lined storage pond. Construction of a pipeline segment to bypass the lined pond and directly feed AMD to the CTP.	X				

TABLE 4-3

Status of Remedial Actions Included in the ROD, ROD Amendments, and ESDs for OU 2

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Area	Cleanup Actions	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
AMD Storage	Surface Storage: Use the existing 7 million gallon lined pond In-Mine Storage: New gravity diversion system to route water from the upper workings into the mine pool during those times when the CTP is shut down for maintenance, or when the mine water flow exceeds treatment capacity. Upgrade of existing mine pool pumping system to pump diverted water back up from storage to the 9 level where it gravity-flows to the CTP.	X				
AMD Treatment at CTP	An alternative to the wetlands treatment system identified in the 1992 ROD, which includes updating and upgrading the existing lime neutralization/ high-density sludge treatment plant and adding tri-media filters. AMD and other sources of water currently treated at the CTP to be treated at the upgraded CTP, along with other Site waters identified in the 1992 ROD if treatment is necessary.				X	The Upper Basin ROD Amendment includes costs for updating and upgrading the CTP that are consistent with the actions included in the 2001 ROD Amendment for OU 2.
Sludge Management at the CIA	Maximized use of the existing unlined disposal area located in the CIA. Capping of the existing unlined disposal area when capacity is reached. Construction of new lined disposal bed on the southeast corner of the CIA if cost-effective regional disposal capacity does not become available.				X	The capacity of the CIA disposal area has not yet been reached. Costs for closure of the existing disposal area and construction of a new lined sludge pond are included in the Upper Basin ROD Amendment.
Remediation Goals/Discharge Limits at CTP	Discharge limits for the upgraded CTP are based on current Idaho water quality standards and national recommended water quality criteria for				X	TMDLs were proposed, but ultimately not promulgated in the State of Idaho. Current discharge limits for the CTP are

TABLE 4-3

Status of Remedial Actions Included in the ROD, ROD Amendments, and ESDs for OU 2

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Area	Cleanup Actions	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
	the contaminants of concern (aluminum, arsenic, cadmium, copper, iron, lead, mercury, manganese, selenium, thallium, silver, and zinc), as well as the CTP Total Maximum Daily Load limits for cadmium, lead, and zinc. Since there is no mixing zone for the CTP, the discharge limits are expected to be met where the CTP discharges into Bunker Creek and are based on the expected hardness of the effluent.					defined in the Upper Basin ROD Amendment.

[1] Source: Record of Decision (ROD) for Operable Unit 2 (U.S. Environmental Protection Agency [EPA], 1992).

[2] Source: Explanation of Significant Differences for Revised Remedial Actions at the Bunker Hill Superfund Site (EPA, 1996a).

[3] Source: 1996 ROD Amendment for OU 2 (EPA, 1996b).

[4] Source: Explanation of Significant Differences for Revised Remedial Actions at the Bunker Hill Superfund Site OU 2 (EPA, 1998b).

[5] Source: 2001 ROD Amendment for OU 2 (EPA, 2001d).

TABLE 4-4
Status of Remedial Actions Included in the ROD for OU 3
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Medium/Area	Cleanup Actions[1]	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
Selected Remedy for Human Health Protection in Community and Residential Areas						
Soil and House Dust	Partial removal and replacement of residential soil with lead concentrations above 1,000 milligrams per kilogram (mg/kg); vegetative barriers to control or limit migration of soils between 700 and 1,000 mg/kg; and a combination of removals, barriers, and access restrictions at commercial and undeveloped properties and recreation areas.		X			
	Reduction of individual house dust lead concentrations and loadings using information and intervention, vacuum loan program/dust mats, and interior source removals.		X			
	Management of contaminated materials by protecting barriers, disposal areas, and clean fill sources through institutional controls.		X			
Drinking Water	Public information program and multiple alternative drinking water sources provided.		X			
Aquatic Food Sources	Public information program, intervention, and monitoring of ingestion of aquatic food sources.		X			

TABLE 4-4
Status of Remedial Actions Included in the ROD for OU 3
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Medium/Area	Cleanup Actions[1]	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
Selected Remedy for Ecological Protection in the Upper Basin and Lower Basin						
Upper Basin	Stabilization of stream beds and banks subject to erosion, implementation of runon/runoff controls, and construction of sediment traps	X			X	Some actions in the 2002 ROD have been taken. Those that have not been implemented yet are included in the Upper Basin ROD Amendment.
	Construction of improvements to sewer and storm drain systems to reduce infiltration of contaminated groundwater.				X	Inflow and infiltration (I&I) was considered for the Upper Basin ROD Amendment, but not included because the mass loading of contaminants to the South Fork of the Coeur d'Alene River (SFCDR) from I&I is relatively low compared with other significant sources in the Upper Basin.
Canyon Creek	Pilot and demonstration projects for treatment of creek water and groundwater near the mouth of Canyon Creek. Implementation of water treatment or other technology based on the outcome of the demonstration project.	X			X	Pilot testing was completed and the proposed passive surface water treatment option was deemed infeasible. The Upper Basin ROD Amendment includes collection of Woodland Park groundwater and conveyance to and treatment at the Central Treatment Plant (CTP).
	Stabilization of stream banks and dumps.				X	
	Remediation of mine/mill sites with human health exposures using a combination of access controls, capping, and removals.				X	

TABLE 4-4
Status of Remedial Actions Included in the ROD for OU 3
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Medium/Area	Cleanup Actions[1]	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
Ninemile Creek	Removal of significant loading sources.				X	
	Impacted sediments and tailings placed in onsite or regional repository.				X	
	Tailings impoundments provided with low-permeability cap.				X	
	Waste rock subject to erosion or leaching consolidated and contained above floodplain.				X	
	Treatment of water from seeps and five adits.				X	
	Hydraulic controls/treatment as needed for loads that are not controlled by removal or containment.				X	
	Bioengineering to stabilize stream beds and banks to mitigate mining impacts on riverine and riparian zones.				X	
	Remediate the Day Rock mine and mill site using a combination of access controls, capping, and removals.				X	
Pine Creek	Bank and bed stabilization and riparian zone revegetation with remaining hot spot removals.	X			X	Some actions in the 2002 ROD have been taken. Those that have not been implemented yet are included in the Upper Basin ROD Amendment.
	Stream improvements to mitigate environment impacts from mining, including regrading of stream reaches that go dry in the summer months.	X			X	Some actions in the 2002 ROD have been taken. Those that have not yet been implemented are included in the Upper Basin ROD Amendment.

TABLE 4-4
Status of Remedial Actions Included in the ROD for OU 3
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Medium/Area	Cleanup Actions[1]	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
SFCDR above Elizabeth Park	Stabilization and bioengineering of stream channel and banks to protect riverine and riparian receptors, with associated hot spot removals in upper floodplain.				X	
	Remediation of mine/mill sites with human health exposures using a combination of access controls, capping, and removals.				X	
SFCDR (Elizabeth Park to Confluence with the North Fork Coeur d'Alene River, including the Bunker Hill Box)	Hydrogeologic investigation: surface water and groundwater monitoring and modeling				X	
	Coordination with remedial activities within the Box, which includes actions such as controlling loads to surface water from the Central Impoundment Area (CIA) and upgrading the Central Treatment Plant (CTP).				X	
Lower Basin Stream Banks and Beds, including the Harrison Delta (Riparian and Riverine)	Goal is to implement complete removal of contaminated bank wedges from highly-erosive areas. Where complete removal is not feasible, partial removal may be followed by capping with clean topsoil to enhance vegetation establishment and isolate contaminants from receptors.			X		Lower Basin activities are outside the scope of this Upper Basin ROD Amendment and are expected to be addressed in a separate, future ROD Amendment.
	Stabilization of banks and revegetation of removal areas to protect riparian zone ecological receptors and humans.			X		Lower Basin activities are outside the scope of this Upper Basin ROD Amendment and are expected to be addressed in a separate, future ROD Amendment.

TABLE 4-4
Status of Remedial Actions Included in the ROD for OU 3
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Medium/Area	Cleanup Actions[1]	Completed	In Progress	Planned or Potential for Future Implementation	Superseded by Upper Basin ROD Amendment	Notes
	Construction and operation of sediment traps at four splay areas where the river overflows its banks during high-flow conditions, following a pilot study at one area.			X		Lower Basin activities are outside the scope of this Upper Basin ROD Amendment and are expected to be addressed in a separate, future ROD Amendment.
	Periodic removal of river bed sediments in Dudley reach or other natural depositional areas identified during remedial design.			X		Lower Basin activities are outside the scope of this Upper Basin ROD Amendment and are expected to be addressed in a separate, future ROD Amendment.
Lower Basin Floodplain	Reduction of exposure using a combination of removals, capping, and soil amendments in areas of high waterfowl use, high lead, road access, and relatively low recontamination potential. Human health concerns also to be addressed in identified areas.		X	X		Lower Basin activities are outside the scope of this Upper Basin ROD Amendment and are expected to be addressed in a separate, future ROD Amendment.
	Identification of agricultural and other areas with lower levels of lead for cleanup to provide additional clean feeding areas.		X	X		Lower Basin activities are outside the scope of this Upper Basin ROD Amendment and are expected to be addressed in a separate, future ROD Amendment.

[1] Source: Tables 12.1-2 and 12.2-1 in the Record of Decision for Operable Unit 3 (U.S. Environmental Protection Agency, 2002).

TABLE 5-1
Known Source Areas and Approximate Volumes of Mining-Related Contamination in the Upper Basin
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Number of Source Areas	Number of Historical Producing Mines	Number of Historical Mills	Ore Produced (tons)	Tailings Produced[a] (tons)
Upper SFCDR (upstream of Wallace, Idaho)	181	11	7	25,000,000	20,000,000
Canyon Creek	127	21	13	35,000,000	27,000,000
Ninemile Creek	70	8	7	5,000,000	4,100,000
Big Creek	68	4	2	12,000,000	11,000,000
Moon Creek	14	2	1	5,600	4,000
Pine Creek	131	14	10	3,200,000	2,500,000
Mainstem SFCDR (not including the Bunker Hill Box)	174	25	4	9,800,000	9,400,000
Bunker Hill Box	NA	NA	15	48,000,000	34,500,000[b]
Total	**765**	**85**	**59**	**167,000,000**	**74,000,000**

Notes:

Sources: Remedial Investigation and Feasibility Study Reports for the Coeur d'Alene Basin (EPA, 2001b, 2001c).

[a] Estimated tailings generated from ore produced in each watershed were not necessarily disposed of within the watershed where the ore was mined. An estimated 62 million tons of tailings have been discharged to the Basin since mining began.

[b] Personal communication from Keith R. Long, Mineral Resource Analyst, Western Mineral and Environmental Resources Science Center, U.S. Geological Survey, November 9, 2011.

EPA = U.S. Environmental Protection Agency
SFCDR = South Fork Coeur d'Alene River

NA = not available

TABLE 7-1

Summary of Contaminants of Concern

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Contaminant of Potential Ecological Concern	Minimum Concentration Detected	Maximum Concentration Detected	Units	Frequency of Detection (%)	95% UCL of the Mean	Units	2001 Remedial Investigation Screening Level[a]
Soil and Sediments Combined							
Arsenic	1.4	3,610	mg/kg	322 / 327	102	mg/kg	-
Cadmium	0.113	543	mg/kg	311 / 410	32.1	mg/kg	-
Copper	5.79	3,100	mg/kg	335 / 364	174	mg/kg	-
Lead	5.16	67,100	mg/kg	403 / 482	7,800	mg/kg	-
Mercury	0.011	51.5	mg/kg	212 / 259	4.78	mg/kg	-
Silver	0.17	347	mg/kg	221 / 256	27.5	mg/kg	-
Zinc	10	83,900	mg/kg	337 / 420	4,480	mg/kg	-
Sediments							
Arsenic	2	384	mg/kg	72 / 74	124	mg/kg	13.6
Cadmium	0.56	177	mg/kg	61 / 68	33.5	mg/kg	1.56
Copper	16	706	mg/kg	73 / 74	173	mg/kg	32.3
Lead	9	40,500	mg/kg	74 / 74	7,983	mg/kg	51.5
Mercury	0.03	25.1	mg/kg	52 / 64	6.1	mg/kg	0.179
Silver	1	120	mg/kg	51 / 71	30.1	mg/kg	4.5
Zinc	22	9,900	mg/kg	74 / 74	3,031	mg/kg	200
Surface Water							
Cadmium, dissolved	0.02	408	µg/L	1,873 / 2,321	11.3	µg/L	0.38
Cadimium, total	0.05	407	µg/L	1,809 / 2,179	11.6	µg/L	2
Copper, dissolved	0.1	260	µg/L	153 / 486	8.02	µg/L	3.2
Copper, total	0.16	310	µg/L	173 / 460	10.5	µg/L	1
Lead, dissolved	0.001	578	µg/L	1,825 / 2,304	22.8	µg/L	1.09
Lead, total	0.06	4,260	µg/L	1,946 / 2,217	82.9	µg/L	15
Zinc, dissolved	0.101	17,300	µg/L	2,195 / 2,342	1,561	µg/L	42
Zinc, total	0.94	18,000	µg/L	2,083 / 2,213	1,646	µg/L	30

Notes:

[a]Table 5.1-11 for sediments and Table 5.1-9 for surface water, Coeur d'Alene Basin Remedial Investigation Report (EPA, 2001b).

mg/kg = milligram(s) per kilogram

µg/L = microgram(s) per liter

95% UCL: 95 percent upper confidence limit of the mean.

Source: Upper Basin data from Tables 7.2-2 through 7.2-5 in the Record of Decision for Operable Unit 3 (EPA, 2002).

TABLE 7-2

Ecological Exposure Pathways of Concern

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Exposure Medium	Receptor	Endangered/ Threatened Species Flag (Y or N)	Exposure Routes	Assessment Endpoints	Measurement Endpoints
Soil	Birds	N	Ingestion of chemicals in soil and food	**Migratory Bird (Migratory Bird Treaty Act [MBTA]-protected) species:** Health, survival, growth, and reproduction of individual migratory birds and the abiotic and biotic habitat conditions supportive of these species; any exposure resulting in effects greater than expected at background chemical concentrations or exceeding toxicological screening criteria. **Non-migratory Bird (not listed under MBTA) species:** Survival, reproduction, growth, and abundance conducive to the maintenance of viable (self-sustaining) species populations at levels that are characteristic of natural habitats in the region and supportive of the community structure; any exposure resulting in $\geq$20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of contaminants of potential ecological concern (COPECs) in soil and biota; **Effects:** Individual-level measures: Effects on health, survival, growth, or reproduction of migratory birds; Population-level measures: Effects on survival, reproduction, growth, or abundance for bird species
	Mammals	Y[a]	Ingestion of chemicals in soil and food	Survival, reproduction, growth, and abundance conducive to the maintenance of viable (self-sustaining) species populations at levels that are characteristic of natural habitats in the region and supportive of the community structure. Any exposure resulting in $\geq$20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in soil and biota; **Effects:** Individual-level measures: Effects on health, survival, growth, or reproduction of special-status animal species; Population-level measures: Effects on survival, reproduction, growth, or abundance for mammalian species
	Amphibians	Y[a]	Direct contact with chemicals in soil	Survival, reproduction, growth, and abundance conducive to the maintenance of viable (self-sustaining) populations of individual species at levels that are characteristic of natural habitats in the region and supportive of aquatic and terrestrial community structures. Any exposure resulting in $\geq$20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in soil; **Effects:** Individual-level measures: Effects on health, survival, growth, or reproduction of special-status animal species; Population-level measures: Effects on survival, reproduction, growth, or abundance of amphibian species
	Terrestrial Plants	Y	Root uptake of chemicals in soil	**Special-status Plants** (e.g., Threatened or Endangered, culturally significant, and/or state or agency Species of Special Concern): Survival, reproduction, and abundance conducive to the maintenance of viable (self-sustaining) populations of individual species at levels that are characteristic of natural habitats in the region and supportive of terrestrial community structure. Any exposure resulting in $\geq$20 percent reduction in attributes relative to reference or baseline data. **Other Terrestrial Plants:** Community composition, density, species diversity, and community structure that provide suitable habitat and forage for indigenous wildlife species; survival and reproduction capable of maintaining viable populations of indigenous plant species that are characteristic of natural habitats in the region supportive of the aquatic and terrestrial community structure. Any exposure resulting in $\geq$20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in soil; **Effects:** Population-level measures: Effects on survival, reproduction, growth, or abundance of special-status plant species; Community-level measures: Effects on terrestrial plant community composition, density, species diversity, or community structure
	Terrestrial Invertebrates	N	Ingestion and direct contact with chemicals in soil	Terrestrial invertebrate community composition, abundance, density, species diversity, and community structure supportive of terrestrial ecosystem processes (e.g., nutrient cycling, decomposition) as well as providing prey for terrestrial predators; survival and reproduction capable of maintaining viable populations of indigenous invertebrate species that are characteristic of natural habitats in the region supportive of terrestrial community structure. Any exposure resulting in $\geq$20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in soil; **Effects:** Effects on terrestrial invertebrate community composition, density, species diversity, or community structure
	Soil Processes	N	Direct contact of microbes with chemicals in soil	Soil microbial community viability and sustainability that are capable of supporting nutrient cycling and other ecosystem processes necessary for higher plants and animals. Any exposure resulting in $\geq$20 percent reduction in ecosystem function relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in soil; **Effects:** Effects on terrestrial plant community composition, density, species diversity, or community structure

TABLE 7-2

Ecological Exposure Pathways of Concern

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Exposure Medium	Receptor	Endangered/ Threatened Species Flag (Y or N)	Exposure Routes	Assessment Endpoints	Measurement Endpoints
Sediments	Birds	Y[a]	Ingestion of chemicals in sediments and food	**Migratory Bird (MBTA-protected) species:** Health, survival, growth, and reproduction of individual migratory birds and the abiotic and biotic habitat conditions supportive of these species; any exposure resulting in effects greater than expected at background chemical concentrations or exceeding toxicological screening criteria.	**Exposure:** Concentrations of COPECs in sediments and biota; **Effects:** Individual-level measures: Effects on health, survival, growth, or reproduction of migratory birds or of special-status animal species
	Mammals	N	Ingestion of chemicals in sediments and food	Survival, reproduction, growth, and abundance conducive to the maintenance of viable (self-sustaining) species populations at levels that are characteristic of natural habitats in the region and supportive of the community structure. Any exposure resulting in ≥20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in sediments and biota; **Effects:** Population-level measures: Effects on survival, reproduction, growth, or abundance for mammalian species
	Fish	Y[a]	Ingestion and direct contact with chemicals in sediments	Survival, reproduction, growth, and abundance conducive to the maintenance of viable (self-sustaining) populations of individual species at levels that are characteristic of natural habitats in the region and supportive of the aquatic community structure. Any exposure resulting in ≥20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in sediments; **Effects:** Individual-level measures: Effects on health, survival, growth, or reproduction of special-status animal species; Population-level measures: Effects on survival, reproduction, growth, or abundance for fish species
	Benthic Invertebrates	N	Ingestion and direct contact with chemicals in sediments	Community composition, abundance, density, species diversity, and community structure supportive of aquatic ecosystem processes (e.g., nutrient cycling, decomposition) as well as providing prey for aquatic predators; survival and reproduction capable of maintaining viable populations of indigenous invertebrate species that are characteristic of natural habitats in the region supportive of aquatic community structure. Any exposure resulting in ≥20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in sediments; **Effects:** Effects on aquatic invertebrate community composition, density, species diversity, or community structure
	Aquatic Plants	N	Root uptake of chemicals in sediment and direct contact with chemicals in sediments	Community composition, density, species diversity, and community structure that provide suitable habitat and forage for indigenous wildlife species; survival and reproduction capable of maintaining viable populations of indigenous plant species that are characteristic of natural habitats in the region supportive of the aquatic community structure. Any exposure resulting in ≥20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in sediments; **Effects:** Effects on aquatic plant community composition, density, species diversity, or community structure
	Amphibians	Y[a]	Direct contact with chemicals in sediments	Survival, reproduction, growth, and abundance conducive to the maintenance of viable (self-sustaining) populations of individual species at levels that are characteristic of natural habitats in the region and supportive of aquatic and terrestrial community structures. Any exposure resulting in ≥20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in sediments; **Effects:** Individual-level measures: Effects on health, survival, growth, or reproduction of special-status animal species; Population-level measures: Effects on survival, reproduction, growth, or abundance of amphibian species
	Terrestrial Plants	Y	Root uptake of chemicals in sediments	**Special-status Plants** (e.g., Threatened or Endangered, culturally significant, and/or state or agency Species of Special Concern): Survival, reproduction, and abundance conducive to the maintenance of viable (self-sustaining) populations of individual species at levels that are characteristic of natural habitats in the region and supportive of terrestrial community structure. Any exposure resulting in ≥20 percent reduction in attributes relative to reference or baseline data. **Other Terrestrial Plants:** Community composition, density, species diversity, and community structure that provide suitable habitat and forage for indigenous wildlife species; survival and reproduction capable of maintaining viable populations of indigenous plant species that are characteristic of natural habitats in the region supportive of terrestrial community structure. Any exposure resulting in ≥20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in sediments; **Effects:** Population-level measures: Effects on survival, reproduction, growth, or abundance of special-status plant species; Community-level measures: Effects on terrestrial plant community composition, density, species diversity, or community structure

TABLE 7-2

Ecological Exposure Pathways of Concern

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Exposure Medium	Receptor	Endangered/ Threatened Species Flag (Y or N)	Exposure Routes	Assessment Endpoints	Measurement Endpoints
Sediments (continued)	Terrestrial Invertebrates	N	Ingestion and direct contact with chemicals in sediment	Community composition, abundance, density, species diversity, and community structure supportive of terrestrial ecosystem processes (e.g., nutrient cycling, decomposition) as well as providing prey for terrestrial predators; survival and reproduction capable of maintaining viable populations of indigenous invertebrate species that are characteristic of natural habitats in the region supportive of terrestrial community structure. Any exposure resulting in $\geq$20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in sediments; **Effects:** Effects on terrestrial invertebrate community composition, density, species diversity, or community structure
	Soil Processes	N	Direct contact of microbes with chemicals in sediments	Soil microbial community viability and sustainability that are capable of supporting nutrient cycling and other ecosystem processes necessary for higher plants and animals. Any exposure resulting in $\geq$20 percent reduction in ecosystem function relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in sediments; **Effects:** Effects on terrestrial plant community composition, density, species diversity, or community structure
Surface Water	Birds	Y[a]	Ingestion of chemicals in surface water and food	**Migratory Bird (MBTA-protected) species:** Health, survival, growth, and reproduction of individual migratory birds and the abiotic and biotic habitat conditions supportive of these species; any exposure resulting in effects greater than expected at background chemical concentrations or exceeding toxicological screening criteria.	**Exposure:** Concentrations of COPECs in surface water and biota; **Effects:** Individual-level measures: Effects on health, survival, growth, or reproduction of migratory birds or of special-status animal species
	Mammals	Y[a]	Ingestion of chemicals in surface water and food	Survival, reproduction, growth, and abundance conducive to the maintenance of viable (self-sustaining) species populations at levels that are characteristic of natural habitats in the region and supportive of the community structure. Any exposure resulting in $\geq$20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in surface water and biota; **Effects:** Individual-level measures: Effects on health, survival, growth, or reproduction of special-status animal species; Population-level measures: Effects on survival, reproduction, growth, or abundance for mammalian species
	Fish	Y[a]	Ingestion and direct contact with chemicals in surface water	Survival, reproduction, growth, and abundance conducive to the maintenance of viable (self-sustaining) populations of individual species at levels that are characteristic of natural habitats in the region and supportive of the aquatic community structure. Any exposure resulting in $\geq$20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in surface water; **Effects:** Individual-level measures: Effects on health, survival, growth, or reproduction of special-status animal species; Population-level measures: Effects on survival, reproduction, growth, or abundance for fish species
	Benthic Invertebrates	N	Ingestion and direct contact with chemicals in surface water	Community composition, abundance, density, species diversity, and community structure supportive of aquatic ecosystem processes (e.g., nutrient cycling, decomposition) as well as providing prey for aquatic predators; survival and reproduction capable of maintaining viable populations of indigenous invertebrate species that are characteristic of natural habitats in the region supportive of aquatic community structure. Any exposure resulting in $\geq$20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in surface water; **Effects:** Effects on aquatic invertebrate community composition, density, species diversity, or community structure
	Aquatic Plants	N	Root uptake and direct contact with chemicals in surface water	Community composition, density, species diversity, and community structure that provide suitable habitat and forage for indigenous wildlife species; survival and reproduction capable of maintaining viable populations of indigenous plant species that are characteristic of natural habitats in the region supportive of the aquatic community structure. Any exposure resulting in >20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in surface water; **Effects:** Effects on aquatic plant community composition, density, species diversity, or community structure
	Amphibians	Y[a]	Direct contact with chemicals in surface water	Survival, reproduction, growth, and abundance conducive to the maintenance of viable (self-sustaining) populations of individual species at levels that are characteristic of natural habitats in the region and supportive of aquatic and terrestrial community structures. Any exposure resulting in $\geq$20 percent reduction in attributes relative to reference or baseline data.	**Exposure:** Concentrations of COPECs in surface water; **Effects:** Individual-level measures: Effects on health, survival, growth, or reproduction of special-status animal species; Population-level measures: Effects on survival, reproduction, growth, or abundance of amphibian species

Notes:

[a] For Endangered or Threatened animal species and those animals listed by USFWS as Species of Concern, there was an additional Assessment Endpoint: Health, survival, growth, and reproduction of individuals and the abiotic and biotic habitat conditions that are necessary to maintain current population and are also conducive to future recovery of the species; any exposure resulting in effects greater than expected at background chemical concentrations or exceeding toxicological screening criteria. Adequate habitat conditions to allow existing individuals to survive and reproduce.

TABLE 7-3

Measures of Ecosystem and Receptor Characteristics, Related Assessment Endpoints, and Linkages to Secondary Effects of Mining-Related Hazardous Substances

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Habitat Type	Assessment Endpoint(s)	Measure of Ecological Receptor Characteristics	Linkage
Riverine	Fish, Amphibians, Special-Status Species, Aquatic Invertebrate Community	Bank stability	Loss of bank stability due to toxic effects of mining-related hazardous substances on riparian vegetation results in loss of instream habitat, increased sedimentation, and changes in channel morphology.
		Substrate composition and mobility	Substrate mobility and loss of favorable bottom substrate composition due to mining-related impacts reduce quality and quantity of fish and invertebrate habitat.
		Temperature	Toxic effects of mining-related hazardous substances on riparian vegetation and resultant changes in bank stability, channel morphology, and stream shading adversely affect stream temperatures.
Riparian	Migratory Birds and Mammals	Habitat Suitability Index rating	Toxic effects of mining-related hazardous substances on riparian vegetation may degrade important habitat for migratory birds and mammals.
	Landscape Characteristics	Spatial distribution of healthy riparian communities	Toxic effects of mining-related hazardous substances on riparian vegetation may result in landscape-scale loss of riparian habitat health and connectivity.

TABLE 7-4

Concentrations of Contaminants of Ecological Concern Expected to Provide Protection of Ecological Receptors

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Habitat Type/Name	Exposure Medium	Contaminant of Ecological Concern	Protective Level	Units	Basis	Assessment Endpoint
Freshwater Stream -- SFCDR and its Tributaries	Sediment	Lead	530	mg/kg	Risk-Based Level (CH2M HILL, 2006; Hansen, 2007; Hansen et al., 2011; Sample et al., 2011)	**Migratory bird (Migratory Bird Treaty Act [MBTA]-protected) species:** Health, survival, growth, and reproduction of individual migratory birds and the abiotic and biotic habitat conditions supportive of these species; any exposure resulting in effects greater than expected at background chemical concentrations or exceeding toxicological screening criteria.
	Surface Water	Arsenic	150	µg/L	State of Idaho Chronic Water Quality Standards	**Endangered or Threatened animal species and those animals listed by USFWS as Species of Concern:** Health, survival, growth, and reproduction of individuals and the abiotic and biotic habitat conditions that are necessary to maintain current population and are also conducive to future recovery of the species; any exposure resulting in effects greater than expected at background chemical concentrations or exceeding toxicological screening criteria. Adequate habitat conditions to allow existing individuals to survive and reproduce. **Other fish species:** Survival, reproduction, growth, and abundance conducive to the maintenance of viable (self-sustaining) populations of individual species at levels that are characteristic of natural habitats in the region and supportive of the aquatic community structure. Any exposure resulting in >20 percent reduction in attributes relative to reference or baseline data.
		Cadmium	0.62[a]	µg/L	State of Idaho Chronic SFCDR-Specific AWQC	
		Copper	6.3[b]	µg/L	State of Idaho Chronic Water Quality Standards	
		Lead	14.7[c]	µg/L	State of Idaho Chronic SFCDR-Specific AWQC	
		Mercury	0.012[d]	µg/L	State of Idaho Chronic Water Quality Standards	
		Zinc	123[e]	µg/L	State of Idaho Chronic SFCDR-Specific AWQC	
Upland Areas within the SFCDR Watershed	Soil	Lead	530	mg/kg	CH2M HILL, 2006; Hansen, 2007; Hansen et al., 2011; Sample et al., 2011	**Migratory Bird (MBTA-protected) species:** Health, survival, growth, and reproduction of individual migratory birds and the abiotic and biotic habitat conditions supportive of these species; any exposure resulting in effects greater than expected at background chemical concentrations or exceeding toxicological screening criteria.

Notes:

[a] The cleanup level for cadmium is the SFCDR-specific chronic AWQC, as specified in IDAPA 58.01.02.284, which is a function of hardness as defined by the equation: $(1.101672-(\ln(hardness)*0.041838))*e^{(0.7852*\ln(hardness)-3.490)}$. The value presented in this table was calculated at a hardness of 50 mg/L as calcium carbonate ($CaCO_3$).

[b] The cleanup level for copper is the State of Idaho chronic AWQC, as specified in IDAPA 58.01.02.210, which is a function of hardness as defined by the equation: $0.960*e^{(0.8545*\ln(hardness)-1.465)}$. The value presented in this table was calculated at a hardness of 50 mg/L as $CaCO_3$.

[c] The cleanup level for lead is the SFCDR-specific chronic AWQC, as specified in IDAPA 58.01.02.284, which is a function of hardness as defined by the equation: $e^{(0.9402*\ln(hardness) - 0.9875)}$. The value presented in this table was calculated at a hardness of 50 mg/L as $CaCO_3$.

[d] In 2005, the State of Idaho adopted EPA's methylmercury fish tissue criterion for protection of human health. The state decided to remove the former aquatic life criteria for mercury and rely on the fish tissue criterion to provide protection for aquatic life. Thus, current Idaho water quality standards do not have mercury water column criteria for the protection of aquatic life. While EPA approved of Idaho's adoption of the fish tissue criterion, it disapproved of the removal of the mercury water column criteria for the protection of aquatic life in a letter to the Idaho Department of Environmental Quality (IDEQ) dated December 12, 2008. The effect of EPA's decision is that the previously adopted mercury criterion (approved by EPA in 1997) of 0.012 mg/L for chronic conditions is to remain in effect until the State of Idaho develops and adopts, and EPA approves, revisions to the numeric acute and chronic aquatic life criteria for mercury.

[e] The cleanup level for zinc is the SFCDR-specific chronic AWQC, as specified in IDAPA 58.01.02.284, which is a function of hardness as defined by the equation: $e^{(0.66244*\ln(hardness)+2.2235)}$. The value presented in this table was calculated at a hardness of 50 mg/L as $CaCO_3$.

µg/L = micrograms per liter

AWQC = ambient water quality criterion

EPA = U.S. Environmental Protection Agency

IDAPA = Idaho Administrative Procedures Act

MCL = maximum contaminant level

mg/L =milligrams per liter

SFCDR = South Fork of the Coeur d'Alene River

USFWS = U.S. Fish and Wildlife Service

TABLE 8-1
Cleanup Levels for Contaminants of Concern in Surface Water
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Contaminant of Concern	Cleanup Level (μg/L)	Basis for Cleanup Level
Arsenic	10	Federal MCL in drinking water
Cadmium	0.62[a]	State of Idaho SFCDR-Specific AWQC
Copper	6.3[b]	State of Idaho Water Quality Standards
Lead	14.7[c]	State of Idaho SFCDR-Specific AWQC
Mercury	0.012[d]	State of Idaho Water Quality Standards
Zinc	123[e]	State of Idaho SFCDR-Specific AWQC

Notes:

[a] The cleanup level for cadmium is the SFCDR-specific chronic AWQC, as specified in IDAPA 58.01.02.284, which is a function of hardness as defined by the equation: $(1.101672-(\ln(\text{hardness})*0.041838))*e^{(0.7852*\ln(\text{hardness})-3.490)}$. The value presented in this table was calculated at a hardness of 50 mg/L as calcium carbonate ($CaCO_3$).

[b] The cleanup level for copper is the State of Idaho chronic AWQC, as specified in IDAPA 58.01.02.210 , which is a function of hardness as defined by the equation: $0.960*e^{(0.8545*\ln(\text{hardness})-1.465)}$. The value presented in this table was calculated at a hardness of 50 mg/L as $CaCO_3$.

[c] The cleanup level for lead is the SFCDR-specific chronic AWQC, as specified in IDAPA 58.01.02.284, which is a function of hardness as defined by the equation: $e^{(0.9402*\ln(\text{hardness}) - 0.9875)}$. The value presented in this table was calculated at a hardness of 50 mg/L as $CaCO_3$.

[d] In 2005, the State of Idaho adopted the U.S. Environmental Protection Agency's (EPA's) methylmercury fish tissue criterion for protection of human health. The State decided to remove the former aquatic life criteria for mercury and rely on the fish tissue criterion to provide protection for aquatic life. Thus, current Idaho water quality standards do not have mercury water column criteria for the protection of aquatic life. While EPA approved of Idaho's adoption of the fish tissue criterion, it disapproved of the removal of the mercury water column criteria for the protection of aquatic life in a letter to the Idaho Department of Environmental Quality (IDEQ) dated December 12, 2008. The effect of EPA's decision is that the previously adopted mercury criterion (approved by EPA in 1997) of 0.012 mg/L for chronic conditions is to remain in effect until the State of Idaho develops and adopts, and EPA approves, revisions to the numeric acute and chronic aquatic life criteria for mercury.

[e] The cleanup level for zinc is the SFCDR-specific chronic AWQC, as specified in IDAPA 58.01.02.284,, which is a function of hardness as defined by the equation: $e^{(0.6624*\ln(\text{hardness})+2.2235)}$. The value presented in this table was calculated at a hardness of 50 mg/L as CaCO3.

μg/L = micrograms per liter
AWQC = ambient water quality criterion
IDAPA = Idaho Administrative Procedures Act
MCL = maximum contaminant level
mg/L =milligrams per liter
SFCDR = South Fork of the Coeur d'Alene River

TABLE 8-2
Cleanup Levels for Contaminants of Concern in Groundwater
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Contaminant of Concern	Cleanup Level (μg/L)	Basis for Cleanup Level
Arsenic	10	Federal MCL in drinking water
Cadmium	5	Federal MCL in drinking water
Copper	1,300	Federal MCL in drinking water
Lead	15	Federal MCL in drinking water
Mercury	2	Federal MCL in drinking water
Zinc	5,000	Federal MCL in drinking water

Notes:

μg/L = micrograms per liter
MCL = maximum contaminant level

TABLE 8-3
Comparison of Remedial Action Objectives (RAOs) Presented in Historical RODs and this Upper Basin ROD Amendment
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	OU 1 ROD RAOs[1]	OU 2 ROD RAOs[1]	OU 3 ROD RAOs	Upper Basin ROD Amendment RAO(s)	RAOs from Previous RODs Superseded by Upper Basin ROD Amendment?	Rationale for Differences in RAOs
HUMAN HEALTH						
Soil/Sediments/Source Materials			Reduce mechanical transportation of soil and sediments containing unacceptable levels of contaminants into residential areas and structures.	No changes from OU 3 ROD.	No	No differences.
	Decrease exposure to lead-contaminated residential soils such that 95 percent or more of the children in the area have blood lead levels below 10 micrograms per deciliter (µg/dL), and less than 1 percent have blood levels greater than 15 µg/dL.	Decrease exposure to lead-contaminated residential soils such that 95 percent or more of the children in the area have blood lead levels below 10 µg/dL, and less than 1 percent have blood levels greater than 15 µg/dL.	Reduce human exposure to soil, including residential garden soil, and sediments that have concentrations of contaminants of concern greater than selected risk-based levels for soil.	Reduce human exposure to soil, sediments, and source materials, including residential yard soil, that have concentrations of contaminants of concern (COCs) greater than remediation goals for soil.	Yes, the RAO in the OU 3 ROD is superseded by the ROD Amendment. RAOs for OU 1 and OU 2 remain applicable.	The RAO is essentially the same as in the OU 3 ROD. The primary difference from the OU 1 and OU 2 RAOs is that the current RAO is focused on reducing exposure above remediation goals, while the OU 1 and OU 2 RAOs are focused on reduction of blood lead levels in children. The switch from blood lead levels to remediation goals in soil was made for two reasons: (1) CERCLA Five-Year Reviews have demonstrated that risk-based remediation goals are effective in reducing blood lead levels to acceptable concentrations, and (2) measurement of blood lead levels is intrusive to the public but measurement of contaminant concentrations in soil is relatively simple.
House Dust	House dust not explicitly addressed.	Clean all homes exceeding 1,000 parts per million (ppm) lead in house dust after remedial actions are completed. Develop and implement an interior dust monitoring program and, if needed, implement site-specific remediation.	Reduce human exposure to lead in house dust via tracking from areas outside the home and via air pathways, exceeding health risk goals.	No changes from OU 3 ROD.	No	No differences from the OU 3 ROD.
Groundwater and Surface Water as Drinking Water		Provide an alternative source of water for any well used for drinking water.	Reduce ingestion by humans of groundwater or surface water withdrawn or diverted from a private, unregulated source, used as drinking water, and containing COCs exceeding drinking water standards and risk-based levels for drinking water.	Restore surface water designated as beneficial use for drinking water to meet drinking water and water quality standards. Prevent ingestion of surface water used as drinking water and containing COCs exceeding drinking water standards and associated risk-	Yes	RAOs were not included for groundwater and surface water in the RODs for OUs 1 and 2. The ROD for OU 3 focused only on

	OU 1 ROD RAOs[1]	OU 2 ROD RAOs[1]	OU 3 ROD RAOs	Upper Basin ROD Amendment RAO(s)	RAOs from Previous RODs Superseded by Upper Basin ROD Amendment?	Rationale for Differences in RAOs
				based levels for drinking water. Prevent discharges of seeps, springs, and leachate that would cause surface water to exceed drinking water and water quality standards.		reducing ingestion. The Selected Remedy also focuses on reducing ingestion but adds to that objective the restoration of surface water to meet drinking water and water quality standards. The Selected Remedy does not include an RAO to reduce ingestion of groundwater because this is already addressed throughout the Upper Basin through the Institutional Controls Program (ICP).
Aquatic Food Sources			Reduce human exposure to unacceptable levels of COCs via ingestion of aquatic food sources (e.g., fish and water potatoes).	No changes from OU 3 ROD.	No	No RAOs were included for OUs 1 and 2. No differences from the OU 3 ROD.
ECOLOGICAL RECEPTORS						
Ecosystem Physical Structure and Function			Remediate soil, sediment, and water quality and mitigate mining impacts in habitat areas to be capable of supporting a functional ecosystem for the aquatic and terrestrial plant and animal populations in the Coeur d'Alene Basin. Maintain (or provide) soil, sediment, and water quality and mitigate mining impacts in habitat areas to be supportive of individuals of special-status biota that are protected under the Endangered Species Act and the Migratory Bird Treaty Act.	Reduce COCs in soil, sediments, and surface water to support a functional ecosystem for aquatic and terrestrial plant and animal populations (including, but not limited to, waterfowl, riparian songbirds, and other species protected under the Endangered Species Act, the Fish and Wildlife Conservation Act, and the Migratory Bird Treaty Act), in the Upper Basin.	No	No RAOs were included for ecosystems in the OU 1 and OU 2 Selected Remedies. The RAO is essentially the same as that included in the OU 3 ROD, only it is now focused on the Upper Basin rather than the entire Coeur d'Alene Basin. The RAO adds protection for aquatic biota protected under the Fish and Wildlife Conservation Act compared to the RAO in the OU 3 ROD.

TABLE 8-3
Comparison of Remedial Action Objectives (RAOs) Presented in Historical RODs and this Upper Basin ROD Amendment
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	OU 1 ROD RAOs[1]	OU 2 ROD RAOs[1]	OU 3 ROD RAOs	Upper Basin ROD Amendment RAO(s)	RAOs from Previous RODs Superseded by Upper Basin ROD Amendment?	Rationale for Differences in RAOs
Soil/Sediments/Source Materials			Prevent ingestion of arsenic, cadmium, copper, lead, mercury, silver, and zinc by ecological receptors at concentrations that result in unacceptable risks.	No changes from OU 3 ROD.	No	No RAOs were included for OUs 1 and 2. No differences from the OU 3 ROD.
			Reduce loadings of cadmium, copper, lead, and zinc from soil and sediments to surface water so that loadings do not cause exceedances of potential surface water quality applicable or relevant and appropriate requirements (ARARs).	Reduce risks from COCs in soil, sediments, and source materials to acceptable exposure levels that are protective of ecological receptors.	No	No RAOs were included for OUs 1 and 2. Essentially the same as the OU 3 RAO, but expanded to include all COCs (in this case, arsenic, mercury, and silver).
			Prevent transport of cadmium, copper, lead, and zinc from soil and sediments to groundwater at concentrations that exceed potential surface water quality ARARs.	Reduce transport and deposition of COCs from soil, sediments, and source materials into surface water and groundwater at concentrations above levels that are protective of ecological receptors.	No	No RAOs were included for OUs 1 and 2. Essentially the same as the OU 3 RAO, but expanded to include all COCs (in this case, arsenic, mercury, and silver).
			Prevent dermal contact with arsenic, cadmium, copper, lead, mercury, silver, and zinc by ecological receptors at concentrations that result in unacceptable risks.	No changes from OU 3 ROD.	No	No RAOs were included for OUs 1 and 2. No differences from the OU 3 ROD.
Surface Water						
			Prevent dermal contact with and ingestion of cadmium, copper, lead, and zinc by ecological receptors at concentrations that exceed potential surface water quality ARARs.	Reduce risks from COCs in surface water to acceptable exposure levels that are protective of ecological receptors.	Yes	No RAOs were included for OUs 1 and 2. Essentially the same as the OU 3 RAO, but expanded to include all COCs (in this case, arsenic, mercury, and silver).
Mine Water, including Adits, Seeps, Springs, and Leachate		Prevent release of untreated acid mine discharge (AMD), which has metals concentrations that greatly exceed water quality standards, into Bunker Creek and the South Fork of the Coeur d'Alene River (SFCDR). Reduce the quantity of AMD generated by the mine.	Prevent discharge of cadmium, copper, lead, and zinc in mine water, including adits, seeps, springs, and leachate to surface water at concentrations that exceed potential surface water quality ARARs.	Reduce discharge of mine water, including adits, seeps, springs and leachate, containing COCs to surface water at concentrations that cause surface water to exceed levels protective of ecological receptors.	No	Essentially the same as the OU 3 RAO, but expanded to include all COCs (in this case, arsenic, mercury, and silver). In contrast to the OU 2 RAO, requires that the discharge not exceed surface water quality ARARs (rather than "not greatly exceed").

TABLE 8-3
Comparison of Remedial Action Objectives (RAOs) Presented in Historical RODs and this Upper Basin ROD Amendment
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	OU 1 ROD RAOs[1]	OU 2 ROD RAOs[1]	OU 3 ROD RAOs	Upper Basin ROD Amendment RAO(s)	RAOs from Previous RODs Superseded by Upper Basin ROD Amendment?	Rationale for Differences in RAOs
Groundwater		Reduce the concentrations and mass per day of metals discharged into Bunker Creek and the SFCDR in order to improve overall water quality in the Coeur d'Alene River Basin.[2]	Prevent discharge of groundwater to surface water at concentrations of cadmium, copper, lead, and zinc that exceed potential surface water quality ARARs.	Reduce discharge of groundwater containing COCs to surface water at concentrations that cause surface water to exceed levels protective of ecological receptors.	No	No RAOs were included for OUs 1 and 2. Essentially the same as the OU 3 RAO, but expanded to include all COCs (in this case, arsenic, mercury, and silver).

Notes:

[1] RAOs presented in the RODs for OUs 1 and 2 are formatted much differently than in the ROD for OU 3 and the Upper Basin ROD Amendment. Therefore, RAOs for OUs 1 and 2 are not included for each line item.

ARARs = applicable or relevant and appropriate requirements
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
COC = contaminant of concern
OU = Operable Unit
ppm = parts per million
RAO = Remedial Action Objective
ROD = Record of Decision
SFCDR = South Fork Coeur d'Alene River
µg/dL = micrograms per deciliter

TABLE 9-1

Descriptions of Typical Conceptual Designs (TCDs)

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

TCD Code	Name	Description
Source Control TCDs		
C01	Excavation (dry)	Physically remove solid waste material using equipment including backhoes, hydraulic excavators (trackhoes), draglines, bulldozers, and scrapers.
C01b	Excavation (60% dry/40% wet)	Same as C01, except C01b assumes that 40% of the excavation would be conducted below the water table. Therefore, this option includes dewatering.
C02a through C02c	Regrade/Consolidate/Revegetate	Reduce the potential for erosion and leaching of metals by regrading waste material and placing a vegetative cover.
C03	Low-Permeability Cap	Significantly reduce metals loads by substantially reducing infiltration through waste materials. Includes a geosynthetic clay liner (GCL) as part of the cap.
C04	Low-Permeability Cap with Seepage Collection	Same as C03 for the low-permeability cap with addition of water collection upgradient of the waste pile, to minimize leaching of the waste and seepage at the downgradient toe of the waste pile so that it could be treated.
C05	Low-Permeability Cap with Erosion Protection	Same as C03 for the low-permeability cap, with erosion protection to minimize the erosion of waste below the nominal 100-year flood level.
C06	Waste Consolidation Area with Erosion Protection	Onsite consolidation of waste material in an area that includes a high-performance GCL cap. Geotextile and low-permeability native soil are beneath the waste.
C07	Waste Consolidation Area Above Flood Level	Same as C06 except this waste consolidation area is above the 100-year flood level.
C08a	Repository	This includes a flexible membrane liner (FML) cap and an FML bottom liner that would provide a high level of performance. The capacity is 1 million cubic yards.
C09	Impoundment Closure	Address the closure of existing abandoned tailings impoundments or cells by capping the impoundment with a GCL and regrading.
HAUL-2	Haul to Repository	Transport the waste materials to a repository.
Water Collection, Conveyance, and Management TCDs		
C10	Adit Drainage Collection	Collect adit drainage for conveyance to a water treatment facility by constructing a partial bulkhead at the base of the adit.
C11a through C11j	Hydraulic Isolation Using Slurry Wall	Minimize the discharge of contaminated groundwater to the surface water system, thereby reducing the dissolved metals loading to the surface water system. Installation of slurry walls ranging in depths from 15 to 50 feet. Only includes slurry wall on one side of the river. TCDs 11h through 11j include a drain.
C14a through C14c	Stream Lining	Reduce dissolved metals loading from groundwater to the stream and reduce surface water recharge of the aquifer with installation of polyvinyl chloride (PVC) liner and a geotextile layer keyed into the anchor trench. Lining ranges in width from 10 to 100 feet.
C15a through C15d	French Drain	Intercept contaminated groundwater that would otherwise discharge to the natural drain by installing French drain in trench and piping collected water to a water treatment system for treatment and subsequent discharge. Depths range from 10 to 25 feet below ground surface (bgs).
C17a through C17e	Groundwater Extraction Well	Intercept metals-contaminated groundwater prior to discharge into a surface water body using extraction wells ranging from 20 to 70 feet deep.
C18	SFCDR Diversion	Temporarily divert the South Fork Coeur d'Alene River (SFCDR) for cutoff wall installation which transverses the SFCDR valley floor. The SFCDR diversion is assumed to include a cofferdam with a series of pumps and a conveyance pipeline to transport the SFCDR water to a downstream location.
C19	I-90 Crossing	Removal of I-90 at select locations is required for cutoff wall installation which transverses the SFCDR valley floor. Removal and replacement of I-90 is assumed to occur in phases.
C-20	Check Dam	Prevent the flow of Bunker Hill Mine water into the Reed and Russell Adit Tunnels and out of the adit openings using check dams at tunnel entrances.
PIPE-1 through PIPE-4	Gravity Pipeline	Convey water to the treatment plant by gravity flow to the extent possible. Pipeline is assumed to be below-grade high-density polyethylene (HDPE) pipe ranging from 6 to 36 inches in diameter.

TABLE 9-1

Descriptions of Typical Conceptual Designs (TCDs)

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

TCD Code	Name	Description
PRESSURE-PIPE-1 through PIPE-4	Pressurized Pipeline	Convey water to the treatment plant by pumping. Pipeline is assumed to be below-grade HDPE pipe ranging from less than 6 inches to greater than 14 inches in diameter.
PUMP-1 through PUMP-5	Pump Station	Contain and pump the collected water designated for active treatment at the CTP. The pump station is assumed to include a wet well and stainless steel pumps with pump capacities ranging from 0.14 to 6.5 million gallons per day (MGD).
Water Treatment TCDs		
WT01	Centralized High-Density Sludge (HDS) Treatment at Central Treatment Plant (CTP)	Treat mining-impacted waters responsible for high metals loading to the SFCDR. The waters are collected at Operable Unit (OU) 2/OU 3 sites and conveyed to the CTP in Kellogg, Idaho, for treatment. Combines HDS metals precipitation with granular media filtration, and includes necessary upgrades to the CTP.
WT02	Onsite Semi-Passive Water Treatment Using Lime Addition and Settling Pond(s)	Treat water onsite with modest operation and maintenance (O&M) requirements. Especially applicable for high-strength waters that are collected in a pipe or channel but not conveyed to the CTP for centralized treatment. Uses mechanical (non-electrical) addition of dry lime based on flow and sedimentation of metal hydroxide solids in settling ponds.
WT03	Onsite Semi-Passive Water Treatment Using Sulfate-Reducing Bioreactor (SRB) System	Treat water onsite with low O&M requirements. Especially applicable for low- to moderate-strength waters that are collected in a pipe or channel but not conveyed to the CTP for centralized treatment. Consists of SRB vessels for precipitation of metal-sulfide solids, and a passive aeration channel, an aerobic polishing pond, and a wetland for removal of byproducts and polishing.
WT04a and WT04b	*In Situ* Groundwater Treatment Using Sulfate-Reducing Permeable Reactive Barrier (SR-PRB)	Treat groundwater emanating from a metals-contaminated site prior to discharging to surface water. Permeable reactive barrier, consisting of a trench filled with organic media, constructed perpendicular to groundwater flow to intercept and treat groundwater. Treatment is effected by biological sulfate reduction and precipitation of metal-sulfide solids. This is designed for either a 10-foot-deep (WT04a) or a 40-foot-deep (WT04b) barrier.
Human Health TCDs		
HH-2	Upland Waste Pile Soil Cover	Decrease human exposure to mining-related waste materials at waste piles using cover similar to C02.
HH-3	Millsite Decontamination	Decrease human exposure to mining-related waste materials at millsites. Hazardous substances would be disposed of in accordance with applicable regulations. Access restrictions would be provided.
HH-4	Millsite Demolition/Disposal	Decrease human exposure to mining-related waste materials at millsites. Buildings, structures, foundations, and underlying contaminated soil would be removed. Nonhazardous construction materials would be capped onsite, disposed of in a repository with other mining-related wastes, or disposed of in a landfill. The hazardous substances would be disposed of in accordance with applicable regulations.
Stream and Riparian Cleanup Action TCDs		
CD-AVG	Current Deflectors	Alter stream flows, directing stream energy away from erodible areas, or to prevent channel migration from outflanking shoreline stabilization structures. Current deflectors include several different types of structures constructed of wood, rock, or other materials attached to a bank or in midchannel which redirect stream energy away from erodible areas.
CD-SED	Current Deflectors, Sediment Traps	Same as CD-AVG with sediment traps added to reduce sediment in areas where it impinges on the ecosystem.
VBS-AVG	Vegetative Bank Stabilization	Introduce a self-maintaining mechanism for improving bank stability by planting native species adapted to stream banks. Bank stabilization using vegetative techniques that include the placement/planting of living and organic materials on actively eroding stream banks. These materials may include seeded ground cover, live cuttings, or rooted plant stock, and bundles or mats of live native plant species well adapted to riparian and streambank conditions.

TABLE 9-1

Descriptions of Typical Conceptual Designs (TCDs)

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

TCD Code	Name	Description
BSBR-AVG	Bioengineered Revetments	Create a durable form of bank protection that provides riparian and in-stream habitat features. Bioengineered revetments integrate several bank stabilization materials, including traditional riprap, large woody debris (e.g., large logs and rootwads), and live plantings.
FP/RP-AVG	Floodplain and Riparian Replanting	Provide site stabilization. Bioengineering techniques for riparian zone rehabilitation will generally include replanting of riparian vegetation where possible and additional structural elements (e.g., nurse logs, snags) to provide additional site stabilization.
OFFCH-AVG	Off-Channel Hydrologic Features	Help to moderate and stabilize the hydrology of degraded stream systems using surface water-fed side channels, groundwater-fed side channels, and off-channel ponds and wetlands.
CH REAL-1	Channel Realignment	Reshape stream channels to a more naturally stable condition and to recreate in-channel hydrologic features, particularly increased pool density and volume.

TABLE 9-2
Summary of Combined Remedial Alternatives and Cost Estimates
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Remedial Alternative	Description	Cost ($ Million)[1]	
No Action Alternative	No Action	Capital:	$0.0
		O&M:	$0.0
		Total Cost:	$0.0
Alternative 3+(a)	OU 3 Alternative 3+ (More Extensive Removal, Disposal, and Treatment) and OU 2 Alternative (a): Minimal Stream Lining	Capital:	$1,240
		O&M:	$95
		Total Cost:	$1,340
Alternative 3+(b)	OU 3 Alternative 3+ and OU 2 Alternative (b): Extensive Stream Lining	Capital:	$1,200
		O&M:	$94.9
		Total Cost:	$1,290
Alternative 3+(c)	OU 3 Alternative 3+ and OU 2 Alternative (c): French Drains	Capital:	$1,200
		O&M:	$99.8
		Total Cost:	$1,300
Alternative 3+(d)	OU 3 Alternative 3+ and OU 2 Alternative (d): Stream Lining/French Drain Combination	Capital:	$1,210
		O&M:	$101
		Total Cost:	$1,310
`Alternative 3+(e)	OU 3 Alternative 3+ and OU 2 Alternative (e): Extensive Stream Lining/French Drain Combination	Capital:	$1,430
		O&M:	$104
		Total Cost:	$1,530
Alternative 4+(a)	OU 3 Alternative 4+ (Maximum Removal, Disposal, and Treatment) and OU 2 Alternative (a): Minimal Stream Lining	Capital:	$1,840
		O&M:	$145
		Total Cost:	$1,990
Alternative 4+(b)	OU 3 Alternative 4+ and OU 2 Alternative (b): Extensive Stream Lining	Capital:	$1,800
		O&M:	$145
		Total Cost:	$1,950
Alternative 4+(c)	OU 3 Alternative 4+ and OU 2 Alternative (c): French Drains	Capital:	$1,800
		O&M:	$150
		Total Cost:	$1,950
Alternative 4+(d)	OU 3 Alternative 4+ and OU 2 Alternative (d): Stream Lining/French Drain Combination	Capital:	$1,810
		O&M:	$151
		Total Cost:	$1,960
Alternative 4+(e)	OU 3 Alternative 4+ and OU 2 Alternative (e): Extensive Stream Lining/French Drain Combination	Capital:	$2,030
		O&M:	$154
		Total Cost:	$2,180

[1] The operation and maintenance (O&M) and total costs are presented as net present value (NPV) costs. NPV costs are based on a 30-year planning period and a discount rate of 7%. For standardizing cost estimates, consistent with U.S. Environmental Protection Agency (EPA) guidance, they assume that all construction occurs in year 1. The above cost estimates are feasibility-study-level estimates with a nominal accuracy of –30 percent to +50 percent (–30/+50%). Cost estimates are in 2009 dollars and do not include future escalation.

TABLE 9-3
Summary of Remedy Protection Alternatives and Cost Estimates
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Remedy Protection Alternative	Description	Cost ($ Million)[1]	
Alternative RP-1	No Further Action (Post-Event Response) [2]	Capital:	$ -
		O&M:	$ -
		Total Cost:	$50.1
Alternative RP-2	Modifications to Selected Remedies to Enhance Protectiveness (Remedy Protection Projects)	Capital:	$24.6
		O&M[3]:	$9.16
		Total Cost:	$33.8

[1] The operation and maintenance (O&M) and total costs are presented as net present value (NPV) costs. NPV costs are based on a 30-year planning period and a discount rate of 7%. For standardizing cost estimates, consistent with U.S. Environmental Protection Agency (EPA) guidance, they assume that all construction occurs in year 1. The above cost estimates are feasibility-study-level estimates with a nominal accuracy of –30 percent to +50 percent (–30/+50%). Cost estimates are in 2009 dollars and do not include future escalation.

[2] There are no capital or O&M costs associated with Alternative RP-1. A methodology for evaluating the long-term damage to the existing Selected Remedies that would be expected from storm events in the Upper Basin was developed to complete the NPV cost analysis for Alternative RP-1. See the Upper Basin Focused Feasibility Study (FFS) Report (EPA, 2012) for more details.

[3] Alternative RP-2 O&M costs were calculated assuming that 2 percent of capital costs would be spent annually on repairs to and maintenance of the remedy protection projects.

TABLE 10-1
Comparative Analysis of the No Action Alternative and Alternatives 3+(a) through 3+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	OU 3 Component				
	Alternative 3+: More Extensive Removal, Disposal, and Treatment				
	OU 2 Component				
	OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
	Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
	Combined Upper Basin Alternative				
No Action	**Alternative 3+(a)**	**Alternative 3+(b)**	**Alternative 3+(c)**	**Alternative 3+(d)**	**Alternative 3+(e)**
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT					
No actions to reduce risks. Existing unacceptable risks to ecological receptors would remain unabated. Potential human health risks would remain unchanged. Contaminants would limit recovery of habitat structure and ecosystem function.	Under Alternative 3+(a), environmental risks would be reduced by removing tailings-impacted alluvium and waste rock from the 100-year floodplain, containing/stabilizing other high-level wastes in-place, treatment of most adit drainage, and hydraulic isolation and groundwater treatment at tailings impoundments and river reaches. Intensive stream and riparian cleanup actions and creation of off-channel hydrologic units would improve stream stability and reduce sediment loading. Potential human health risks would be addressed by the above actions and additional access restrictions.	See Alternative 3+(a). In addition, this alternative would provide more extensive stream lining throughout the Bunker Hill "Box". Extraction wells and slurry walls would also be included in some Box tributaries to collect clean groundwater for discharge to the lined stream. Under Alternative 3+(b), there would be no stream liner on the SFCDR in the Box as there is under Alternative 3+(a). Overall moderate AWQC-ratio reduction (3.0 compared to 5.2) for Pinehurst. Attainment of ARARs for surface water would require a period of natural source depletion.	See Alternative 3+(a). Alternative differences include no stream lining and the addition of French drains in the Box. Direct piping of the CTP effluent to the SFCDR is also included. Overall large AWQC-ratio reduction (1.8 compared to 5.2) for Pinehurst. Attainment of ARARs for surface water would require a period of natural source depletion.	See Alternative 3+(c). The only difference between this alternative and Alternative 3+(c) is that this alternative also has a stream liner in Government Gulch, with a slurry wall and extraction wells at the upstream end for discharge of clean groundwater to the lined stream channel. Direct piping of the CTP effluent to the SFCDR is also included. Would provide slightly higher effectiveness than Alternative 3+(c) by providing additional benefits to the water quality in Government Creek. Overall large AWQC-ratio reduction (1.7 compared to 5.2) for Pinehurst.	See Alternative 3+(a). In addition, this alternative includes extensive stream lining with slurry walls and extraction wells for groundwater collection, as well as French drains along the SFCDR in the Box. The extensive actions included in this alternative would effectively decouple the groundwater and surface water systems through the Box. Overall large AWQC-ratio reduction (1.5 compared to 5.2) for Pinehurst. Attainment of ARARs for surface water would require a period of natural source depletion.

TABLE 10-1
Comparative Analysis of the No Action Alternative and Alternatives 3+(a) through 3+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	OU 3 Component				
	Alternative 3+: More Extensive Removal, Disposal, and Treatment				
	OU 2 Component				
	OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
	Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
	Combined Upper Basin Alternative				
No Action	**Alternative 3+(a)**	**Alternative 3+(b)**	**Alternative 3+(c)**	**Alternative 3+(d)**	**Alternative 3+(e)**
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (continued)					
	Decontamination of structures would further address potential human health risks. Overall moderate AWQC-ratio reduction (2.9 compared to 5.2) for Pinehurst. Attainment of ARARs for surface water would require a period of natural source depletion.			Attainment of ARARs for surface water would require a period of natural source depletion.	
COMPLIANCE WITH ARARS					
Would not comply with chemical-specific ARARs for surface water until natural decay processes reduced loading to sufficient levels. Would not meet clean up levels for soil and sediment. Location- and action-specific ARARs would not be applicable.	Would meet surface water ARARs after period of natural source depletion and would result in significantly reduced metals concentrations in surface water. Would meet cleanup levels for soil and sediment at locations where actions are taken. Would comply with all action-specific and location-specific ARARs, including substantive requirements of CWA Section 404, Rivers and Harbors Act Section 10, and Endangered Species Act.	See Alternative 3+(a).	See Alternative 3+(a).	See Alternative 3+(a).	See Alternative 3+(a).

TABLE 10-1
Comparative Analysis of the No Action Alternative and Alternatives 3+(a) through 3+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	OU 3 Component				
	Alternative 3+: More Extensive Removal, Disposal, and Treatment				
	OU 2 Component				
	OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
	Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
	Combined Upper Basin Alternative				
No Action	**Alternative 3+(a)**	**Alternative 3+(b)**	**Alternative 3+(c)**	**Alternative 3+(d)**	**Alternative 3+(e)**
LONG-TERM EFFECTIVENESS AND PERMANENCE					
Does not meet either of the Threshold Criteria; therefore, Primary Balancing Criteria not evaluated.	Significant reduction in expected post-remediation mass loadings in surface water (estimated 41% reduction). Some smaller loading sources would receive no action or limited containment. Low potential for mobilization (through erosion) of contaminated alluvium left in place. Natural source depletion processes would further reduce residual risks from surface water. Risks from contaminated soil and sediment would be significantly reduced. Low residual risk to humans. Decontamination of structures and access restrictions would be effective. Remedy could effectively be maintained through monitoring, maintenance, and institutional controls. Moderate maintenance requirements for caps, stream and riparian cleanup actions, sediment	See Alternative 3+(a). Additional benefits would be achieved through this alternative by significantly improving water quality in several OU 2 tributaries (Government, Magnet, and Deadwood Creeks). Low residual risk to humans. Decontamination of structures and access restrictions would be effective.	Large reduction in expected post-remediation mass loading in surface water (estimated 59% reduction). Some smaller loading sources would receive no action or limited containment. Low potential for mobilization (through erosion) of contaminated alluvium left in place. Natural source depletion processes would further reduce residual risks. Risks from contaminated soil and sediment would be significantly reduced. Low residual risk to humans. Decontamination of structures and access restrictions would be	Large reduction in expected post-remediation mass loading in surface water (estimated 60% reduction). Load reduction estimates provided are for the SFCDR. Additional benefits would be achieved through this alternative by significantly improving water quality in Government Creek. Some smaller loading sources would receive no action or limited containment. Low potential for mobilization (through erosion) of contaminated alluvium left in place. Natural source depletion processes would further reduce residual risks. Risks from contaminated	Large reduction in expected post-remediation mass loadings (estimated 63% reduction). Additional benefits would be achieved through this alternative by significantly improving water quality in many OU 2 tributaries. Some smaller loading sources would receive no action or limited containment. Low potential for mobilization (through erosion) of contaminated alluvium left in place. Natural source depletion processes would further reduce residual risks. Risks from contaminated soil and sediment would be significantly reduced. Low residual risk to humans. Decontamination of

TABLE 10-1
Comparative Analysis of the No Action Alternative and Alternatives 3+(a) through 3+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	OU 3 Component				
	Alternative 3+: More Extensive Removal, Disposal, and Treatment				
	OU 2 Component				
	OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
	Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
	Combined Upper Basin Alternative				
No Action	**Alternative 3+(a)**	**Alternative 3+(b)**	**Alternative 3+(c)**	**Alternative 3+(d)**	**Alternative 3+(e)**
LONG-TERM EFFECTIVENESS AND PERMANENCE (continued)					
	traps, French drains, and stream liners. High maintenance requirements for passive and active treatment.		effective. See Alternative 3+(a). More linear feet of French drain are included in this alternative through the Box, although less stream lining.	soil and sediment would be significantly reduced. Low residual risk to humans. Decontamination of structures and access restrictions would be effective. See Alternative 3+(a). More linear feet of French drain and slightly less stream lining would be included through the Box in this alternative.	structures and access restrictions would be effective. See Alternative 3+(a). Significantly more stream lining and French drains would be included through the Box in the alternative, as well as slurry walls and groundwater extraction wells.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT					
Does not meet either of the Threshold Criteria; therefore, Primary Balancing Criteria therefore not evaluated.	Satisfies the statutory preference for treatment. Estimated average flow rate from all sources to the CTP is approximately 11,500 gpm (290 lb/day). All of this flow is from OU 3. No water from OU 2 would be treated. Semi-passive treatment of 800 gpm (47 lb/day) would occur at 27 additional adits using either	Satisfies the statutory preference for treatment. See Alternative 3+(a).	Satisfies the statutory preference for treatment. Treatment processes and semi-passive treatment scheme are the same as for Alternative 3+(a). Estimated average flow rate from all sources to the CTP is approximately	Satisfies the statutory preference for treatment. Treatment processes and semi-passive treatment scheme are the same as for Alternative 3+(c).	Satisfies the statutory preference for treatment. Treatment processes and semi-passive treatment scheme are the same as for Alternative 3+(a). Estimated average flow rate from all sources to the CTP is approximately 13,900

TABLE 10-1
Comparative Analysis of the No Action Alternative and Alternatives 3+(a) through 3+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	OU 3 Component				
	Alternative 3+: More Extensive Removal, Disposal, and Treatment				
	OU 2 Component				
	OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
	Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
	Combined Upper Basin Alternative				
No Action	**Alternative 3+(a)**	**Alternative 3+(b)**	**Alternative 3+(c)**	**Alternative 3+(d)**	**Alternative 3+(e)**
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT (continued)					
	SRB or lime addition/ precipitation. Volume of contaminated water would be reduced. Spent SRB substrate and hydroxide sludge require disposal. It is assumed that these wastes would be disposed of onsite. Total volume requiring disposal is estimated to be 8,900 cy/y.		15,400 gpm (1,450 lb/day). The majority of this flow is from OU 3 with the exception of approximately 3,900 gpm (1,160 lb/day) from the French drains in OU 2. Total volume of treatment residuals requiring disposal is estimated to be 13,900 cy/y.		gpm (820 lb/day). The majority of this flow is from OU 3 with the exception of approximately 2,400 gpm (530 lb/day) from the French drains and extraction wells in OU 2. Total volume of treatment residuals requiring disposal is estimated to be 11,900 cy/y, less than that of Alternatives 3+(c) and 3+(d).
SHORT-TERM EFFECTIVENESS					
Does not meet either of the Threshold Criteria; therefore, Primary Balancing Criteria not evaluated.	Short-term risks to the community from construction traffic. Risks would be minimized by traffic control plans and selective repository siting. Limited risks to workers from remedial actions. Risks would be minimized with standard health and safety measures. Short-term	See Alternative 3+(a). Slightly higher volume of truck trips would be associated with the longer stream liner lengths in Alternative 3+(b).	See Alternative 3+(a). Slightly higher volume of truck trips would be associated with more extensive floodplain work to install French drains. Slightly less floodplain construction would be required in the Box relative to	See Alternative 3+(c). Slightly higher volume of truck trips would be associated with stream lining and associated work in Government Gulch.	See Alternative 3+(d). Significant increase in highway and local traffic logistics (because of the upstream and downstream cutoff walls on the SFCDR that would need to be constructed through I-90). Relative to other

TABLE 10-1
Comparative Analysis of the No Action Alternative and Alternatives 3+(a) through 3+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	OU 3 Component				
	Alternative 3+: More Extensive Removal, Disposal, and Treatment				
	OU 2 Component				
	OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
	Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
	Combined Upper Basin Alternative				
No Action	**Alternative 3+(a)**	**Alternative 3+(b)**	**Alternative 3+(c)**	**Alternative 3+(d)**	**Alternative 3+(e)**
SHORT-TERM EFFECTIVENESS (continued)					
	environmental impacts could result from construction. These impacts would be minimized and mitigated through engineering controls and revegetation through 3+(d). In the context of current water quality in the SFCDR, these potential risks would be minimal. Implementation period would be approximately the same for Alternatives 3+(a) Based on estimated funding streams, this may be 50 to 90 years[c].		Alternative 3+(b); therefore, short-term risks would be slightly lower. In the context of current water quality in the SFCDR, these potential risks would be minimal.		alternatives, Alternative 3+(e) would present the greatest short-term risks to workers. Implementation of this alternative may take approximately 60 to 100 years[c].
IMPLEMENTABILITY					
Does not meet either of the Threshold Criteria; therefore, Primary Balancing Criteria therefore not evaluated.	No significant technical feasibility concerns. Significant uncertainties in construction volumes (OU 3) – these could be handled in design/ construction phases. Major cost and logistical considerations for obtaining borrow materials and excavating in floodplains. Potential construction	See Alternative 3+(a). Longer stream lining included in Alternative 3+(b) would add to the logistical issues noted, although there is no SFCDR liner in this alternative which would have many logistical challenges.	See Alternative 3+(a). In addition, the extensive French drains included in this alternative would add to the logistical issues noted.	See Alternative 3+(c). In addition, work in Government Gulch would add to the logistical issues noted.	See Alternative 3+(c). In addition, extensive work in the Box would add to the logistical issues noted. Excavation of sediments from below the water table would pose significant logistical issues and result in higher costs. These

TABLE 10-1
Comparative Analysis of the No Action Alternative and Alternatives 3+(a) through 3+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	OU 3 Component				
	Alternative 3+: More Extensive Removal, Disposal, and Treatment				
	OU 2 Component				
	OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
	Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
	Combined Upper Basin Alternative				
No Action	**Alternative 3+(a)**	**Alternative 3+(b)**	**Alternative 3+(c)**	**Alternative 3+(d)**	**Alternative 3+(e)**
IMPLEMENTABILITY (continued)					
	difficulties for hydraulic isolation. The reach of the SFCDR to be lined in the Box would be located within the developed areas of the City of Kellogg. Access for large equipment along with space for SFCDR diversion would pose significant logistical issues. Impacts of stream liners on river hydraulics would need to be evaluated. Treatability testing would be required for semi-passive treatment design. Significant difficulties would be encountered in acquiring land and obtaining approvals for repositories and active treatment conveyance pipelines and for obtaining borrow materials. Services, equipment, and technologies are all available, at least on a regional level.				implementability concerns are great under this alternative because the French drain and pump station depth may range from 10 to 40 feet below ground surface. Deeper excavations, if required, would increase the dewatering difficulties.

TABLE 10-1
Comparative Analysis of the No Action Alternative and Alternatives 3+(a) through 3+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	OU 3 Component				
	Alternative 3+: More Extensive Removal, Disposal, and Treatment				
	OU 2 Component				
	OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
	Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
	Combined Upper Basin Alternative				
No Action	**Alternative 3+(a)**	**Alternative 3+(b)**	**Alternative 3+(c)**	**Alternative 3+(d)**	**Alternative 3+(e)**
COST					
Total Capital Cost $0	**Total Capital Cost** $1,240,000,000	**Total Capital Cost** $1,200,000,000	**Total Capital Cost** $1,200,000,000	**Total Capital Cost** $1,210,000,000	**Total Capital Cost** $1,430,000,000
O&M Cost (30-Year NPV)[a] $0	**O&M Cost (30-Year NPV)[a]** $95,000,000	**O&M Cost (30-Year NPV)[a]** $94,900,000	**O&M Cost (30-Year NPV)[a]** $99,800,000	**O&M Cost (30-Year NPV)[a]** $101,000,000	**O&M Cost (30-Year NPV)[a]** $104,000,000
Total Cost (30-Year NPV)[b] $0	**Total Cost (30-Year NPV)[b]** $1,340,000,000	**Total Cost (30-Year NPV)[b]** $1,290,000,000	**Total Cost (30-Year NPV)[b]** $1,300,000,000	**Total Cost (30-Year NPV)[b]** $1,310,000,000	**Total Cost (30-Year NPV)[b]** $1,530,000,000
Does not meet either of the Threshold Criteria; therefore, Primary Balancing Criteria not evaluated.	Costs for Alternatives 3+(a) through 3+(d) are very similar and within the accuracy of the estimate (-30/+50%). Costs for alternatives based on Alternative 3+ are lower than corresponding alternatives based on Alternative 4+.	Costs for Alternatives 3+(a) through 3+(d) are very similar and within the accuracy of the estimate (-30/+50%). Costs for alternatives based on Alternative 3+ are lower than corresponding alternatives based on Alternative 4+.	Costs for Alternatives 3+(a) through 3+(d) are very similar and within the accuracy of the estimate (-30/+50%). Costs for alternatives based on Alternative 3+ are lower than corresponding alternatives based on Alternative 4+.	Costs for Alternatives 3+(a) through 3+(d) are very similar and within the accuracy of the estimate (-30/+50%). Costs for alternatives based on Alternative 3+ are lower than corresponding alternatives based on Alternative 4+.	This alternative has a relatively high cost although is still within the accuracy of the estimate relative to Alternatives 3+(a) through 3+(d). Costs for alternatives based on Alternative 3+ are lower than corresponding alternatives based on Alternative 4+.

Notes:
[a] O&M costs over 30 years in current dollars, assuming a 7% discount factor.
[b] Total NPV cost equals the total equivalent cost of the alternative over 30 years in current dollars, assuming a 7% discount factor.
[c] This assumes a rough estimated range of $15M/yr to $25M/yr of available annual funding to cover capital costs.

TABLE 10-1
Comparative Analysis of the No Action Alternative and Alternatives 3+(a) through 3+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	OU 3 Component				
	Alternative 3+: More Extensive Removal, Disposal, and Treatment				
	OU 2 Component				
	OU 2 Alternative (a)	OU 2 Alternative (b)	OU 2 Alternative (c)	OU 2 Alternative (d)	OU 2 Alternative (e)
	Minimal Stream Lining	Extensive Stream Lining	French Drains	Stream Lining/French Drain Combination	Extensive Stream Lining/French Drain Combination
	Combined Upper Basin Alternative				
No Action	Alternative 3+(a)	Alternative 3+(b)	Alternative 3+(c)	Alternative 3+(d)	Alternative 3+(e)

Notes (continued):
ARARs = applicable or relevant and appropriate requirements
AWQC = ambient water quality criteria
CTP = Central Treatment Plant
CWA = Clean Water Act
cy = cubic yards
gpm = gallons per minute
LF = lineal feet
NPV = net present value
O&M = operation and maintenance
OU = Operable Unit
RAO = remedial action objective
SFCDR = South Fork Coeur d'Alene River
SRB = sulfate-reducing bioreactor
cy/y = cubic yards per year

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

TABLE 10-2
Comparative Analysis of Alternatives 4+(a) through 4+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

OU 3 Component				
Alternative 4+: Maximum Removal, Disposal, and Treatment				
OU 2 Component				
OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
Combined Upper Basin Alternative				
Alternative 4+(a)	**Alternative 4+(b)**	**Alternative 4+(c)**	**Alternative 4+(d)**	**Alternative 4+(e)**
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT				
Would reduce environmental risks with extensive removal and containment to address all known soil and sediment above cleanup levels. Highest-performance containment using repositories. Expanded treatment would address all adit drainages of concern and remaining contaminated groundwater. More off-channel hydrologic units would be created. Demolition and cleanup of any structures would further address potential human health risks. Would provide high effectiveness in containing all media with significant loading potential, and in recovery of ecosystem function. Extensive hauling would pose significant short-term risks to the community and to workers. Overall moderate AWQC-ratio reduction (2.8 compared to 5.2) for Pinehurst.	See Alternative 4+(a). In addition, this alternative would provide more extensive stream lining throughout the Box. Extraction wells and slurry walls would also be included in some Box tributaries to collect clean groundwater for discharge to the lined stream. Under Alternative 4+(b), there would be no stream liner on the SFCDR as there is under Alternative 4+(a). Overall moderate AWQC-ratio reduction (2.8 compared to 5.2) for Pinehurst. Attainment of ARARs for surface water would require a period of natural source depletion	See Alternative 4+(a). Alternative differences include no stream lining and the addition of French drains in the Box. Direct piping of the CTP effluent to the SFCDR is also included. Overall large AWQC-ratio reduction (1.6 compared to 5.2) for Pinehurst. Attainment of ARARs for surface water would require a period of natural source depletion.	See Alternative 4+(c). The only difference between this alternative and Alternative 4+(c) is that this alternative also has stream lining in Government Gulch with a slurry wall and extraction wells at the upstream end for discharge of clean groundwater to the lined stream channel. Direct piping of the CTP effluent to the SFCDR is also included. Overall large AWQC-ratio reduction (1.5 compared to 5.2) for Pinehurst. Attainment of ARARs for surface water would require a period of natural source depletion.	See Alternative 4+(a). In addition, this alternative includes extensive stream lining with slurry walls and extraction wells for groundwater collection, as well as French drains along the SFCDR. Overall large AWQC-ratio reduction (1.3 compared to 5.2) for Pinehurst. Attainment of ARARs for surface water would require a period of natural source depletion.

OU 3 Component				
Alternative 4+: Maximum Removal, Disposal, and Treatment				
OU 2 Component				
OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
Combined Upper Basin Alternative				
Alternative 4+(a)	**Alternative 4+(b)**	**Alternative 4+(c)**	**Alternative 4+(d)**	**Alternative 4+(e)**
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (continued)				
Attainment of ARARs for surface water would require a period of natural source depletion.				
COMPLIANCE WITH ARARS				
Would meet ARARs for surface water after a period of natural source reduction and would result in significantly reduce metals concentrations in surface water. Would meet cleanup levels for soil and sediment in locations where actions are taken. Would comply with all action-specific and location-specific ARARs, including substantive requirements of CWA Section 404, Rivers and Harbors Act Section 10, and Endangered Species Act. Potential difficulties in meeting requirements for repository siting and obtaining borrow materials.	See Alternative 4+(a)	See Alternative 4+(a)	See Alternative 4+(a)	See Alternative 4+(a)

TABLE 10-2
Comparative Analysis of Alternatives 4+(a) through 4+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

OU 3 Component				
Alternative 4+: Maximum Removal, Disposal, and Treatment				
OU 2 Component				
OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
Combined Upper Basin Alternative				
Alternative 4+(a)	**Alternative 4+(b)**	**Alternative 4+(c)**	**Alternative 4+(d)**	**Alternative 4+(e)**
LONG-TERM EFFECTIVENESS AND PERMANENCE				
Moderate reduction in expected post-remediation mass loading in surface water (estimated 45% reduction). All significant loading sources in OU 3 would receive action. Low potential for mobilization (through erosion) of contaminated alluvium left in place. Natural recovery processes would further reduce residual risks. Risks from contaminated soil and sediment would be significantly reduced. Low residual risk to humans. All areas posing significant risk would be cleaned up or contained. Remedy could effectively be maintained through monitoring, maintenance, and institutional controls. Moderate maintenance requirements for caps; low maintenance requirements for stream and riparian cleanup actions; high maintenance requirements for passive and active treatment.	See Alternative 4+(a).	See Alternative 4+(a). Large reduction in expected post-remediation mass loadings (estimated 63% reduction). Some smaller loading sources would receive no action or limited containment. Low potential for mobilization (through erosion) of contaminated alluvium left in place. Natural recovery processes would further reduce residual risks. Risks from contaminated soil and sediment would be significantly reduced.	See Alternative 4+(a). Large reduction in expected post-remediation mass loadings (estimated 65% reduction). Some smaller loading sources would receive no action or limited containment. Low potential for mobilization (through erosion) of contaminated alluvium left in place. Natural recovery processes would further reduce residual risks. Risks from contaminated soil and sediment would be significantly reduced.	See Alternative 4+(a). Large reduction in expected post-remediation mass loadings (estimated 68% reduction). Some smaller loading sources would receive no action or limited containment. Low potential for mobilization (through erosion) of contaminated alluvium left in place. Surface water ARARs would be achieved at the time of remedy completion. Risks from contaminated soil and sediment would be significantly reduced.

TABLE 10-2
Comparative Analysis of Alternatives 4+(a) through 4+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

OU 3 Component				
Alternative 4+: Maximum Removal, Disposal, and Treatment				
OU 2 Component				
OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
Combined Upper Basin Alternative				
Alternative 4+(a)	**Alternative 4+(b)**	**Alternative 4+(c)**	**Alternative 4+(d)**	**Alternative 4+(e)**
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT				
Satisfies the statutory preference for treatment. Estimated average flow rate from all sources to the CTP is approximately 14,000 gpm (184 lb/day). All of this flow is from OU 3. No water from OU 2 would be treated. Semi-passive treatment of 1,410 gpm (49 lb/day) would occur at 54 additional adits using either SRB or lime addition/ precipitation. Volume of contaminated water would be reduced. Treatment residuals (Spent SRB media and hydroxide sludge) would require proper disposal to ensure that leaching of metals into the environment would not occur. It is assumed that these wastes would be disposed of onsite. Total volume requiring disposal is estimated to be 9,900 cy/y.	See Alternative 4+(a).	Treatment processes and semi-passive treatment scheme are the same as for Alternative 4+(a). Total volume of treatment residuals requiring disposal is greater, and estimated to be 14,900 cy/y. Estimated average flow rate from all sources to the CTP is approximately 17,900 gpm (1,350 lb/day). The majority of this flow is from OU 3 with the exception of approximately 3,900 gpm (1,160 lb/day) from the French drains in OU 2.	Treatment processes and semi-passive treatment scheme are the same as for Alternative 4+(a). Estimated average flow rate from all sources to the CTP is approximately 17,900 gpm (1,330 lb/day). The majority of this flow is from OU 3 with the exception of approximately 3,900 gpm (1,150 lb/day) from the French drains and extraction wells in OU 2. Treatment residuals volumes are approximately the same as for Alternative 4+(c).	Treatment processes and semi-passive treatment scheme are the same as for Alternative 4+(a). Estimated average flow rate from all sources to the CTP is approximately 16,400 gpm (720 lb/day). The majority of this flow is from OU 3 with the exception of approximately 2,400 gpm (531 lb/day) from the French drains and extraction wells in OU 2. Reduction in toxicity, mobility, or volume is lower than that for Alternatives 4+(d) and 4+(c) but higher than that for Alternatives 4+(a) and (b). Total volume of treatment residuals requiring disposal is greater than Alternative 4+(a) and (b) but less than Alternatives 4+(c) and (d), and is estimated to be 12,900 cy/y.

TABLE 10-2
Comparative Analysis of Alternatives 4+(a) through 4+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

OU 3 Component				
Alternative 4+: Maximum Removal, Disposal, and Treatment				
OU 2 Component				
OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
Combined Upper Basin Alternative				
Alternative 4+(a)	**Alternative 4+(b)**	**Alternative 4+(c)**	**Alternative 4+(d)**	**Alternative 4+(e)**
SHORT-TERM EFFECTIVENESS				
Potentially significant short-term risks to the community from construction traffic. Risks would be minimized by traffic control plans and selective repository siting. Limited risks to workers from remediation actions. Risks would be minimized with standard health and safety measures. The scope of actions under Alternative 4+ would increase the risk of work injury relative to Alternative 3+. Significant and ongoing impacts to environment during several decades (or more) of construction. In the context of current water quality in the SFCDR, these potential risks would be minimal. Approx. 80 to 130 years[c] to implement actions for Alternatives 4+(a) through 4+(d). Additional time would be required for natural source depletion to attain ARARs in surface water. In addition, water treatment would need to continue beyond the Remedy	See Alternative 4+(a). Slightly higher volume of truck trips would be associated with the longer stream liner lengths in Alternative 4+(b).	See Alternative 4+(a). Slightly higher volume of truck trips would be associated with more extensive floodplain work to install French drains. Slightly less floodplain construction would be required in the Box relative to Alternative 4+(b); therefore, short-term risks would be slightly lower. In the context of current water quality in the SFCDR, these potential risks would be minimal. Approx. 80 to 130 years[c] to implement actions. Additional time would be required for natural source depletion to attain ARARs for surface water; however, it is expected this time would be shorter than Alternatives 3+(a) and 3+(b) and Alternatives 4+(a) and (b), given the lower predicted AWQC ratios at remedy completion. In addition, water treatment would need to be continued beyond the Remedy	See Alternative 4+(c). Slightly higher volume of truck trips would be associated with stream lining and associated work in Government Gulch.	See Alternative 4+(d). Slightly higher volume of truck trips would be associated with additional construction work in the Box. Short-term risks would be higher than for Alternatives 4+(a) through 4+(d) due to extensive floodplain construction in the Box. In the context of current water quality in the SFCDR, these potential risks would be minimal. Approximately 90 to 140 years to implement actions. Less time would be required for natural source depletion to attain ARARs for surface water given the lower predicted AWQC ratios at remedy completion. In addition, water treatment would need to be continued beyond the Remedy Implementation Phase for an unknown period of time.

TABLE 10-2
Comparative Analysis of Alternatives 4+(a) through 4+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

OU 3 Component				
Alternative 4+: Maximum Removal, Disposal, and Treatment				
OU 2 Component				
OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
Combined Upper Basin Alternative				
Alternative 4+(a)	**Alternative 4+(b)**	**Alternative 4+(c)**	**Alternative 4+(d)**	**Alternative 4+(e)**
SHORT-TERM EFFECTIVENESS (continued)				
Implementation Phase for an unknown period of time.		Implementation Phase for an unknown period of time.		
IMPLEMENTABILITY				
Technically feasible, but major logistical constraints on truck traffic. Large uncertainty in construction volumes – these could further increase construction difficulties and administrative difficulties. Major cost and logistical considerations for obtaining borrow materials and excavating in floodplains. Potential construction difficulties for hydraulic isolation. Treatability testing would be required as with Alternatives 3+(a) through 3+(e). Potential significant difficulties in acquiring land and approvals for repositories and active treatment pipelines, obtaining borrow materials, and coordinating truck traffic. Services, equipment, and technologies are all available, at least on a regional level.	See Alternative 4+(a). Longer stream lining included in Alternative 4+(b) would add to the logistical issues noted, although there is no SFCDR liner in the Box this alternative which would have many logistical challenges.	See Alternative 4+(a). In addition, the extensive French drains included in this alternative would add to the logistical issues noted.	See Alternative 4+(c). In addition, work in Government Gulch would add to the logistical issues noted.	See Alternative 4+(c). In addition, extensive work in the Box would add to the logistical issues noted. Excavation of sediments from below the water table would pose significant logistical issues and result in higher costs. These implementability concerns are great under this Alternative because the French drain and pump station depth may range from 10 to 40 feet below ground surface. Deeper excavations, if required, would increase the dewatering difficulties.

TABLE 10-2
Comparative Analysis of Alternatives 4+(a) through 4+(e)
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

OU 3 Component				
Alternative 4+: Maximum Removal, Disposal, and Treatment				
OU 2 Component				
OU 2 Alternative (a)	**OU 2 Alternative (b)**	**OU 2 Alternative (c)**	**OU 2 Alternative (d)**	**OU 2 Alternative (e)**
Minimal Stream Lining	**Extensive Stream Lining**	**French Drains**	**Stream Lining/French Drain Combination**	**Extensive Stream Lining/French Drain Combination**
Combined Upper Basin Alternative				
Alternative 4+(a)	**Alternative 4+(b)**	**Alternative 4+(c)**	**Alternative 4+(d)**	**Alternative 4+(e)**
COST				
Total Capital Cost $1,840,000,000	**Total Capital Cost** $1,800,000,000	**Total Capital Cost** $1,800,000,000	**Total Capital Cost** $1,810,000,000	**Total Capital Cost** $2,030,000,000
O&M Cost (30-Year NPV) [a] $145,000,000	**O&M Cost (30-Year NPV)** [a] $145,000,000	**O&M Cost (30-Year NPV)** [a] $150,000,000	**O&M Cost (30-Year NPV)** [a] $151,000,000	**O&M Cost (30-Year NPV)** [a] $154,000,000
Total Cost (30-Year NPV) [b] $1,990,000,000	**Total Cost (30-Year NPV)** [b] $1,950,000,000	**Total Cost (30-Year NPV)** [b] $1,950,000,000	**Total Cost (30-Year NPV)** [b] $1,960,000,000	**Total Cost (30-Year NPV)** [b] $2,180,000,000
Costs for Alternatives 4+(a) through 4+(d) are very similar and within the accuracy of the estimate (-30/+50%).Costs for alternatives based on Alternative 4+ are higher than corresponding alternatives based on Alternative 3+.	Costs for Alternatives 4+(a) through 4+(d) are very similar and within the accuracy of the estimate (-30/+50%).Costs for alternatives based on Alternative 4+ are higher than corresponding alternatives based on Alternative 3+.	Costs for Alternatives 4+(a) through 4+(d) are very similar and within the accuracy of the estimate (-30/+50%).Costs for alternatives based on Alternative 4+ are higher than corresponding alternatives based on Alternative 3+.	Costs for Alternatives 4+(a) through 4+(d) are very similar and within the accuracy of the estimate (-30/+50%). Costs for alternatives based on Alternative 4+ are higher than corresponding alternatives based on Alternative 3+.	This alternative has a relatively high cost although is still within the accuracy of the estimate relative to Alternatives 4+(a) through 4+(d). Costs for alternatives based on Alternative 4+ are higher than corresponding alternatives based on Alternative 3+.

Notes:
[a] O&M costs over 30 years in current dollars, assuming a 7% discount factor.
[b]Total NPV cost equals the total equivalent cost of the alternative over 30 years in current dollars, assuming a 7% discount factor.
[c]This assumes a rough estimated range of $15M/yr to $25M/yr of available annual funding to cover capital costs.
ARARs = applicable or relevant and appropriate requirements
CTP = Central Treatment Plant
CWA = Clean Water Act
cy = cubic yards
gpm = gallons per minute

Notes (continued):
LF = linear feet
NPV = net present value
O&M = operation and maintenance
OU = Operable Unit
RAO = remedial action objective
SFCDR = South Fork Coeur d'Alene River
SRB = sulfate-reducing bioreactor

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

TABLE 10-3

Estimated Post-Remediation Dissolved Zinc AWQC Ratios and Load Reductions at Elizabeth Park and Pinehurst

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	At Remedy Completion					
	Post-Remediation Dissolved Zinc Load (lb/day)	80% Probability Interval on Load Estimate		Post-Remediation Dissolved Zinc Load Reduction		
	Best Estimate[1]	Lower	Upper	Pounds/Day	Percent	AWQC Ratio
Elizabeth Park (Station SF-268)						
No Action Alternative	1,260	330	2,540	0	0	5.5
Alt. 3+ (OU 3 Only)	513	90	1,120	744	59	1.9
Alt. 4+ (OU 3 Only)	432	75	940	825	66	1.6
Pinehurst (Station SF-271)						
No Action Alternative	2,290	433	4,910	0	0	5.2
Alt. 3+(a)	1,340	225	2,940	941	41	2.9
Alt. 3+(b)	1,350	227	2,960	933	41	3.0
Alt. 3+(c)	942	97	2,140	1,340	59	1.8
Alt. 3+(d)	905	84	2,060	1,380	60	1.7
Alt. 3+(e)	835	71	1,900	1,450	63	1.5
Alt. 4+(a)	1,250	223	2,700	1,040	45	2.8
Alt. 4+(b)	1,250	226	2,720	1,030	45	2.8
Alt. 4+(c)	844	90	1,910	1,440	63	1.6
Alt. 4+(d)	807	76	1,830	1,480	65	1.5
Alt. 4+(e)	737	63	1,680	1,550	68	1.3

Notes:

[1]The 'best estimate' is the calculated output from the Predictive Analysis model when the mean value is assumed for all the input variables [material volumes] and factors [relative leaching potential and source remediation factors].

The predicted post-remediation timing for the No Action Alternative is different from the predicted post-remediation timing for the action alternatives because the No Action Alternative prediction reflects current conditions, whereas each of the action alternatives would take several decades to complete. With any of the alternatives, it is assumed that high-priority sources for action would be targeted early, so it is anticipated that disproportionally greater effects of the remedy would be seen during the earlier portions of the implementation period.

AWQC = ambient water quality criteria

OU = Operable Unit

TABLE 10-4
Comparative Analysis of Remedy Protection Alternatives
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	Description of Criterion	ALTERNATIVE RP-1 No Further Action (Post-Event Response)	ALTERNATIVE RP-2 Modifications to Selected Remedies to Enhance Protectiveness (Remedy Protection Projects)
Threshold Criteria			
Overall Protection of Human Health and the Environment	Ability of alternative to achieve and maintain protection of human health and the environment	Alternative RP-1 would be protective of human health and the environment because the existing Selected Human Health Remedies are currently protective. The risk of exposure to contaminated material for Alternative RP-1 could temporarily increase following a storm event from the time the Selected Remedies were damaged until the post-event response was completed.	Alternative RP-2 would be protective of human health and the environment because the existing Selected Human Health Remedies are currently protective. Additionally, Alternative RP-2 would be more protective of human health and the environment than Alternative RP-1 because it would enhance the long-term effectiveness and permanence of the Selected Remedies by reducing the potential for floods or surface water flow to damage the existing Selected Remedies.
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)	Ability of alternative to meet location- and action-specific ARARs	Alternative RP-1 could potentially be implemented in compliance with location- and action-specific ARARs. Chemical-specific ARARs were not included as part of this evaluation because the remedy protection alternatives only maintain the existing Selected Remedies.	Alternative RP-2 could potentially be implemented in compliance with location- and action-specific ARARs. Chemical-specific ARARs were not included as part of this evaluation because the remedy protection alternatives only maintain the existing Selected Remedies.
Primary Balancing Criteria			
Long-Term Effectiveness and Permanence	Ability of technology to be protective of human health and the environment without upset over the long term	Alternative RP-1 would provide relatively less long-term effectiveness and permanence. Based on hydrologic and hydraulic models, there are areas of the existing Selected Remedies which are at risk of recontamination due to flooding and uncontrolled surface water flow. Alternative RP-1 would not address this issue of permanence of the existing Selected Remedies, but instead would rely on post-event response to repair the Selected Remedies when damaged.	Alternative RP-2 would enhance the long-term effectiveness and permanence of the Selected Remedies. This alternative would be expected to provide protectiveness to the communities from storm events smaller than the 50-year event.

TABLE 10-4
Comparative Analysis of Remedy Protection Alternatives
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	Description of Criterion	**ALTERNATIVE RP-1 No Further Action (Post-Event Response)**	**ALTERNATIVE RP-2 Modifications to Selected Remedies to Enhance Protectiveness (Remedy Protection Projects)**
Reduction of Toxicity, Mobility, or Volume through Treatment	Ability of alternative to reduce mobility, toxicity, or volume of contaminants	Alternative RP-1 would not reduce the toxicity, mobility, or volume of metals contamination through treatment.	Alternative RP-2 would not reduce the toxicity, mobility, or volume of metals contamination through treatment.
Short-Term Effectiveness	Ability of alternative to protect human health and the environment during the short-term time frame	In general, Alternative RP-1 would be effective in the short term because the existing Selected Remedies are currently protective of human health and the environment. Much of the existing infrastructure within communities is under-capacity. Therefore, Alternative RP-1 would allow a relatively higher risk of contaminant mobility within residential areas during and immediately following storm events. Additionally, the risk of exposure could temporarily increase following a storm event until the post-event response is completed.	Alternative RP-2 would be effective in the short term because the existing Selected Remedies are currently protective of human health and the environment. Additionally, Alternative RP-2 would reduce the risk of exposure to contaminated material by protecting the Selected Remedies up to the 50-year storm event. This alternative would effectively convey stormwater and floodwater for storm events smaller than the 50-year event and would reduce the risk of exposure and mobility of contaminants within residential areas.
Implementability	Ability of alternative to meet technical, administrative, and logistical challenges associated with implementation	Alternative RP-1 would not be expected to have any technical feasibility issues. There would be administrative issues regarding the availability of funds to repair the Selected Remedies following a storm event. Additionally, in some cases, the repair of the protective barriers could be time-sensitive in order to maintain protectiveness and limit a resident's risk of exposure.	Alternative RP-2 would not be expected to have any technical implementability issues. The technologies and process options applied for Alternative RP-2 are standard engineering practices. There could be administrative issues that arise in regard to which state or local entity will perform and fund the O&M tasks associated with Alternative RP 2. Additionally, there could be logistical challenges to performing Alternative RP-2 on private properties, where access and easement agreements would be needed prior to construction.

TABLE 10-4
Comparative Analysis of Remedy Protection Alternatives
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

	Description of Criterion	ALTERNATIVE RP-1 No Further Action (Post-Event Response)	ALTERNATIVE RP-2 Modifications to Selected Remedies to Enhance Protectiveness (Remedy Protection Projects)
Cost	Total Capital Cost for Upper Basin Communities[1]	NA	$13,700,000
	O&M Cost (30-Year NPV) for Upper Basin Communities[1]	NA	$4,980,000
	Total Cost (30-Year NPV) for Upper Basin Communities[1]	$33,800,000	$18,700,000
	Total Capital Cost for Side Gulches[2]	NA	$10,900,000
	O&M Cost (30-Year NPV) for Side Gulches[2]	NA	$4,180,000
	Total Cost (30-Year NPV) for Side Gulches[2]	$16,300,000	$15,100,000
	Total Cost (30-Year NPV)	**$50,100,000**	**$33,800,000**

Notes:

NPV = net present value
ARARs = applicable or relevant and appropriate requirements
NA = not applicable

[1] The costs for Alternatives RP-1 and RP-2 in the eight primary Upper Basin communities include Pinehurst, Smelterville, Kellogg, Wardner, Osburn, Silverton, Wallace, and Mullan.
[2] Side gulch costs for Alternatives RP-1 and RP-2 are approximate based on assumptions discussed in Appendix D of the Upper Basin Focused Feasibility Study (FFS) Report (U.S. Environmental Protection Agency, 2012).

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

TABLE 12-1

Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Upper SFCDR Watershed

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
UpperSFCDRSeg01	Human Health Waste Piles	HHWPUG01-1	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1	58,443	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
		HHWPUG01-2	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1	58,443	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
		HHWPUG01-3	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1	58,443	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
		HHWPUG01-4	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1	58,443	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
		HHWPUG01-5	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1	58,443	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
	Mine and Mill Sites	LOK004	SHOWSHOE NO. 2	Floodplain waste rock	C01	Excavation	61,200	4.28	CY	$ 262,000	$ 183,000	$ 445,000	$ -	$ 445,000
					C07	Waste Consolidation Area Above Flood Level	61,200	14.70	CY	$ 900,000	$ 630,000	$ 1,530,000	$ 198,000	$ 1,730,000
				Adit drainage	C10	Adit Drainage Collection	1	9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT02	Onsite Semi-Passive Treatment Using Lime Addition	101		GPM	$ 521,000	$ 365,000	$ 886,000	$ 1,210,000	$ 2,100,000
		LOK009	SNOWSTORM NO. 4	Floodplain waste rock	C01	Excavation	22,080	4.28	CY	$ 94,500	$ 66,200	$ 160,700	$ -	$ 161,000
					C07	Waste Consolidation Area Above Flood Level	22,080	14.70	CY	$ 325,000	$ 227,000	$ 552,000	$ 71,400	$ 623,000
		LOK011	SNOWSTORM NO. 3	Floodplain waste rock	C01	Excavation	55,000	4.28	CY	$ 235,000	$ 165,000	$ 400,000	$ -	$ 400,000
					C07	Waste Consolidation Area Above Flood Level	55,000	14.70	CY	$ 809,000	$ 566,000	$ 1,380,000	$ 178,000	$ 1,550,000
				Adit drainage	C10	Adit Drainage Collection	1	9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	5,386		GPM	$ 3,620,000	$ 3,870,000	$ 7,490,000	$ 2,630,000	$ 10,100,000
		LOK024	SILVER CABLE MINE	Adit drainage	C10	Adit Drainage Collection	1	9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT02	Onsite Semi-Passive Treatment Using Lime Addition	89.8		GPM	$ 493,000	$ 345,000	$ 838,000	$ 1,190,000	$ 2,030,000
		MUL012	STAR 1200 LEVEL	Floodplain waste rock	C01	Excavation	216,000	4.28	CY	$ 462,000	$ 324,000	$ 786,000	$ -	$ 786,000
					C03	Low-Permeability Cap	6.75	225,000	AC	$ 1,520,000	$ 1,060,000	$ 2,580,000	$ 182,000	$ 2,760,000
				Adit drainage	C10	Adit Drainage Collection	1	9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	312		GPM	$ 210,000	$ 224,000	$ 434,000	$ 197,000	$ 631,000
		MUL018	MULLAN METALS MINE	Floodplain waste rock	C01	Excavation	14,400	4.28	CY	$ 61,600	$ 43,100	$ 105,000	$ -	$ 105,000
					C07	Waste Consolidation Area Above Flood Level	14,400	14.70	CY	$ 212,000	$ 148,000	$ 360,000	$ 46,600	$ 407,000
		MUL021	INDEPENDENCE MINE	Floodplain waste rock	C01	Excavation	29,040	4.28	CY	$ 24,900	$ 17,400	$ 42,300	$ -	$ 42,300
					C03	Low-Permeability Cap	1.21	225,000	AC	$ 272,000	$ 191,000	$ 463,000	$ 32,700	$ 496,000
		MUL027	MORNING NO. 4	Upland waste rock	C02b	Regrade/Consolidate/Revegetate	0.99	167,000	AC	$ 165,000	$ 116,000	$ 281,000	$ 21,500	$ 303,000
				Adit drainage	C10	Adit Drainage Collection	1	9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT03	Onsite Semi-Passive Treatment Using SRB	13.6		GPM	$ 221,000	$ 155,000	$ 376,000	$ 547,000	$ 923,000
		MUL028	MORNING NO. 5	Floodplain waste rock	C01	Excavation	102,000	4.28	CY	$ 87,300	$ 61,100	$ 148,000	$ -	$ 148,000
					C03	Low-Permeability Cap	4.25	225,000	AC	$ 956,000	$ 669,000	$ 1,630,000	$ 115,000	$ 1,740,000
				Adit drainage	C10	Adit Drainage Collection	1	9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT03	Onsite Semi-Passive Treatment Using SRB	39.5		GPM	$ 388,000	$ 272,000	$ 660,000	$ 600,000	$ 1,260,000
		MUL045	HOMESTAKE MINE	Floodplain waste rock	C01	Excavation	27,600	4.28	CY	$ 118,000	$ 82,700	$ 201,000	$ -	$ 201,000
					C07	Waste Consolidation Area Above Flood Level	27,600	14.70	CY	$ 406,000	$ 284,000	$ 690,000	$ 89,300	$ 779,000
		MUL052	COPPER KING MINE	Floodplain waste rock	C01	Excavation	15,000	4.28	CY	$ 12,800	$ 8,990	$ 21,800	$ -	$ 21,800
					C03	Low-Permeability Cap	1.33	225,000	AC	$ 299,000	$ 209,000	$ 508,000	$ 35,900	$ 544,000
				Adit drainage	C10	Adit Drainage Collection	1	9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT02	Onsite Semi-Passive Treatment Using Lime Addition	50.3		GPM	$ 390,000	$ 273,000	$ 663,000	$ 1,160,000	$ 1,820,000
		MUL053	NATIONAL MINE	Upland waste rock (erosion potential)	C02a	Regrade/Consolidate/Revegetate	3.16	84,300	AC	$ 266,000	$ 186,000	$ 452,000	$ 34,600	$ 487,000
		MUL054	UNNAMED ADIT	Upland waste rock (erosion potential)	C02a	Regrade/Consolidate/Revegetate	0.94	84,300	AC	$ 79,200	$ 55,500	$ 135,000	$ 10,300	$ 145,000
		MUL071	ATLAS MINE	Floodplain waste rock	C01	Excavation	2,500	4.28	CY	$ 2,140	$ 1,500	$ 3,640	$ -	$ 3,640
					C03	Low-Permeability Cap	8.14	225,000	AC	$ 1,830,000	$ 1,280,000	$ 3,110,000	$ 220,000	$ 3,330,000
		MUL120	BANNER MINE NO. 02	Floodplain waste rock	C01	Excavation	560	4.28	CY	$ 479	$ 336	$ 815	$ -	$ 815
					C03	Low-Permeability Cap	0.34	225,000	AC	$ 76,500	$ 53,600	$ 130,000	$ 9,180	$ 139,000
		MUL129	ATLAS MINE ROCK DUMP	Floodplain waste rock	C01	Excavation	26,640	4.28	CY	$ 22,800	$ 16,000	$ 38,800	$ -	$ 38,800
					C03	Low-Permeability Cap	1.11	225,000	AC	$ 250,000	$ 175,000	$ 425,000	$ 30,000	$ 455,000
		MUL132	NATIONAL MILLSITE ADJACENT TAILINGS	Upland tailings	C01	Excavation	1,800	4.28	CY	$ 7,700	$ 5,390	$ 13,100	$ -	$ 13,100
					C07	Waste Consolidation Area Above Flood Level	1,800	14.70	CY	$ 26,500	$ 18,500	$ 45,000	$ 5,820	$ 50,800
		MUL142	GROUSE GULCH IMPACTED RIPARIAN	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	34,300	13.50	CY	$ 232,000	$ 162,000	$ 394,000	$ -	$ 394,000
					C07	Waste Consolidation Area Above Flood Level	34,300	14.70	CY	$ 252,000	$ 176,000	$ 428,000	$ 55,500	$ 483,500
		WAL038	SF CDA RIVER IMPACTED FLOODPLAIN: NO. 1	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	480,000	13.50	CY	$ 3,760,000	$ 2,630,000	$ 6,390,000	$ -	$ 6,390,000
					C08a	Repository	480,000	17.70	CY	$ 4,930,000	$ 3,450,000	$ 8,380,000	$ 690,000	$ 9,070,000
					HAUL-2	Haul to Repository	2,400,000	1.10	CY-MI	$ 1,530,000	$ 1,070,000	$ 2,600,000	$ -	$ 2,600,000
		WAL076	MARY D CLAIM WORKINGS	Floodplain waste rock	C01	Excavation	40,800	4.28	CY	$ 175,000	$ 122,000	$ 297,000	$ -	$ 297,000
					C07	Waste Consolidation Area Above Flood Level	40,800	14.70	CY	$ 600,000	$ 420,000	$ 1,020,000	$ 132,000	$ 1,150,000
		WAL077	GOLCONDA TAILINGS	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	42,000	13.50	CY	$ 567,000	$ 397,000	$ 964,000	$ -	$ 964,000
					C08a	Repository	42,000	17.70	CY	$ 743,000	$ 520,000	$ 1,260,000	$ 104,000	$ 1,370,000
					HAUL-2	Haul to Repository	210,000	1.10	CY-MI	$ 231,000	$ 161,000	$ 392,000	$ -	$ 392,000
	Water Treatment Pipelines	PIPING_01		Adit drainage	PIPE-3	Gravity Pipeline-24"	13,439	139.00	LF	$ 1,870,000	$ 1,310,000	$ 3,180,000	$ 149,000	$ 3,300,000
		PIPING_02		Groundwater	PIPE-1	Gravity Pipeline-6"	187	58.70	LF	$ 11,000	$ 7,670	$ 18,700	$ 877	$ 19,600
		PIPING_02.5		Combined Waters	PIPE-3	Gravity Pipeline-24"	6,972	139.00	LF	$ 969,000	$ 678,000	$ 1,650,000	$ 77,500	$ 1,725,000
		PIPING_03		Groundwater	PIPE-1	Gravity Pipeline-6"	1,993	58.70	LF	$ 117,000	$ 81,900	$ 199,000	$ 9,360	$ 208,000

TABLE 12-1

Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Upper SFCDR Watershed

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
		PIPING_03.5		Combined Waters	PIPE-3	Gravity Pipeline-24"	8,865	139.00	LF	$ 1,230,000	$ 863,000	$ 2,090,000	$ 98,600	$ 2,190,000
		PIPING_4		Groundwater	PIPE-1	Gravity Pipeline-6"	2,000	58.70	LF	$ 117,000	$ 82,200	$ 199,000	$ 9,390	$ 209,000
		PIPING_05		Adit drainage	PIPE-2	Gravity Pipeline-12"	150	86.20	LF	$ 13,000	$ 9,070	$ 22,100	$ 1,040	$ 23,100
		PIPING_05.25		Combined Waters	PIPE-2	Gravity Pipeline-12"	716	86.20	LF	$ 61,700	$ 43,200	$ 105,000	$ 4,940	$ 110,000
		PIPING_05.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	10,397	180	LF	$ 1,870,000	$ 1,310,000	$ 3,180,000	$ 150,000	$ 3,330,000
		PIPING_06		Adit drainage	PIPE-3	Gravity Pipeline-24"	4,000	139	LF	$ 556,000	$ 389,000	$ 945,000	$ 44,500	$ 990,000
		PIPING_07.25		Combined Waters	PIPE-3	Gravity Pipeline-24"	12,170	139	LF	$ 1,690,000	$ 1,180,000	$ 2,870,000	$ 135,000	$ 3,010,000
		PIPING_07.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	17,829	180	LF	$ 3,210,000	$ 2,250,000	$ 5,460,000	$ 257,000	$ 5,720,000
Total for Upper SFCDR Watershed										**$ 40,700,000**	**$ 29,900,000**	**$ 70,600,000**	**$ 10,800,000**	**$ 81,400,000**

Notes:

UOM = units of measure
GPM = gallons per minute
LF = lineal foot
LS = lump sum
CY = cubic yards

O&M = operation and maintenance
NPV = net present value
AC = acres
CY-MI = cubic yards per mile
TCD = typical conceptual design

It is important to note that TCDs are only conceptual designs, and the constructed remedies at specific source sites may differ from the TCDs based on future site- and waste-specific characterization assessments and other pre-design activiti

Costs for human health waste piles are included in the Selected Remedy. It is assumed that contaminated material (likely upland waste rock) will be encountered near community and residential areas during implementation of the Selected Remedy.

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

TABLE 12-2
Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Canyon Creek Watershed
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
CCSeg01	Mine and Mill Sites	BUR109	OOM PAUL NO. 1	Upland waste rock (erosion potential)	C01	Excavation	27,400	$ 4.28	CY	$ 23,500	$ 16,400	$ 39,900	$ -	$ 39,900
					C03	Low-Permeability Cap	1.14	$ 225,000.00	AC	$ 257,000	$ 180,000	$ 437,000	$ 30,800	$ 468,000
CCSeg02	Mine and Mill Sites	BUR107	AJAX NO. 3	Upland waste rock (erosion potential)	C01	Excavation	139,000	$ 4.28	CY	$ 119,000	$ 83,300	$ 202,000	$ -	$ 202,000
					C04	Low-Permeability Cap w/Seepage Collection	2.34	$ 254,000.00	AC	$ 594,000	$ 416,000	$ 1,010,000	$ 137,000	$ 1,150,000
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680.00	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	89.8		GPM	$ 60,300	$ 64,500	$ 125,000	$ 45,700	$ 171,000
		BUR130	MARSH MINE	Upland waste rock (erosion potential)	C01	Excavation	3,000	$ 4.28	CY	$ 2,570	$ 1,800	$ 4,370	$ -	$ 4,370
					C03	Low-Permeability Cap	2.38	$ 225,000.00	AC	$ 536,000	$ 375,000	$ 911,000	$ 64,300	$ 975,000
		BUR145	ONEILL GULCH UNNAMED ROCK DUMP	Upland waste rock (erosion potential)	C01	Excavation	56,000	$ 4.28	CY	$ 240,000	$ 168,000	$ 408,000	$ -	$ 408,000
					C07	Waste Consolidation Area Above Flood Level	56,000	$ 14.70	CY	$ 823,000	$ 576,000	$ 1,400,000	$ 181,000	$ 1,580,000
		BUR150	CANYON CK GARBAGE DUMP	Floodplain waste rock	C01	Excavation	32,600	$ 4.28	CY	$ 27,900	$ 19,500	$ 47,400	$ -	$ 47,400
					C03	Low-Permeability Cap	1.36	$ 225,000.00	AC	$ 306,000	$ 214,000	$ 520,000	$ 36,700	$ 557,000
		BUR153	CANYON CK IMPACTED FLOODPLAIN (CCSeg02 & CCSeg04)	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	35,000	$ 13.50	CY	$ 236,000	$ 165,000	$ 401,000	$ -	$ 401,000
					C08a	Repository	35,000	$ 17.70	CY	$ 310,000	$ 217,000	$ 527,000	$ 43,400	$ 570,000
					HAUL-2	Haul to Repository	175,000	$ 1.10	CY-MI	$ 96,100	$ 67,300	$ 163,000	$ -	$ 163,000
	Water Treatment Pipelines	PIPING_8	BUR107 to Int G	Adit drainage	PIPE-1	Gravity Pipeline-6"	4,597	$ 58.70	LF	$ 270,000	$ 189,000	$ 459,000	$ 21,600	$ 481,000
	Stream and Riparian Stabilization Actions	CC02-1	Oom Paul No. 1 mine site to Gorge Gulch	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	1,990	$ 122.00	LF	$ 243,000	$ 170,000	$ 413,000	$ 72,800	$ 486,000
					CD-AVG	Current Deflector Average Cost	59.7	$ 2,060.00	EA	$ 123,000	$ 86,100	$ 209,000	$ 36,900	$ 246,000
					CD-SED	Current Deflector Sediment Traps	6.6	$ 1,870.00	EA	$ 12,300	$ 8,640	$ 20,900	$ 74,100	$ 95,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	663,369	$ 1.34	SF	$ 889,000	$ 622,000	$ 1,510,000	$ 160,000	$ 1,670,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	3,317	$ 52.00	LF	$ 172,000	$ 121,000	$ 293,000	$ 51,700	$ 345,000
CCSeg03	Mine and Mill Sites	BUR087	HERCULES NO. 3	Upland waste rock (erosion potential)	C01	Excavation	25,000	$ 4.28	CY	$ 53,500	$ 37,500	$ 91,000	$ -	$ 91,000
					C03	Low-Permeability Cap	3.88	$ 225,000.00	AC	$ 873,000	$ 611,000	$ 1,480,000	$ 105,000	$ 1,590,000
		BUR090	HERCULES NO. 4	Upland tailings	C01	Excavation	30,000	$ 4.28	CY	$ 128,000	$ 89,900	$ 218,000	$ -	$ 218,000
					C07	Waste Consolidation Area Above Flood Level	30,000	$ 14.70	CY	$ 441,000	$ 309,000	$ 750,000	$ 97,000	$ 847,000
				Upland waste rock (erosion potential)	C01	Excavation	55,000	$ 4.28	CY	$ 47,100	$ 33,000	$ 80,100	$ -	$ 80,100
					C03	Low-Permeability Cap	10.49	$ 225,000.00	AC	$ 2,360,000	$ 1,650,000	$ 4,010,000	$ 283,000	$ 4,290,000
		BUR146	GORGE GULCH IMPACTED RIPARIAN	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	51,000	$ 13.50	CY	$ 344,000	$ 241,000	$ 585,000	$ -	$ 585,000
					C08a	Repository	51,000	$ 17.70	CY	$ 451,000	$ 316,000	$ 767,000	$ 63,200	$ 830,000
					HAUL-2	Haul to Repository	255,000	$ 1.10	CY-MI	$ 140,000	$ 98,000	$ 238,000	$ -	$ 238,000
		BUR149	AJAX NO.2 ADJACENT ROCK DUMP	Upland waste rock (erosion potential)	C01	Excavation	10,400	$ 4.28	CY	$ 8,900	$ 6,230	$ 15,100	$ -	$ 15,100
					C03	Low-Permeability Cap	0.51	$ 225,000.00	AC	$ 115,000	$ 80,300	$ 195,000	$ 13,800	$ 209,000
		BUR180	STANLEY MINE	Upland waste rock (erosion potential)	C01	Excavation	5,500	$ 4.28	CY	$ 4,710	$ 3,300	$ 8,010	$ -	$ 8,010
					C03	Low-Permeability Cap	0.23	$ 225,000.00	AC	$ 51,800	$ 36,200	$ 88,000	$ 6,210	$ 94,200
	Water Treatment Pipelines	PIPING_10		Adit drainage	PIPE-1	Gravity Pipeline-6"	227	$ 58.70	LF	$ 13,300	$ 9,330	$ 22,600	$ 1,070	$ 23,700
		PIPING_10.25		Combined Waters	PIPE-1	Gravity Pipeline-6"	1,135	$ 58.70	LF	$ 66,600	$ 46,600	$ 113,000	$ 5,330	$ 119,000
		PIPING_10.5		Combined Waters	PIPE-1	Gravity Pipeline-6"	265	$ 58.70	LF	$ 15,500	$ 10,900	$ 26,400	$ 1,240	$ 28,000
		PIPING_9		Adit drainage	PIPE-1	Gravity Pipeline-6"	4,599	$ 58.70	LF	$ 270,000	$ 189,000	$ 459,000	$ 21,600	$ 481,000
CCSeg04	Human Health Waste Piles	HHWPCC04-1	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1	$ 58,443.08	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
		HHWPCC04-2	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1	$ 58,443.08	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
		HHWPCC04-3	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1	$ 58,443.08	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
	Mine and Mill Sites	BUR067	TAMARACK NO.7 (1200 LEVEL)	Upland tailings	C01	Excavation	2,500	$ 4.28	CY	$ 10,700	$ 7,490	$ 18,200	$ -	$ 18,200
					C07	Waste Consolidation Area Above Flood Level	2,500	$ 14.70	CY	$ 36,800	$ 25,700	$ 62,500	$ 8,090	$ 70,600
				Upland waste rock (potential intermixed tailings)	C01	Excavation	350,000	$ 4.28	CY	$ 749,000	$ 524,000	$ 1,270,000	$ -	$ 1,270,000
					C03	Low-Permeability Cap	9.5	$ 225,000.00	AC	$ 1,070,000	$ 748,000	$ 1,820,000	$ 128,000	$ 1,950,000
					C07	Waste Consolidation Area Above Flood Level	350,000	$ 14.70	CY	$ 2,570,000	$ 1,800,000	$ 4,370,000	$ 566,000	$ 4,940,000
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680.00	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	1,414		GPM	$ 950,000	$ 1,020,000	$ 1,970,000	$ 723,000	$ 2,690,000
		BUR072	STANDARD-MAMMOTH NO.4	Upland waste rock (erosion potential)	C03	Low-Permeability Cap	1.74	$ 225,000.00	AC	$ 392,000	$ 274,000	$ 666,000	$ 47,000	$ 713,000
		BUR073	STANDARD-MAMMOTH CAMPBELL ADIT	Upland waste rock (erosion potential)	C01	Excavation	126,000	$ 4.28	CY	$ 108,000	$ 75,500	$ 184,000	$ -	$ 184,000
					C03	Low-Permeability Cap	5.27	$ 225,000.00	AC	$ 1,190,000	$ 830,000	$ 2,020,000	$ 142,000	$ 2,160,000
		BUR075	SHERMAN 1000 LEVEL (OREANO ADIT)	Upland tailings	C01	Excavation	3,500	$ 4.28	CY	$ 15,000	$ 10,500	$ 25,500	$ -	$ 25,500
				Upland tailings	C07	Waste Consolidation Area Above Flood Level	3,500	$ 14.70	CY	$ 51,500	$ 36,000	$ 87,500	$ 11,300	$ 98,800
		BUR094	SHERMAN 600 LEVEL	Upland waste rock (erosion potential)	C02a	Regrade/Consolidate/Revegetate	1.4	$ 84,300.00	AC	$ 118,000	$ 82,600	$ 201,000	$ 15,300	$ 216,000
		BUR096	ANCHOR MINE	Upland waste rock	C02a	Regrade/Consolidate/Revegetate	1.42	$ 84,300.00	AC	$ 120,000	$ 83,800	$ 204,000	$ 15,600	$ 219,000
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680.00	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	7.27		GPM	$ 4,890	$ 5,230	$ 10,100	$ 3,700	$ 13,800
		BUR097	HIDDEN TREASURE MINE	Upland waste rock	C02a	Regrade/Consolidate/Revegetate	0.87	$ 84,300.00	AC	$ 73,300	$ 51,300	$ 125,000	$ 9,530	$ 134,000
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680.00	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	1,293		GPM	$ 869,000	$ 929,000	$ 1,800,000	$ 659,000	$ 2,460,000
		BUR098	HERCULES NO. 5	Upland waste rock (potential intermixed tailings)	C01	Excavation	55,000	$ 4.28	CY	$ 235,000	$ 165,000	$ 400,000	$ -	$ 400,000
					C07	Waste Consolidation Area Above Flood Level	55,000	$ 14.70	CY	$ 809,000	$ 566,000	$ 1,380,000	$ 178,000	$ 1,550,000
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680.00	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	1,346		GPM	$ 905,000	$ 968,000	$ 1,870,000	$ 896,000	$ 2,770,000
		BUR112	GEM NO.2	Adit drainage	C10	Adit Drainage Collection	1	$ 9,680.00	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	89.8		GPM	$ 60,300	$ 64,500	$ 125,000	$ 45,700	$ 171,000
		BUR117	FRISCO MILLSITE	Upland tailings	C01	Excavation	1,800	$ 4.28	CY	$ 7,700	$ 5,390	$ 13,100	$ -	$ 13,100

TABLE 12-2
Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Canyon Creek Watershed
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
					C07	Waste Consolidation Area Above Flood Level	1,800	$ 14.70	CY	$ 26,500	$ 18,500	$ 45,000	$ 5,820	$ 50,800
				Upland waste rock (potential intermixed tailings)	C03	Low-Permeability Cap	1.11	$ 225,000.00	AC	$ 250,000	$ 175,000	$ 425,000	$ 30,000	$ 455,000
		BUR118	FRISCO NO.2 & NO.1	Upland waste rock (erosion potential)	C01	Excavation	33,000	$ 4.28	CY	$ 141,000	$ 98,900	$ 240,000	$ -	$ 240,000
					C07	Waste Consolidation Area Above Flood Level	33,000	$ 14.70	CY	$ 485,000	$ 340,000	$ 825,000	$ 107,000	$ 932,000
		BUR119	BLACK BEAR NO.4	Upland waste rock	C02a	Regrade/Consolidate/Revegetate	2.08	$ 84,300.00	AC	$ 175,000	$ 123,000	$ 298,000	$ 22,800	$ 321,000
		BUR120	SILVER MOON MINE	Upland waste rock (erosion potential)	C02a	Regrade/Consolidate/Revegetate	0.93	$ 84,300.00	AC	$ 78,400	$ 54,900	$ 133,000	$ 10,200	$ 144,000
		BUR121	BLACK BEAR FRACTION	Upland waste rock (erosion potential)	C01	Excavation	103,000	$ 4.28	CY	$ 88,200	$ 61,700	$ 150,000	$ -	$ 150,000
					C03	Low-Permeability Cap	2.01	$ 225,000.00	AC	$ 452,000	$ 317,000	$ 769,000	$ 54,300	$ 823,000
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680.00	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	1,014		GPM	$ 682,000	$ 729,000	$ 1,410,000	$ 517,000	$ 1,930,000
		BUR122	FLYNN MINE	Upland waste rock (erosion potential)	C01	Excavation	27,000	$ 4.28	CY	$ 23,100	$ 16,200	$ 39,300	$ -	$ 39,300
					C03	Low-Permeability Cap	1.12	$ 225,000.00	AC	$ 252,000	$ 176,000	$ 428,000	$ 30,200	$ 458,000
		BUR124	OMAHA MINE	Upland waste rock (erosion potential)	C02a	Regrade/Consolidate/Revegetate	1	$ 84,300.00	AC	$ 84,300	$ 59,000	$ 143,000	$ 11,000	$ 154,000
		BUR128	HECLA-STAR MINE & MILLSITE COMPLEX	Upland tailings	C01	Excavation	43,400	$ 4.28	CY	$ 186,000	$ 130,000	$ 316,000	$ -	$ 316,000
					C07	Waste Consolidation Area Above Flood Level	43,400	$ 14.70	CY	$ 638,000	$ 447,000	$ 1,090,000	$ 140,000	$ 1,230,000
				Building & structures	HH-3	Millsite Decontamination	1	$ 135,800.00	EA	$ 136,000	$ 95,100	$ 231,000	$ 6,790	$ 238,000
		BUR129	TIGER-POORMAN MINE	Upland tailings	C01	Excavation	5,250	$ 4.28	CY	$ 22,500	$ 15,700	$ 38,200	$ -	$ 38,200
					C07	Waste Consolidation Area Above Flood Level	5,250	$ 14.70	CY	$ 77,200	$ 54,000	$ 131,000	$ 17,000	$ 148,000
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680.00	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	89.8		GPM	$ 60,300	$ 64,500	$ 125,000	$ 45,700	$ 171,000
		BUR141	CANYON CK IMPACTED FLOODPLAIN	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	22,000	$ 13.50	CY	$ 297,000	$ 208,000	$ 505,000	$ -	$ 505,000
					C08a	Repository	22,000	$ 17.70	CY	$ 389,000	$ 273,000	$ 662,000	$ 54,500	$ 717,000
					HAUL-2	Haul to Repository	110,000	$ 1.10	CY-MI	$ 121,000	$ 84,500	$ 206,000	$ -	$ 206,000
		BUR142	GEM MILLSITE	Upland tailings	C01	Excavation	4,900	$ 4.28	CY	$ 10,500	$ 7,340	$ 17,800	$ -	$ 17,800
					C07	Waste Consolidation Area Above Flood Level	4,900	$ 14.70	CY	$ 36,000	$ 25,200	$ 61,200	$ 7,920	$ 69,100
				Upland waste rock (potential intermixed tailings)	C03	Low-Permeability Cap	3.02	$ 225,000.00	AC	$ 680,000	$ 476,000	$ 1,160,000	$ 81,500	$ 1,240,000
		BUR143	CANYON CK IMPACTED RIPARIAN	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	32,000	$ 13.50	CY	$ 432,000	$ 302,000	$ 734,000	$ -	$ 734,000
					C08a	Repository	32,000	$ 17.70	CY	$ 566,000	$ 396,000	$ 962,000	$ 79,300	$ 1,040,000
					HAUL-2	Haul to Repository	160,000	$ 1.10	CY-MI	$ 176,000	$ 123,000	$ 299,000	$ -	$ 299,000
		BUR144	STANDARD-MAMMOTH LOADING AREA	Upland waste rock (erosion potential)	C01	Excavation	39,000	$ 4.28	CY	$ 33,400	$ 23,400	$ 56,800	$ -	$ 56,800
					C03	Low-Permeability Cap	2.54	$ 225,000	AC	$ 572,000	$ 400,000	$ 972,000	$ 68,600	$ 1,040,000
		BUR177	JOE MATT MINE	Upland waste rock (erosion potential)	C01	Excavation	200	$ 4.28	CY	$ 171	$ 120	$ 291	$ -	$ 291
					C03	Low-Permeability Cap	0.68	$ 225,000	AC	$ 153,000	$ 107,000	$ 260,000	$ 18,400	$ 278,000
		BUR178	WEST HECLA MINE	Upland waste rock (erosion potential)	C01	Excavation	11,000	$ 4.28	CY	$ 9,420	$ 6,590	$ 16,000	$ -	$ 16,000
					C03	Low-Permeability Cap	0.46	$ 225,000	AC	$ 104,000	$ 72,500	$ 177,000	$ 12,400	$ 189,000
		BUR190	GEM NO.3	Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	449		GPM	$ 302,000	$ 323,000	$ 625,000	$ 165,000	$ 790,000
		BUR191	FRISCO NO.3	Upland waste rock	C02a	Regrade/Consolidate/Revegetate	1.55	$ 84,300	AC	$ 131,000	$ 91,500	$ 223,000	$ 17,000	$ 240,000
		BUR192	BLACK BEAR MILLSITE	Floodplain tailings (discrete site)	C01	Excavation	3,100	$ 4.28	CY	$ 13,300	$ 9,290	$ 22,600	$ -	$ 22,600
					C07	Waste Consolidation Area Above Flood Level	3,100	$ 14.70	CY	$ 45,600	$ 31,900	$ 77,500	$ 10,000	$ 87,500
				Upland waste rock (erosion potential)	C01	Excavation	27,000	$ 4.28	CY	$ 23,100	$ 16,200	$ 39,300	$ -	$ 39,300
					C03	Low-Permeability Cap	1.12	$ 225,000	AC	$ 252,000	$ 176,000	$ 428,000	$ 30,200	$ 458,000
	Water Treatment Pipelines	PIPING_11		Adit drainage	PIPE-3	Gravity Pipeline-24"	137	$ 139	LF	$ 19,100	$ 13,300	$ 32,400	$ 1,520	$ 33,920
		PIPING_11.5		Combined Waters	PIPE-3	Gravity Pipeline-24"	717	$ 139	LF	$ 99,700	$ 69,800	$ 170,000	$ 7,970	$ 177,000
		PIPING_12.5		Combined Waters	PIPE-3	Gravity Pipeline-24"	236	$ 139	LF	$ 32,800	$ 23,000	$ 55,800	$ 2,630	$ 58,400
		PIPING_13.5		Combined Waters	PIPE-3	Gravity Pipeline-24"	753	$ 139	LF	$ 105,000	$ 73,300	$ 178,000	$ 8,380	$ 187,000
		PIPING_14.5		Combined Waters	PIPE-3	Gravity Pipeline-24"	1,152	$ 139	LF	$ 160,000	$ 112,000	$ 272,000	$ 12,800	$ 285,000
		PIPING_15.5		Combined Waters	PIPE-3	Gravity Pipeline-24"	8,216	$ 139	LF	$ 1,140,000	$ 799,000	$ 1,940,000	$ 91,400	$ 2,030,000
		PIPING_16.5		Combined Waters	PIPE-3	Gravity Pipeline-24"	1,731	$ 139	LF	$ 241,000	$ 168,000	$ 409,000	$ 19,200	$ 428,000
		PIPING_17		Adit drainage	PIPE-2	Gravity Pipeline-12"	129	$ 86.20	LF	$ 11,100	$ 7,790	$ 18,900	$ 890	$ 79,800
		PIPING_17.5		Combined Waters	PIPE-3	Gravity Pipeline-24"	4,212	$ 139	LF	$ 586,000	$ 410,000	$ 996,000	$ 46,800	$ 1,040,000
		PIPING_18		Adit drainage	PIPE-1	Gravity Pipeline-6"	7,076	$ 58.70	LF	$ 415,000	$ 291,000	$ 706,000	$ 33,200	$ 739,000
		PIPING_19.25		Combined Waters	PIPE-2	Gravity Pipeline-12"	499	$ 86.20	LF	$ 43,000	$ 30,100	$ 73,100	$ 3,440	$ 76,500
		PIPING_19.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	4,431	$ 180.00	LF	$ 798,000	$ 558,000	$ 1,360,000	$ 63,800	$ 1,420,000
	Stream and Riparian Stabilization Actions	CC04-1	Gorge Gulch to West Bell mine site	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	5,999	$ 122	LF	$ 732,000	$ 512,000	$ 1,240,000	$ 220,000	$ 1,460,000
					CD-AVG	Current Deflector Average Cost	180	$ 2,060	EA	$ 371,000	$ 260,000	$ 631,000	$ 111,000	$ 742,000
					CD-SED	Current Deflector Sediment Traps	20	$ 1,870	EA	$ 37,400	$ 26,200	$ 63,600	$ 224,000	$ 288,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	380,826	$ 1.34	SF	$ 510,000	$ 357,000	$ 867,000	$ 91,900	$ 959,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	9,998	$ 52.00	LF	$ 520,000	$ 364,000	$ 884,000	$ 156,000	$ 1,040,000
Total for Canyon Creek Watershed										**$ 35,400,000**	**$ 26,200,000**	**$ 61,600,000**	**$ 7,700,000**	**$ 69,300,000**

Notes:

EA = each	O&M = operation and maintenance
GPM = gallons per minute	NPV = net present value
LF = lineal foot	AC = acres
CY = cubic yards	LS = lump sum
CY-MI = cubic yards per mile	SF = square feet
TCD = typical conceptual design	UOM = units of measure

TABLE 12-2
Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Canyon Creek Watershed
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)

It is important to note that TCDs are only conceptual designs, and the constructed remedies at specific source sites may differ from the TCDs based on future site- and waste-specific characterization assessments and other pre-design activities

Costs for human health waste piles are included in the Selected Remedy. It is assumed that contaminated material (likely upland waste rock) will be encountered near community and residential areas during implementation of the Selected Remedy.

Stream and riparian stabilization actions are specified by stream reach. See Figure 12-18 for the location of each stream reach.

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

TABLE 12-3

Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Canyon Creek Watershed -- Woodland Park

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
CCSeg05	Mine and Mill Sites	OSB047	CANYON CK FORMOSA REACH SVNRT REHAB	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	17,000	$ 13.50	CY	$ 47,000	$ 32,900	$ 79,900	$ -	$ 79,900
					C08a	Repository	17,000	$ 17.70	CY	$ 61,700	$ 43,200	$ 105,000	$ 8,640	$ 114,000
					HAUL-2	Haul to Repository	85,000	$ 1.10	CY-MI	$ 19,100	$ 13,400	$ 32,500	$ -	$ 32,500
		WAL010	CANYON CK POND REACH SVNRT REHAB	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	15,000	$ 13.50	CY	$ 13,800	$ 9,640	$ 23,400	$ -	$ 23,400
					C08a	Repository	15,000	$ 17.70	CY	$ 18,100	$ 12,600	$ 30,700	$ 2,530	$ 33,200
					HAUL-2	Haul to Repository	75,000	$ 1.10	CY-MI	$ 5,600	$ 3,920	$ 9,520	$ -	$ 9,520
		WAL011	CANYON SILVER (FORMOSA) MINE	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	8,800	$ 13.50	CY	$ 29,700	$ 20,800	$ 50,500	$ -	$ 50,500
					C08a	Repository	8,800	$ 17.70	CY	$ 38,900	$ 27,300	$ 66,200	$ 5,450	$ 71,700
					HAUL-2	Haul to Repository	44,000	$ 1.10	CY-MI	$ 12,100	$ 8,450	$ 20,600	$ -	$ 20,600
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	89.8		GPM	$ 60,300	$ 64,500	$ 125,000	$ 45,700	$ 171,000
		WAL039	STANDARD-MAMMOTH MILLSITE	Upland tailings	C01	Excavation	12,500	$ 4.28	CY	$ 53,500	$ 37,500	$ 91,000	$ -	$ 91,000
					C08a	Repository	12,500	$ 17.70	CY	$ 221,000	$ 155,000	$ 376,000	$ 31,000	$ 407,000
					HAUL-2	Haul to Repository	62,500	$ 1.10	CY-MI	$ 68,600	$ 48,000	$ 117,000	$ -	$ 117,000
		WAL040	CANYON CK IMPACTED FLOODPLAIN	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	18,000	$ 13.50	CY	$ 175,000	$ 122,000	$ 297,000	$ -	$ 297,000
					C08a	Repository	18,000	$ 17.70	CY	$ 229,000	$ 161,000	$ 390,000	$ 32,100	$ 422,000
					HAUL-2	Haul to Repository	90,000	$ 1.10	CY-MI	$ 71,200	$ 49,800	$ 121,000	$ -	$ 121,000
		WAL041	CANYON CK REPOSITORY REACH SVNRT REHAB	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	61,000	$ 13.50	CY	$ 53,500	$ 37,500	$ 91,000	$ -	$ 91,000
					C08a	Repository	61,000	$ 17.70	CY	$ 70,200	$ 49,100	$ 119,000	$ 9,830	$ 129,000
					HAUL-2	Haul to Repository	305,000	$ 1.10	CY-MI	$ 21,800	$ 15,200	$ 37,000	$ -	$ 37,000
		WAL042	CANYON CK TAILINGS REPOSITORY SVNRT	Floodplain tailings - inactive facilities	C03	Low-Permeability Cap	5.15	$ 225,000	AC	$ 579,000	$ 406,000	$ 985,000	$ 69,500	$ 1,050,000
		WAL081	WALLACE OLD PRIVATE LANDFILL	Floodplain artificial fill	C01	Excavation	5,700	$ 4.28	CY	$ 12,200	$ 8,540	$ 20,800	$ -	$ 20,800
					C08a	Repository	5,700	$ 17.70	CY	$ 50,400	$ 35,300	$ 85,700	$ 7,060	$ 92,800
					HAUL-2	Haul to Repository	28,500	$ 1.10	CY-MI	$ 15,600	$ 11,000	$ 26,600	$ -	$ 26,600
		WP-OPTIONC	WOODLAND PARK OPTION C	Floodplain sediments	C14b	Stream Lining	2,700	$ 505	LF	$ 1,360,000	$ 954,000	$ 2,310,000	$ 54,500	$ 2,370,000
					C15b	French Drain	7,800	$ 907	LF	$ 7,070,000	$ 4,950,000	$ 12,000,000	$ 141,000	$ 12,200,000
				Groundwater	WT01	Centralized HDS Treatment at CTP	673		GPM	$ 452,000	$ 484,000	$ 936,000	$ 549,000	$ 1,490,000
	Water Treatment Pipelines	PIPING_20.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	4,014	$ 180.00	LF	$ 722,000	$ 506,000	$ 1,230,000	$ 57,800	$ 1,290,000
		PIPING_20.6		Combined Waters	PIPE-4	Gravity Pipeline-36"	604	$ 180.00	LF	$ 109,000	$ 76,100	$ 185,000	$ 8,700	$ 194,000
		PIPING_20.7		Combined Waters	PIPE-4	Gravity Pipeline-36"	2,759	$ 180.00	LF	$ 497,000	$ 348,000	$ 845,000	$ 39,700	$ 885,000
		PIPING_20.8		Combined Waters	PIPE-4	Gravity Pipeline-36"	6,719	$ 180.00	LF	$ 1,210,000	$ 847,000	$ 2,060,000	$ 96,800	$ 2,150,000
	Stream and Riparian Stabilization Actions	CC05-1	West Bell mine site to unnamed creek	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	667	$ 122	LF	$ 81,400	$ 57,000	$ 138,000	$ 24,400	$ 163,000
					CD-AVG	Current Deflector Average Cost	10	$ 2,060	EA	$ 20,600	$ 14,400	$ 35,000	$ 6,180	$ 41,200
					CD-SED	Current Deflector, Sediment Traps	1	$ 1,870	EA	$ 1,870	$ 1,310	$ 3,180	$ 11,200	$ 14,400
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	683,391	$ 1.34	SF	$ 916,000	$ 641,000	$ 1,560,000	$ 165,000	$ 1,720,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	1,111	$ 52.00	LF	$ 57,800	$ 40,400	$ 98,200	$ 17,300	$ 116,000
		CC05-2	Unnamed creek to the South Fork Coeur d'Alene River	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	4,033	$ 122	LF	$ 492,000	$ 344,000	$ 836,000	$ 148,000	$ 984,000
					CD-AVG	Current Deflector Average Cost	60	$ 2,060	EA	$ 124,000	$ 86,500	$ 211,000	$ 37,100	$ 248,000
					CD-SED	Current Deflector, Sediment Traps	7	$ 1,870	EA	$ 13,100	$ 9,160	$ 22,300	$ 78,500	$ 101,000
					CH REAL-1	Channel Realignment	89,623	$ 42.20	SY	$ 3,780,000	$ 2,650,000	$ 6,430,000	$ 643,000	$ 7,070,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	1,344,352	$ 1.34	SF	$ 1,800,000	$ 1,260,000	$ 3,060,000	$ 324,000	$ 3,380,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	6,722	$ 52.00	LF	$ 350,000	$ 245,000	$ 595,000	$ 105,000	$ 700,000
Total for Woodland Park Area of Canyon Creek Watershed										**$ 21,000,000**	**$ 14,900,000**	**$ 35,900,000**	**$ 2,720,000**	**$ 38,600,000**

Notes:

EA = each	O&M = operation and maintenance
GPM = gallons per minute	NPV = net present value
LF = lineal foot	TCD = typical conceptual design
LS = lump sum	SY = square yards
CY = cubic yards	SF = square feet
CY-MI = cubic yards per mile	UOM = units of measure

It is important to note that TCDs are only conceptual designs, and the constructed remedies at specific source sites may differ from the TCDs based on future site- and waste-specific characterization assessments and other pre-design activities

Costs for human health waste piles are included in the Selected Remedy. It is assumed that contaminated material (likely upland waste rock) will be encountered near community and residential areas during implementation of the Selected Remedy.

Stream and riparian stabilization actions are specified by stream reach. See Figure 12-18 for the location of each stream reach.

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

TABLE 12-4
Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Ninemile Creek Watershed
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
NMSeg01	Mine and Mill Sites	BUR051	SUNSET MINE	Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT02	Onsite Semi-Passive Treatment Using Lime Addition	89.8		GPM	$ 493,000	$ 345,000	$ 838,000	$ 1,190,000	$ 2,030,000
		BUR053	INTERSTATE-CALLAHAN MINE/ROCK DUMPS	Upland waste rock (erosion potential)	C01	Excavation	111,500	$ 4.28	CY	$ 477,000	$ 334,000	$ 811,000	-	$ 811,000
					C07	Waste Consolidation Area Above Flood Level	111,500	$ 14.70	CY	$ 1,640,000	$ 1,150,000	$ 2,790,000	$ 361,000	$ 3,150,000
					HAUL-2	Haul To Repository	151,201	$ 1.10	CY-MI	$ 166,000	$ 116,000	$ 282,000	-	$ 282,000
		BUR140	NINEMILE CREEK IMPACTED FLOODPLAIN	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	10,000	$ 13.50	CY	$ 135,000	$ 94,500	$ 230,000	-	$ 230,000
					C07	Waste Consolidation Area Above Flood Level	10,000	$ 14.70	CY	$ 147,000	$ 103,000	$ 250,000	$ 32,300	$ 282,000
					HAUL-2	Haul To Repository	11,648	$ 1.10	CY-MI	$ 12,800	$ 8,950	$ 21,800	-	$ 21,800
		BUR160	INTERSTATE-CALLAHAN LOWER ROCK DUMPS	Upland waste rock (erosion potential)	C01	Excavation	74,100	$ 4.28	CY	$ 317,000	$ 222,000	$ 539,000	-	$ 539,000
					C07	Waste Consolidation Area Above Flood Level	74,100	$ 14.70	CY	$ 1,090,000	$ 762,000	$ 1,850,000	$ 240,000	$ 2,090,000
					HAUL-2	Haul To Repository	92,695	$ 1.10	CY-MI	$ 102,000	$ 71,200	$ 173,000	-	$ 173,000
	Stream and Riparian Stabilization Actions	NM01-1	Headwaters of East Fork Ninemile Creek to Interstate Mill site	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	4,011	$ 122	LF	$ 489,000	$ 343,000	$ 832,000	$ 147,000	$ 979,000
					CD-AVG	Current Deflector Average Cost	48.00	$ 2,060	EA	$ 98,900	$ 69,200	$ 168,000	$ 29,700	$ 198,000
					CD-SED	Current Deflector, Sediment Traps	5.00	$ 1,870	EA	$ 9,350	$ 6,550	$ 15,900	$ 56,100	$ 72,000
					FP/RP-AVG	Floodplain and Riparian Zone Replanting Average Cost	200,531	$ 1.34	SF	$ 269,000	$ 188,000	$ 457,000	$ 48,400	$ 505,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	4,011	$ 52.00	LF	$ 209,000	$ 146,000	$ 355,000	$ 62,600	$ 418,000
NMSeg02	Mine and Mill Sites	BUR055	INTERSTATE MILLSITE	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	30,700	$ 13.50	CY	$ 414,000	$ 290,000	$ 704,000	-	$ 704,000
					C07	Waste Consolidation Area Above Flood Level	30,700	$ 14.70	CY	$ 451,000	$ 316,000	$ 767,000	$ 99,300	$ 866,000
					HAUL-2	Haul To Repository	26,746	$ 1.10	CY-MI	$ 29,400	$ 20,600	$ 50,000	-	$ 50,000
				Upland Tailings	C01	Excavation	78,200	$ 4.28	CY	$ 335,000	$ 234,000	$ 569,000	-	$ 569,000
					C07	Waste Consolidation Area Above Flood Level	78,200	$ 14.70	CY	$ 1,150,000	$ 805,000	$ 1,960,000	$ 253,000	$ 2,210,000
					HAUL-2	Haul To Repository	68,129	$ 1.10	CY-MI	$ 74,800	$ 52,400	$ 127,000	-	$ 127,000
		BUR056	TAMARACK ROCK DUMPS	Upland waste rock (potential intermixed tailings)	C01	Excavation	253,600	$ 4.28	CY	$ 1,090,000	$ 760,000	$ 1,850,000	-	$ 1,850,000
					C07	Waste Consolidation Area Above Flood Level	253,600	$ 14.70	CY	$ 3,730,000	$ 2,610,000	$ 6,340,000	$ 820,000	$ 7,160,000
					HAUL-2	Haul To Repository	85,494	$ 1.10	CY-MI	$ 93,900	$ 65,700	$ 160,000	-	$ 160,000
		BUR058	TAMARACK NO.3	Upland waste rock	C01	Excavation	13,500	$ 4.28	CY	$ 57,800	$ 40,400	$ 98,200	-	$ 98,200
					C07	Waste Consolidation Area Above Flood Level	13,500	$ 14.70	CY	$ 198,000	$ 139,000	$ 337,000	$ 43,700	$ 381,000
					HAUL-2	Haul To Repository	32,881	$ 1.10	CY-MI	$ 36,100	$ 25,300	$ 61,400	-	$ 61,400
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT02	Onsite Semi-Passive Treatment Using Lime Addition	89.8		GPM	$ 493,000	$ 345,000	$ 838,000	$ 1,190,000	$ 2,030,000
		BUR139	REX NO. 1	Upland waste rock	C01	Excavation	5,500	$ 4.28	CY	$ 23,500	$ 16,500	$ 40,000	-	$ 40,000
					C07	Waste Consolidation Area Above Flood Level	5,500	$ 14.70	CY	$ 80,900	$ 56,600	$ 138,000	$ 17,800	$ 155,000
					HAUL-2	Haul To Repository	19,229	$ 1.10	CY-MI	$ 21,100	$ 14,800	$ 35,900	-	$ 35,900
		BUR170	TAMARACK 400 LEVEL	Upland waste rock (potential intermixed tailings)	C01	Excavation	17,700	$ 4.28	CY	$ 75,800	$ 53,000	$ 129,000	$ -	$ 129,000
					C07	Waste Consolidation Area Above Flood Level	17,700	$ 14.70	CY	$ 260,000	$ 182,000	$ 442,000	$ 57,200	$ 499,000
					HAUL-2	Haul To Repository	2,749	$ 1.10	CY-MI	$ 3,020	$ 2,110	$ 5,130	$ -	$ 5,130
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT02	Onsite Semi-Passive Treatment Using Lime Addition	74.5		GPM	$ 453,000	$ 317,000	$ 770,000	$ 1,160,000	$ 1,930,000
		BUR171	TAMARACK NO.5	Upland waste rock (potential intermixed tailings)	C01	Excavation	6,500	$ 4.28	CY	$ 27,800	$ 19,500	$ 47,300	$ -	$ 47,300
					C07	Waste Consolidation Area Above Flood Level	6,500	$ 14.70	CY	$ 95,600	$ 66,900	$ 163,000	$ 21,000	$ 184,000
					HAUL-2	Haul to Repository	2,831	$ 1.10	CY-MI	$ 3,110	$ 2,180	$ 5,290	$ -	$ 5,290
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT02	Onsite Semi-Passive Treatment Using Lime Addition	27.4		GPM	$ 330,000	$ 231,000	$ 561,000	$ 1,060,000	$ 1,620,000
		BUR172	TAMARACK UNNAMED ADIT	Upland waste rock	C01	Excavation	4,300	$ 4.28	CY	$ 18,400	$ 12,900	$ 31,300	$ -	$ 31,300
					C07	Waste Consolidation Area Above Flood Level	4,300	$ 14.70	CY	$ 63,200	$ 44,200	$ 107,000	$ 13,900	$ 121,000
					HAUL-2	Haul to Repository	2,052	$ 1.10	CY-MI	$ 2,250	$ 1,580	$ 3,830	$ -	$ 3,830
		BUR173	TAMARACK MILLSITE	Upland Tailings	C01	Excavation	5,200	$ 4.28	CY	$ 22,300	$ 15,600	$ 37,900	$ -	$ 37,900
					C07	Waste Consolidation Area Above Flood Level	5,200	$ 14.70	CY	$ 76,400	$ 53,500	$ 130,000	$ 16,800	$ 147,000
					HAUL-2	Haul to Repository	2,117	$ 1.10	CY-MI	$ 2,320	$ 1,630	$ 3,950	$ -	$ 3,950
		OSB040	EF NINEMILE CK HECLA REHAB	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	19,000	$ 13.50	CY	$ 257,000	$ 180,000	$ 437,000	$ -	$ 437,000
					C07	Waste Consolidation Area Above Flood Level	19,000	$ 14.70	CY	$ 279,000	$ 196,000	$ 475,000	$ 61,400	$ 536,000
					HAUL-2	Haul to Repository	56,712	$ 1.10	CY-MI	$ 62,300	$ 43,600	$ 106,000	$ -	$ 106,000
		OSB044	SUCCESS MINE ROCK DUMP	Upland tailings (jig tailings)	C01	Excavation	155,100	$ 4.28	CY	$ 664,000	$ 465,000	$ 1,130,000	$ -	$ 1,130,000
					C07	Waste Consolidation Area Above Flood Level	155,100	$ 14.70	CY	$ 2,280,000	$ 1,600,000	$ 3,880,000	$ 502,000	$ 4,380,000
					HAUL-2	Haul to Repository	86,950	$ 1.10	CY-MI	$ 95,500	$ 66,800	$ 162,000	$ -	$ 162,000
				Upland waste rock	C01	Excavation	7,300	$ 4.28	CY	$ 31,200	$ 21,900	$ 53,100	$ -	$ 53,100
					C07	Waste Consolidation Area Above Flood Level	7,300	$ 14.70	CY	$ 107,000	$ 75,100	$ 182,100	$ 23,600	$ 206,000
					HAUL-2	Haul to Repository	4,092	$ 1.10	CY-MI	$ 4,490	$ 3,150	$ 7,640	$ -	$ 7,640
				Floodplain sediments	C01b	Excavation (60% dry/40% wet)	4,300	$ 13.50	CY	$ 58,100	$ 40,600	$ 98,700	$ -	$ 98,700
					C07	Waste Consolidation Area Above Flood Level	4,300	$ 14.70	CY	$ 63,200	$ 44,200	$ 107,400	$ 13,900	$ 121,000
					HAUL-2	Haul to Repository	2,411	$ 1.10	CY-MI	$ 2,650	$ 1,850	$ 4,500	$ -	$ 4,500
		OSB048	AMERICAN MINE	Upland waste rock	C02a	Regrade/Consolidate/Revegetate	0.15	$ 84,300	AC	12,600	$ 8,850	$ 21,500	$ 1,640	$ 23,100
		OSB056	EF NINEMILE CK IMPACTED RIPARIAN	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	1,600	$ 13.50	CY	$ 21,600	$ 15,100	$ 36,700	$ -	$ 36,700
					C07	Waste Consolidation Area Above Flood Level	1,600	$ 14.70	CY	$ 23,500	$ 16,500	$ 40,000	$ 5,170	$ 45,170
					HAUL-2	Haul to Repository	1,342	$ 1.10	CY-MI	$ 1,470	$ 1,030	$ 2,500	$ -	$ 2,500
		OSB057	EF NINEMILE CK IMPACTED RIPARIAN	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	13,000	$ 13.50	CY	$ 176,000	$ 123,000	$ 299,000	$ -	$ 299,000
					C07	Waste Consolidation Area Above Flood Level	13,000	$ 14.70	CY	$ 191,000	$ 134,000	$ 325,000	$ 42,000	$ 367,000
					HAUL-2	Haul to Repository	12,532	$ 1.10	CY-MI	$ 13,800	$ 9,630	$ 23,400	$ -	$ 23,400
		OSB058	EF NINEMILE CK SVNRT REHAB	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	1,600	$ 13.50	CY	$ 21,600	$ 15,100	$ 36,700	$ -	$ 36,700
					C07	Waste Consolidation Area Above Flood Level	1,600	$ 14.70	CY	$ 23,500	$ 16,500	$ 40,000	$ 5,170	$ 45,200
					HAUL-2	Haul to Repository	2,452	$ 1.10	CY-MI	$ 2,690	$ 1,880	$ 4,570	$ -	$ 4,570
		OSB088	ALAMEDA MINE	Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	5.83		GPM	$ 3,920	$ 4,200	$ 8,120	$ 2,970	$ 11,100
		OSB089	SUCCESS NO.3	Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	15.7		GPM	$ 10,600	$ 11,300	$ 21,900	$ 8,690	$ 30,600
	Water Treatment Pipelines	PIPING_21		Adit drainage	PIPE-1	Gravity Pipeline-6"	893	$ 58.70	LF	$ 52,400	$ 36,700	$ 89,100	$ 4,200	$ 93,300
		PIPING_22.5		Combined Waters	PIPE-1	Gravity Pipeline-6"	10,408	$ 58.70	LF	$ 611,000	$ 428,000	$ 1,040,000	$ 48,900	$ 1,090,000

TABLE 12-4

Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Ninemile Creek Watershed

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
	Stream and Riparian Stabilization Actions	NM02-1	Interstate Mill site on the East Fork to the mainstem Ninemile Creek	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	7,553	$ 122	LF	$ 921,000	$ 645,000	$ 1,570,000	$ 276,000	$ 1,840,000
					CD-AVG	Current Deflector Average Cost	90	$ 2,060	EA	$ 185,000	$ 130,000	$ 315,000	$ 55,600	$ 371,000
					CD-SED	Current Deflector, Sediment Traps	10	$ 1,870	EA	$ 18,700	$ 13,100	$ 31,800	$ 112,000	$ 144,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	377,656	$ 1.34	SF	$ 506,000	$ 354,000	$ 860,000	$ 91,100	$ 951,000
					OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	347	$ 42.60	SY	$ 14,800	$ 10,300	$ 25,100	$ 2,660	$ 27,800
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	7,553	$ 52.00	LF	$ 393,000	$ 275,000	$ 668,000	$ 118,000	$ 786,000
NMSeg04	Mine and Mill Sites	OSB038	CALIFORNIA NO.4	Floodplain waste rock	C01	Excavation	15,100	$ 4.28	CY	$ 64,600	$ 45,200	$ 110,000	$ -	$ 110,000
					C07	Waste Consolidation Area Above Flood Level	15,100	$ 14.70	CY	$ 222,000	$ 155,000	$ 377,000	$ 48,800	$ 426,000
					HAUL-2	Haul to Repository	61,658	$ 1.10	CY-MI	$ 67,700	$ 47,400	$ 115,000	$ -	$ 115,000
		OSB039	DAYROCK MINE	Upland tailings	C01	Excavation	11,000	$ 4.28	CY	$ 47,100	$ 33,000	$ 80,100	$ -	$ 80,100
					C07	Waste Consolidation Area Above Flood Level	11,000	$ 14.70	CY	$ 162,000	$ 113,000	$ 275,000	$ 35,600	$ 311,000
					HAUL-2	Haul to Repository	44,979	$ 1.10	CY-MI	$ 49,400	$ 34,600	$ 84,000	$ -	$ 84,000
				Floodplain sediments	C01b	Excavation (60% dry/40% wet)	22,000	$ 13.50	CY	$ 297,000	$ 208,000	$ 505,000	$ -	$ 505,000
					C07	Waste Consolidation Area Above Flood Level	22,000	$ 14.70	CY	$ 323,000	$ 226,000	$ 549,000	$ 71,100	$ 620,000
					HAUL-2	Haul to Repository	89,958	$ 1.10	CY-MI	$ 98,800	$ 69,100	$ 168,000	$ -	$ 168,000
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	6.10		GPM	$ 4,100	$ 4,390	$ 8,490	$ 3,110	$ 11,600
				Buildings & Structures	HH-3	Millsite Decontamination	1	$ 135,800	EA	$ 136,000	$ 95,100	$ 231,000	$ 6,790	$ 238,000
		OSB052	DAYROCK MINE TLGS PILE/SVNRT REPOSITORY	Upland tailings - inactive facilities	C09	Impoundment Closure	5.55	$ 246,000	AC	$ 1,370,000	$ 956,000	$ 2,330,000	$ 273,000	$ 2,600,000
		OSB059	NINEMILE CK BELOW DAYROCK MINE	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	33,000	$ 13.50	CY	$ 446,000	$ 312,000	$ 758,000	$ -	$ 758,000
					C07	Waste Consolidation Area Above Flood Level	33,000	$ 14.70	CY	$ 485,000	$ 340,000	$ 825,000	$ 107,000	$ 932,000
					HAUL-2	Haul to Repository	88,063	$ 1.10	CY-MI	$ 96,700	$ 67,700	$ 164,000	$ -	$ 164,400
		OSB060	NINEMILE CK SVNRT REHAB NEAR BLACKCLD	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	800	$ 13.50	CY	$ 10,800	$ 7,560	$ 18,400	$ -	$ 18,400
					C07	Waste Consolidation Area Above Flood Level	800	$ 14.70	CY	$ 11,800	$ 8,230	$ 20,000	$ 2,590	$ 22,600
					HAUL-2	Haul to Repository	2,589	$ 1.10	CY-MI	$ 2,840	$ 1,990	$ 4,830	$ -	$ 4,830
		OSB082	MONARCH MINE BLACKCLOUD CK	Floodplain waste rock	C01	Excavation	13,000	$ 4.28	CY	$ 55,600	$ 38,900	$ 94,500	$ -	$ 94,500
					C07	Waste Consolidation Area Above Flood Level	13,000	$ 14.70	CY	$ 191,000	$ 134,000	$ 325,000	$ 42,000	$ 367,000
					HAUL-2	Haul to Repository	40,847	$ 1.10	CY-MI	$ 44,900	$ 31,400	$ 76,300	$ -	$ 76,300
		OSB115	OPTION MINE	Upland waste rock (erosion potential)	C01	Excavation	300	$ 4.28	CY	$ 1,280	$ 899	$ 2,180	$ -	$ 2,180
					C07	Waste Consolidation Area Above Flood Level	300	$ 14.70	CY	$ 4,410	$ 3,090	$ 7,500	$ 970	$ 8,470
					HAUL-2	Haul to Repository	199	$ 1.10	CY-MI	$ 219	$ 153	$ 372	$ -	$ 372
		WAL033	NINEMILE CK POTENTIAL TAILINGS DEPOSIT	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	34,000	$ 13.50	CY	$ 459,000	$ 321,000	$ 780,000	$ -	$ 780,000
					C07	Waste Consolidation Area Above Flood Level	34,000	$ 14.70	CY	$ 500,000	$ 350,000	$ 850,000	$ 110,000	$ 960,000
					HAUL-2	Haul to Repository	148,686	$ 1.10	CY-MI	$ 163,000	$ 114,000	$ 277,000	$ -	$ 277,000
	Water Treatment Pipelines	PIPING_23.5		Combined Waters	PIPE-1	Gravity Pipeline-6"	15,246	$ 58.70	LF	$ 895,000	$ 626,000	$ 1,520,000	$ 71,600	$ 1,590,000
	Stream and Riparian Stabilization Actions	NM04-1	Mainstem Ninemile Creek to Black Cloud Creek	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	2,069	$ 122	LF	$ 252,000	$ 177,000	$ 429,000	$ 75,700	$ 505,000
					CD-AVG	Current Deflector Average Cost	25	$ 2,060	EA	$ 51,500	$ 36,100	$ 87,600	$ 15,500	$ 103,000
					CD-SED	Current Deflector, Sediment Traps	3	$ 1,870	EA	$ 5,610	$ 3,930	$ 9,540	$ 33,700	$ 43,200
					CH REAL-1	Channel Realignment	27,580	$ 42.20	SY	$ 1,160,000	$ 815,000	$ 1,980,000	$ 198,000	$ 2,170,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	144,795	$ 1.34	SF	$ 194,000	$ 136,000	$ 330,000	$ 34,900	$ 365,000
					OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	1,972	$ 42.60	SY	$ 84,000	$ 58,800	$ 143,000	$ 15,100	$ 158,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	2,069	$ 52.00	LF	$ 108,000	$ 75,300	$ 183,000	$ 32,300	$ 216,000
		NM04-2	Black Cloud Creek to Silver Star Mine	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	717	$ 122	LF	$ 87,500	$ 61,200	$ 149,000	$ 26,200	$ 175,000
					CD-AVG	Current Deflector Average Cost	9	$ 2,060	EA	$ 18,500	$ 13,000	$ 31,500	$ 5,560	$ 37,100
					CD-SED	Current Deflector, Sediment Traps	1	$ 1,870	EA	$ 1,870	$ 1,310	$ 3,180	$ 11,200	$ 14,400
					CH REAL-1	Channel Realignment	9,563	$ 42.20	SY	$ 404,000	$ 282,000	$ 686,000	$ 68,600	$ 755,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	143,444	$ 1.34	SF	$ 192,000	$ 135,000	$ 327,000	$ 34,600	$ 362,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	717	$ 52.00	LF	$ 37,300	$ 26,100	$ 63,400	$ 11,200	$ 74,600
		NM04-3	Silver Star Mine to South Fork Coeur d'Alene River	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	5,551	$ 122	LF	$ 677,000	$ 474,000	$ 1,150,000	$ 203,000	$ 1,350,000
					CD-AVG	Current Deflector Average Cost	67	$ 2,060	EA	$ 138,000	$ 96,600	$ 235,000	$ 41,400	$ 276,000
					CD-SED	Current Deflector, Sediment Traps	7	$ 1,870	EA	$ 13,100	$ 9,160	$ 22,300	$ 78,500	$ 101,000
					CH REAL-1	Channel Realignment	74,011	$ 42.20	SY	$ 3,120,000	$ 2,190,000	$ 5,310,000	$ 531,000	$ 5,840,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	666,102	$ 1.34	SF	$ 893,000	$ 625,000	$ 1,520,000	$ 161,000	$ 1,680,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	5,551	$ 52.00	LF	$ 289,000	$ 202,000	$ 491,000	$ 86,600	$ 578,000
Total for Ninemile Creek Watershed										**$ 36,500,000**	**$ 25,500,000**	**$ 62,000,000**	**$ 10,700,000**	**$ 72,800,000**

Notes:

EA = each
GPM = gallons per minute
LF = lineal foot
LS = lump sum
UOM = units of measure

O&M = operation and maintenance
NPV = net present value
AC = acres
SY = square yards

CY = cubic yards
CY-MI = cubic yards per mile
TCD = typical conceptual design
SF = square feet

It is important to note that TCDs are only conceptual designs, and the constructed remedies at specific source sites may differ from the TCDs based on future site- and waste-specific characterization assessments and other pre-design activities.

Stream and riparian stabilization actions are specified by stream reach. See Figure 12-19 for the location of each stream reach.

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

TABLE 12-5

Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Big Creek Watershed

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
BigCrkSeg04	Mine and Mill Sites	KLE047	Big Ck Impacted Riparian: No. 1	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	3,323	$ 13.50	CY	$ 44,900	$ 31,400	$ 76,300	$ -	$ 76,300
					C08a	Repository	3,323	$ 17.70	CY	$ 58,800	$ 41,200	$ 100,000	$ 8,230	$ 108,000
					HAUL-2	Haul to Repository	16,615	$ 1.10	CY-MI	$ 18,200	$ 12,800	$ 31,000	$ -	$ 31,000
		KLE071	Big Ck Impacted Riparian: No. 3	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	49,000	$ 13.50	CY	$ 529,000	$ 370,000	$ 899,000	$ -	$ 899,000
					C08a	Repository	49,000	$ 17.70	CY	$ 694,000	$ 486,000	$ 1,180,000	$ 97,100	$ 1,280,000
					HAUL-2	Haul to Repository	245,000	$ 1.10	CY-MI	$ 215,000	$ 151,000	$ 366,000	$ -	$ 366,000
		KLE073	Big Ck Impacted Riparian: No. 2	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	100,000	$ 13.50	CY	$ 1,350,000	$ 945,000	$ 2,300,000	$ -	$ 2,300,000
					C08a	Repository	100,000	$ 17.70	CY	$ 1,770,000	$ 1,240,000	$ 3,010,000	$ 248,000	$ 3,260,000
					HAUL-2	Haul to Repository	500,000	$ 1.10	CY-MI	$ 549,000	$ 384,000	$ 933,000	$ -	$ 933,000
	Stream and Riparian Stabilization Actions	BIG04-3	Sunshine Mine site to the South Fork Coeur d'Alene River	Bioreach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	4,697	$ 122	LF	$ 573,000	$ 401,000	$ 974,000	$ 172,000	$ 1,150,000
					CD-AVG	Current Deflector Average Cost	120	$ 2,060	EA	$ 247,000	$ 173,000	$ 420,000	$ 74,200	$ 494,000
					CD-SED	Current Deflector, Sediment Traps	14	$ 1,870	EA	$ 26,200	$ 18,300	$ 44,500	$ 157,000	$ 202,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	322,033	$ 1.34	SF	$ 432,000	$ 302,000	$ 734,000	$ 77,700	$ 812,000
					OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	19,520	$ 42.60	SY	$ 832,000	$ 582,000	$ 1,410,000	$ 150,000	$ 1,560,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	4,697	$ 52.00	LF	$ 244,000	$ 171,000	$ 415,000	$ 73,300	$ 488,000
Total for Big Creek Watershed										**$ 7,580,000**	**$ 5,310,000**	**$ 12,900,000**	**$ 1,060,000**	**$ 14,000,000**

Notes:

EA = each
CY = cubic yards
LF = lineal foot
CY-MI = cubic yards per mile
TCD = typical conceptual design

O&M = operation and maintenance
NPV = net present value
SY = square yards
SF = square feet
UOM = units of measure

It is important to note that TCDs are only conceptual designs, and the constructed remedies at specific source sites may differ from the TCDs based on future site- and waste-specific characterization assessments and other pre-design activities.

Stream and riparian stabilization actions are specified by stream reach. See Figure 12-20 for the location of each stream reach.

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

TABLE 12-6

Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Moon Creek Watershed

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
MoonCkSeg02	Mine and Mill Sites	KLE014	ROYAL ANNE MINE	Upland waste rock (erosion potential)	C01	Excavation	200	$ 4.28	CY	$ 856	$ 599	$ 1,460	$ -	$ 1,460
					C08a	Repository	200	$ 17.70	CY	$ 3,540	$ 2,480	$ 6,020	$ 496	$ 6,520
					HAUL-2	Haul to Repository	1,000	$ 1.10	CY-MI	$ 1,100	$ 769	$ 1,870	$ -	$ 1,870
		KLE041	MOON CK IMPACTED RIPARIAN	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	3,300	$ 13.50	CY	$ 44,600	$ 31,200	$ 75,800	$ -	$ 75,800
					C08a	Repository	3,300	$ 17.70	CY	$ 58,400	$ 40,900	$ 99,300	$ 8,180	$ 107,000
					HAUL-2	Haul to Repository	16,500	$ 1.10	CY-MI	$ 18,100	$ 12,700	$ 30,800	$ -	$ 30,800
	Stream and Riparian Stabilization Actions	MC02-2	Unnamed tributary at mile 2.8 to confluence with WF	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	1,334	$ 122	LF	$ 163,000	$ 114,000	$ 277,000	$ 48,800	$ 326,000
					CD-AVG	Current Deflector Average Cost	60	$ 2,060	EA	$ 124,000	$ 86,500	$ 211,000	$ 37,100	$ 248,000
					CD-SED	Current Deflector Sediment Traps	7	$ 1,870	EA	$ 13,100	$ 9,160	$ 22,300	$ 78,500	$ 100,800
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	333,623	$ 1.34	SF	$ 447,000	$ 313,000	$ 760,000	$ 80,500	$ 841,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	1,334	$ 52.00	LF	$ 69,400	$ 48,600	$ 118,000	$ 20,800	$ 139,000
		MC02-3	WF confluence to unnamed tributary at mile 1.2	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	1,117	$ 122	LF	$ 136,000	$ 95,400	$ 231,000	$ 40,900	$ 272,000
					CD-AVG	Current Deflector Average Cost	25	$ 2,060	EA	$ 51,500	$ 36,100	$ 87,600	$ 15,500	$ 103,000
					CD-SED	Current Deflector, Sediment Traps	3	$ 1,870	EA	$ 5,610	$ 3,930	$ 9,540	$ 33,700	$ 43,200
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	167,617	$ 1.34	SF	$ 225,000	$ 157,000	$ 382,000	$ 40,400	$ 422,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	1,117	$ 52.00	LF	$ 58,100	$ 40,700	$ 98,800	$ 17,400	$ 116,000
		MC02-4	Unnamed tributary at mile 1.2 to South Fork Coeur d'Alene River	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	580	$ 122	LF	$ 70,800	$ 49,500	$ 120,000	$ 21,200	$ 142,000
					CD-AVG	Current Deflector Average Cost	26	$ 2,060	EA	$ 53,600	$ 37,500	$ 91,100	$ 16,100	$ 107,000
					CD-SED	Current Deflector, Sediment Traps	3	$ 1,870	EA	$ 5,610	$ 3,930	$ 9,540	$ 33,700	$ 43,200
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	144,894	$ 1.34	SF	$ 194,000	$ 136,000	$ 330,000	$ 34,900	$ 365,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	869	$ 52.00	LF	$ 45,200	$ 31,600	$ 76,800	$ 13,600	$ 90,400
Total for Moon Creek Watershed										**$ 1,790,000**	**$ 1,250,000**	**$ 3,040,000**	**$ 540,000**	**$ 3,580,000**

Notes:

EA = each
CY = cubic yards
LF = lineal foot
CY-MI = cubic yards per mile
TCD = typical conceptual design

O&M = operation and maintenance
NPV = net present value
SF = square feet
UOM = units of measure

It is important to note that TCDs are only conceptual designs, and the constructed remedies at specific source sites may differ from the TCDs based on future site- and waste-specific characterization assessments and other pre-design activities

Stream and riparian stabilization actions are specified by stream reach. See Figure 12-21 for the location of each stream reach.

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

TABLE 12-7
Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Pine Creek Watershed
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
PineCrkSeg01	Human Health Waste Piles	HHWPPC01-1	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1.00	$ 58,443	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
		HHWPPC01-2	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1.00	$ 58,443	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
	Mine and Mill Sites	MAS007	NABOB 1300 LEVEL	Upland waste rock	C01	Excavation	48,000	$ 4.28	CY	$ 205,000	$ 144,000	$ 349,000	$ -	$ 349,000
					C03	Low-Permeability Cap	1.82	$ 225,000	AC	$ 410,000	$ 287,000	$ 697,000	$ 49,100	$ 746,000
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT03	Onsite Semi-Passive Treatment Using SRB	33.2		GPM	$ 348,000	$ 243,000	$ 591,000	$ 595,000	$ 1,190,000
		MAS011	IDAHO PROSPECT: NO. 2	Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT03	Onsite Semi-Passive Treatment Using SRB	0.58		GPM	$ 136,000	$ 95,300	$ 231,000	$ 527,000	$ 758,000
		MAS012	LYNCH-PINE CREEK MINE	Upland waste rock (erosion potential)	C01	Excavation	500	$ 4.28	CY	$ 2,140	$ 1,500	$ 3,640	$ -	$ 3,640
					C07	Waste Consolidation Area Above Flood Level	500	$ 14.70	CY	$ 7,350	$ 5,150	$ 12,500	$ 1,620	$ 14,100
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT02	Onsite Semi-Passive Treatment Using Lime Addition	89.8		GPM	$ 493,000	$ 345,000	$ 838,000	$ 1,190,000	$ 2,030,000
		MAS013	NABOB 600 LEVEL (300 Level)	Upland waste rock (erosion potential)	C01	Excavation	4,700	$ 4.28	CY	$ 20,100	$ 14,100	$ 34,200	$ -	$ 34,200
					C07	Waste Consolidation Area Above Flood Level	4,700	$ 14.70	CY	$ 69,100	$ 48,400	$ 118,000	$ 15,200	$ 133,000
		MAS014	HILARITY MINE	Upland tailings	C01	Excavation	80	$ 4.28	CY	$ 342	$ 240	$ 582	$ -	$ 582
					C08a	Repository	80	$ 17.70	CY	$ 1,420	$ 991	$ 2,410	$ 198	$ 2,610
					HAUL-2	Haul to Repository	400	$ 1.10	CY-MI	$ 439	$ 307	$ 746	$ -	$ 746
				Upland waste rock	C01	Excavation	30,720	$ 4.28	CY	$ 131,000	$ 92,000	$ 223,000	$ -	$ 223,000
					C03	Low-Permeability Cap	1.28	$ 225,000	AC	$ 288,000	$ 202,000	$ 490,000	$ 34,600	$ 525,000
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT02	Onsite Semi-Passive Treatment Using Lime Addition	89.8		GPM	$ 493,000	$ 345,000	$ 838,000	$ 1,190,000	$ 2,030,000
				Seep	WT02	Onsite Semi-Passive Treatment Using Lime Addition	89.8		GPM	$ 493,000	$ 345,000	$ 838,000	$ 1,190,000	$ 2,030,000
		MAS015	LITTLE PITTSBURG MINE: NO. 2	Upland waste rock (erosion potential)	C01	Excavation	1,000	$ 4.28	CY	$ 4,280	$ 3,000	$ 7,280	$ -	$ 7,280
					C07	Waste Consolidation Area Above Flood Level	1,000	$ 14.70	CY	$ 14,700	$ 10,300	$ 25,000	$ 3,230	$ 28,200
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT03	Onsite Semi-Passive Treatment Using SRB	3.01		GPM	$ 152,000	$ 106,000	$ 258,000	$ 528,000	$ 786,000
		MAS016	LITTLE PITTSBURG MINE: NO. 1	Upland waste rock (erosion potential)	C01	Excavation	23,280	$ 4.28	CY	$ 99,600	$ 69,700	$ 169,000	$ -	$ 169,000
					C07	Waste Consolidation Area Above Flood Level	23,280	$ 14.70	CY	$ 342,000	$ 240,000	$ 582,000	$ 75,300	$ 657,000
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT03	Onsite Semi-Passive Treatment Using SRB	0.38		GPM	$ 135,000	$ 94,400	$ 229,000	$ 527,000	$ 756,000
		MAS020	SIDNEY (RED CLOUD) MINE/MILLSITE	Adit drainage	C10	Adit Drainage Collection	1	$ 9,680.00	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT03	Onsite Semi-Passive Treatment Using SRB	40		GPM	$ 391,000	$ 274,000	$ 665,000	$ 550,000	$ 1,220,000
		MAS021	NEVADA-STEWART MINE	Upland waste rock (erosion potential)	C01	Excavation	1,000	$ 4.28	CY	$ 856	$ 599	$ 1,460	$ -	$ 1,460
					C04	Low-Permeability Cap w/Seepage Collection	0.63	$ 254,000	AC	$ 160,000	$ 112,000	$ 272,000	$ 36,800	$ 309,000
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT02	Onsite Semi-Passive Treatment Using Lime Addition	50		GPM	$ 389,000	$ 272,000	$ 661,000	$ 1,140,000	$ 1,800,000
		MAS022	SURPRISE MINE & UPPER ROCK DUMP	Floodplain waste rock	C01	Excavation	48,000	$ 4.28	CY	$ 205,000	$ 144,000	$ 349,000	$ -	$ 349,000
					C07	Waste Consolidation Area Above Flood Level	48,000	$ 14.70	CY	$ 706,000	$ 494,000	$ 1,200,000	$ 155,000	$ 1,360,000
		MAS025	DOUGLAS MINE & MILLSITE	Floodplain waste rock (intermixed tailings)	C01	Excavation	35,000	$ 4.28	CY	$ 150,000	$ 105,000	$ 255,000	$ -	$ 255,000
		MAS029	BIG IT MINE	Upland waste rock (intermixed tailings)	C01	Excavation	700	$ 4.28	CY	$ 3,000	$ 2,100	$ 5,100	$ -	$ 5,100
					C07	Waste Consolidation Area Above Flood Level	700	$ 14.70	CY	$ 10,300	$ 7,200	$ 17,500	$ 2,260	$ 19,800
		MAS035	NABOB 600 LEVEL SHAFT	Upland waste rock (erosion potential)	C01	Excavation	8,000	$ 4.28	CY	$ 34,200	$ 24,000	$ 58,200	$ -	$ 58,200
					C07	Waste Consolidation Area Above Flood Level	8,000	$ 14.70	CY	$ 118,000	$ 82,300	$ 200,000	$ 25,900	$ 226,000
		MAS036	DENVER CK TAILINGS PILE	Floodplain tailings	C01	Excavation	2,700	$ 4.28	CY	$ 11,600	$ 8,090	$ 19,700	$ -	$ 19,700
					C07	Waste Consolidation Area Above Flood Level	2,700	$ 14.70	CY	$ 39,700	$ 27,800	$ 67,500	$ 8,730	$ 76,200
		MAS040	DENVER CK IMPACTED RIPARIAN: NO. 2	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	1,380	$ 13.50	CY	$ 18,600	$ 13,000	$ 31,600	$ -	$ 31,600
					C08a	Repository	1,380	$ 17.70	CY	$ 24,400	$ 17,100	$ 41,500	$ 3,420	$ 44,900
					HAUL-2	Haul to Repository	6,900	$ 1.10	CY-MI	$ 7,580	$ 5,300	$ 12,900	$ -	$ 12,900
		MAS041	DENVER CK IMPACTED RIPARIAN: NO. 3	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	2,340	$ 13.50	CY	$ 31,600	$ 22,100	$ 53,700	$ -	$ 53,700
					C08a	Repository	2,340	$ 17.70	CY	$ 41,400	$ 29,000	$ 70,400	$ 5,800	$ 76,200
					HAUL-2	Haul to Repository	11,700	$ 1.10	CY-MI	$ 12,800	$ 8,990	$ 21,800	$ -	$ 21,800
		MAS042	DENVER CK IMPACTED RIPARIAN: NO. 4	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	1,080	$ 13.50	CY	$ 14,600	$ 10,200	$ 24,800	$ -	$ 24,800
					C08a	Repository	1,080	$ 17.70	CY	$ 19,100	$ 13,400	$ 32,500	$ 2,680	$ 35,200
					HAUL-2	Haul to Repository	5,400	$ 1.10	CY-MI	$ 5,930	$ 4,150	$ 10,100	$ -	$ 10,100
		MAS043	DENVER CK IMPACTED RIPARIAN: NO. 1	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	3,000	$ 13.50	CY	$ 40,500	$ 28,400	$ 68,900	$ -	$ 68,900
					C08a	Repository	3,000	$ 17.70	CY	$ 53,100	$ 37,200	$ 90,300	$ 7,430	$ 97,700
					HAUL-2	Haul to Repository	15,000	$ 1.10	CY-MI	$ 16,500	$ 11,500	$ 28,000	$ -	$ 28,000
		MAS045	HIGHLAND CK IMPACTED RIPARIAN	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	3,000	$ 13.50	CY	$ 40,500	$ 28,400	$ 68,900	$ -	$ 68,900
					C08a	Repository	3,000	$ 17.70	CY	$ 53,100	$ 37,200	$ 90,300	$ 7,430	$ 97,700
					HAUL-2	Haul to Repository	15,000	$ 1.10	CY-MI	$ 16,500	$ 11,500	$ 28,000	$ -	$ 28,000
		MAS046	HIGHLAND & RED CLOUD CK IMPACTED RIPAR	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	23,850	$ 13.50	CY	$ 322,000	$ 225,000	$ 547,000	$ -	$ 547,000
					C08a	Repository	23,850	$ 17.70	CY	$ 422,000	$ 296,000	$ 718,000	$ 59,100	$ 777,000
					HAUL-2	Haul to Repository	119,250	$ 1.10	CY-MI	$ 131,000	$ 91,700	$ 223,000	$ -	$ 223,000
		MAS054	MARMION OR SF FRACTION	Floodplain waste rock	C01	Excavation	10,560	$ 4.28	CY	$ 45,200	$ 31,600	$ 76,800	$ -	$ 76,800

TABLE 12-7

Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Pine Creek Watershed

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
					C07	Waste Consolidation Area Above Flood Level	10,560	$ 14.70	CY	$ 155,000	$ 109,000	$ 264,000	$ 34,200	$ 298,000
				Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT03	Onsite Semi-Passive Treatment Using SRB	7.99		GPM	$ 184,000	$ 129,000	$ 313,000	$ 538,000	$ 851,000
		MAS078	HIGHLAND-SURPRISE MINE & MILLSITE	Adit drainage	C10	Adit Drainage Collection	1	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT03	Onsite Semi-Passive Treatment Using SRB	34.1		GPM	$ 354,000	$ 247,000	$ 601,000	$ 578,000	$ 1,180,000
		MAS083	NABOB MILLSITE	Upland tailings	C01	Excavation	8,150	$ 4.28	CY	$ 34,900	$ 24,400	$ 59,300	$ -	$ 59,300
					C07	Waste Consolidation Area Above Flood Level	8,150	$ 14.70	CY	$ 120,000	$ 83,900	$ 204,000	$ 26,400	$ 230,000
				Upland waste rock	C01	Excavation	29,000	$ 4.28	CY	$ 124,000	$ 86,900	$ 211,000	$ -	$ 211,000
					C03	Low-Permeability Cap	2.81	$ 225,000	AC	$ 632,000	$ 443,000	$ 1,080,000	$ 75,900	$ 1,150,000
		MAS084	DOUGLAS MINESITE TAILINGS REPOSITORY	Floodplain tailings	C01	Excavation	30,000	$ 4.28	CY	$ 128,000	$ 89,900	$ 218,000	$ -	$ 218,000
				Floodplain tailings	C07	Waste Consolidation Area Above Flood Level	30,000	$ 14.70	CY	$ 441,000	$ 309,000	$ 750,000	$ 97,000	$ 847,000
PineCrkSeg03	Mine and Mill Sites	KLW075	MATCHLESS MINE	Floodplain waste rock	C01	Excavation	17,040	$ 4.28	CY	$ 72,900	$ 51,100	$ 124,000	$ -	$ 124,000
					C07	Waste Consolidation Area Above Flood Level	17,040	$ 14.70	CY	$ 250,000	$ 175,000	$ 425,000	$ 55,100	$ 480,000
		KLW079	GOLD EAGLE MINING CO.	Floodplain waste rock	C01	Excavation	9,600	$ 4.28	CY	$ 41,100	$ 28,800	$ 69,900	$ -	$ 69,900
					C07	Waste Consolidation Area Above Flood Level	9,600	$ 14.70	CY	$ 141,000	$ 98,800	$ 240,000	$ 31,000	$ 271,000
		KLW082	CARBONATE MINE: NO. 2	Floodplain waste rock	C01	Excavation	8,160	$ 4.28	CY	$ 34,900	$ 24,400	$ 59,300	$ -	$ 59,300
					C07	Waste Consolidation Area Above Flood Level	8,160	$ 14.70	CY	$ 120,000	$ 84,000	$ 204,000	$ 26,400	$ 230,000
		KLW085	CARBONATE MINE: NO. 1	Floodplain waste rock	C01	Excavation	14,400	$ 4.28	CY	$ 61,600	$ 43,100	$ 105,000	$ -	$ 105,000
					C07	Waste Consolidation Area Above Flood Level	14,400	$ 14.70	CY	$ 212,000	$ 148,000	$ 360,000	$ 46,600	$ 407,000
		MAS003	LIBERAL KING MINE & MILLSITE	Upland waste rock (intermixed tailings)	C04	Low-Permeability Cap w/Seepage Collection	3.86	$ 254,000	AC	$ 980,000	$ 686,000	$ 1,670,000	$ 226,000	$ 1,890,000
Total for Pine Creek Watershed										**$ 11,700,000**	**$ 8,200,000**	**$ 19,900,000**	**$ 9,700,000**	**$ 29,600,000**

Notes:

TCD = typical conceptual design
GPM = gallons per minute
UOM = units of measure
LS = lump sum
CY = cubic yards

O&M = operation and maintenance
NPV = net present value
AC = acres
CY-MI = cubic yards per mile

It is important to note that TCDs are only conceptual designs, and the constructed remedies at specific source sites may differ from the TCDs based on future site- and waste-specific characterization assessments and other pre-design activities.

Costs for human health waste piles are included in the Selected Remedy. It is assumed that contaminated material (likely upland waste rock) will be encountered near community and residential areas during implementation of the Selected Remedy.

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

TABLE 12-8

Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Mainstem SFCDR Watershed

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
MidGradeSeg01	Human Health Waste Piles	HHWPMG01-1	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1	$ 58,443	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
		HHWPMG01-2	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1	$ 58,443	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
		HHWPMG01-3	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1	$ 58,443	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
		HHWPMG01-4	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1	$ 58,443	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
		HHWPMG01-5	Upland waste pile w/human health exposure	Upland waste rock	HH-2	Upland Waste Pile Soil Cover	1	$ 58,443	AC	$ 58,400	$ 40,900	$ 99,300	$ 7,600	$ 107,000
	Mine and Mill Sites	KLE011	SILVER CRESCENT TAILINGS (a)	Upland tailings - inactive facilities	C09	Impoundment Closure	7.89	$ 246,000	LF	$ 1,940,000	$ 1,360,000	$ 3,300,000	$ 388,000	$ 3,690,000
		KLE034	SILVER DOLLAR MINE	Floodplain waste rock	C01	Excavation	22,000	$ 4.28	CY	$ 18,800	$ 13,200	$ 32,000	$ -	$ 32,000
					C03	Low-Permeability Cap	2.29	$ 225,000	AC	$ 515,000	$ 361,000	$ 876,000	$ 61,800	$ 938,000
		KLE035	SILVER SUMMIT MINE	Floodplain waste rock	C01	Excavation	120,000	$ 4.28	CY	$ 257,000	$ 180,000	$ 437,000	$ -	$ 437,000
					C03	Low-Permeability Cap	13.45	$ 225,000	AC	$ 3,030,000	$ 2,120,000	$ 5,150,000	$ 363,000	$ 5,510,000
					HH-3	Millsite Decontamination	1.00	$ 135,800	CY	$ 136,000	$ 95,100	$ 231,000	$ 6,790	$ 238,000
		KLE040	SF CDA RIVER IMPACTED FLOODPLAIN: NO. 5	Floodplain sediments	C11j	Hydraulic Isolation Using Slurry Wall	3,500	$ 1,590	LF	$ 11,100,000	$ 7,790,000	$ 18,900,000	$ 223,000	$ 19,100,000
					WT01	Centralized HDS Treatment at CTP	8.98		GPM	$ 6,030	$ 6,450	$ 12,500	$ 4,570	$ 17,100
		KLE048	SF CDA RIVER SVNRT REHAB	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	190,000	$ 13.50	CY	$ 744,000	$ 521,000	$ 1,270,000	$ -	$ 1,270,000
					C08a	Repository	190,000	$ 17.70	CY	$ 975,000	$ 683,000	$ 1,660,000	$ 137,000	$ 1,800,000
					HAUL-2	Haul to Repository	950,000	$ 1.10	CY-MI	$ 302,000	$ 212,000	$ 514,000	$ -	$ 514,000
		KLE049	SF CDA RIVER IMPACTED RIPARIAN (MidGradSeg01 & MidGradSeg02)	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	200,000	$ 13.50	CY	$ 1,760,000	$ 1,230,000	$ 2,990,000	$ -	$ 2,990,000
					C08a	Repository	200,000	$ 17.70	CY	$ 2,300,000	$ 1,610,000	$ 3,910,000	$ 322,000	$ 4,230,000
					HAUL-2	Haul to Repository	1,000,000	$ 1.10	CY-MI	$ 714,000	$ 500,000	$ 1,210,000	$ -	$ 1,210,000
		KLE067	ST. JOE NO. 4	Upland waste rock (erosion potential)	C01	Excavation	27,500	$ 4.28	CY	$ 23,500	$ 16,500	$ 40,000	$ -	$ 40,000
					C03	Low-Permeability Cap	0.20	$ 225,000	AC	$ 45,000	$ 31,500	$ 76,500	$ 5,400	$ 81,900
		KLE069	ST. JOE NO. 3	Upland waste rock (erosion potential)	C01	Excavation	1,300	$ 4.28	CY	$ 2,780	$ 1,950	$ 4,730	$ -	$ 4,730
					C03	Low-Permeability Cap	0.42	$ 225,000	AC	$ 94,500	$ 66,200	$ 161,000	$ 11,300	$ 172,000
		OSB065	SF CDA RIVER IMPACTED FLOODPLAIN: NO. 3	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	1,400,000	$ 13.50	CY	$ 5,860,000	$ 4,100,000	$ 9,960,000	$ -	$ 9,960,000
					C08a	Repository	1,400,000	$ 17.70	CY	$ 7,680,000	$ 5,380,000	$ 13,100,000	$ 1,080,000	$ 14,100,000
					C15c	French Drain	4,600	$ 949	LF	$ 4,370,000	$ 3,060,000	$ 7,430,000	$ 87,300	$ 7,520,000
					HAUL-2	Haul to Repository	7,000,000	$ 1.10	CY-MI	$ 2,380,000	$ 1,670,000	$ 4,050,000	$ -	$ 4,050,000
				Groundwater	WT01	Centralized HDS Treatment at CTP	4,498		GPM	$ 3,020,000	$ 3,230,000	$ 6,250,000	$ 4,070,000	$ 10,300,000
		OSB117	OSBURN ZANETI STOCKPILED TAILINGS	Floodplain tailings	C01	Excavation	14,000	$ 4.28	CY	$ 59,900	$ 41,900	$ 102,000	$ -	$ 102,000
					C07	Waste Consolidation Area Above Flood Level	14,000	$ 14.70	CY	$ 206,000	$ 144,000	$ 350,000	$ 45,300	$ 395,000
		OSB118	OSBURN NORTH TAILINGS AREA	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	60,000	$ 13.50	CY	$ 810,000	$ 567,000	$ 1,380,000	$ -	$ 1,380,000
					C08a	Repository	60,000	$ 17.70	CY	$ 1,060,000	$ 743,000	$ 1,800,000	$ 149,000	$ 1,950,000
					HAUL-2	Haul to Repository	300,000	$ 1.10	CY-MI	$ 329,000	$ 231,000	$ 560,000	$ -	$ 560,000
		OSB120	SF CDA RIVER IMPACTED FLOODPLAIN: NO. 4	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	1,200,000	$ 13.50	CY	$ 3,890,000	$ 2,720,000	$ 6,610,000	$ -	$ 6,610,000
					C08a	Repository	1,200,000	$ 17.70	CY	$ 5,100,000	$ 3,570,000	$ 8,670,000	$ 714,000	$ 9,380,000
					HAUL-2	Haul to Repository	6,000,000	$ 1.10	CY-MI	$ 1,580,000	$ 1,110,000	$ 2,690,000	$ -	$ 2,690,000
		WAL002	WESTERN UNION LOWER ADIT	Floodplain waste rock	C01	Excavation	200	$ 4.28	CY	$ 171	$ 120	$ 291	$ -	$ 291
					C03	Low-Permeability Cap	0.87	$ 225,000	AC	$ 196,000	$ 137,000	$ 333,000	$ 23,500	$ 357,000
				Adit drainage	C10	Adit Drainage Collection	1.00	$ 9,680	LS	$ 9,680	$ 6,780	$ 16,500	$ 1,740	$ 18,200
					WT01	Centralized HDS Treatment at CTP	0.90		GPM	$ 603	$ 645	$ 1,250	$ 366	$ 1,610
		WAL004	SF CDA RIVER RAILROAD YARDS & IMP FLDP	Floodplain sediments	C01b	Excavation (60% dry/40% wet)	160,000	$ 13.50	CY	$ 1,470,000	$ 1,030,000	$ 2,500,000	$ -	$ 2,500,000
					C08a	Repository	160,000	$ 17.70	CY	$ 1,930,000	$ 1,350,000	$ 3,280,000	$ 270,000	$ 3,550,000
					HAUL-2	Haul to Repository	800,000	$ 1.10	CY-MI	$ 597,000	$ 418,000	$ 1,020,000	$ -	$ 1,020,000
		WAL014	ST. ELMO MINE	Upland waste rock (erosion potential)	C01	Excavation	39,000	$ 4.28	CY	$ 33,400	$ 23,400	$ 56,800	$ -	$ 56,800
					C03	Low-Permeability Cap	1.61	$ 225,000	AC	$ 362,000	$ 254,000	$ 616,000	$ 43,500	$ 660,000
	Water Treatment Pipelines	PIPING_20.9		Combined Waters	PIPE-4	Gravity Pipeline-36"	2,435	$ 180.00	LF	$ 438,000	$ 307,000	$ 745,000	$ 35,100	$ 780,000
		PIPING_23.75		Combined Waters	PIPE-4	Gravity Pipeline-36"	3,508	$ 180.00	LF	$ 631,000	$ 442,000	$ 1,073,000	$ 50,500	$ 1,120,000
		PIPING_24		Adit drainage	PIPE-1	Gravity Pipeline-6"	3,194	$ 58.70	LF	$ 188,000	$ 131,000	$ 319,000	$ 15,000	$ 334,000
		PIPING_24.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	392	$ 180.00	LF	$ 70,500	$ 49,400	$ 120,000	$ 5,640	$ 125,600
		PIPING_25.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	6,323	$ 180.00	LF	$ 1,140,000	$ 797,000	$ 1,940,000	$ 91,000	$ 2,030,000
		PIPING_26		Adit drainage	PIPE-1	Gravity Pipeline-6"	2,984	$ 58.70	LF	$ 175,000	$ 123,000	$ 298,000	$ 14,000	$ 312,000
		PIPING_26.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	6,555	$ 180.00	LF	$ 1,180,000	$ 826,000	$ 2,010,000	$ 94,400	$ 2,100,000
		PIPING_27.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	1,605	$ 180.00	LF	$ 289,000	$ 202,000	$ 491,000	$ 23,100	$ 514,000
		PIPING_28		Groundwater	PIPE-1	Gravity Pipeline-6"	578	$ 58.70	LF	$ 33,900	$ 23,800	$ 57,700	$ 2,720	$ 60,400
		PIPING_28.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	3,715	$ 180.00	LF	$ 669,000	$ 468,000	$ 1,140,000	$ 53,500	$ 1,190,000
		PIPING_29		Groundwater	PIPE-1	Gravity Pipeline-6"	342	$ 58.70	LF	$ 20,100	$ 14,000	$ 34,100	$ 1,600	$ 35,700
		PIPING_29.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	12,851	$ 180.00	LF	$ 2,310,000	$ 1,620,000	$ 3,930,000	$ 185,000	$ 4,120,000
		PIPING_30.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	1,823	$ 180.00	LF	$ 328,000	$ 230,000	$ 558,000	$ 26,200	$ 584,000
		PIPING_31		Groundwater	PIPE-2	Gravity Pipeline-12"	234	$ 86.20	LF	$ 20,200	$ 14,100	$ 34,300	$ 1,610	$ 35,900
		PIPING_31.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	9,827	$ 180.00	LF	$ 1,770,000	$ 1,240,000	$ 3,010,000	$ 142,000	$ 3,150,000
		PIPING_32		Groundwater	PIPE-2	Gravity Pipeline-12"	235	$ 86.20	LF	$ 20,300	$ 14,200	$ 34,500	$ 1,620	$ 36,000
		PIPING_32.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	7,470	$ 180.00	LF	$ 1,340,000	$ 941,000	$ 2,280,000	$ 108,000	$ 2,390,000
		PIPING_33.5		Combined Waters	PIPE-4	Gravity Pipeline-36"	10,779	$ 180.00	LF	$ 1,940,000	$ 1,360,000	$ 3,300,000	$ 155,000	$ 3,460,000
	Stream and Riparian Stabilization Actions	MG01-10	W.F. Rosebud Creek to unnamed creek at RM 14.0	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	400	$ 122	LF	$ 48,800	$ 34,200	$ 83,000	$ 14,600	$ 97,600
					CD-AVG	Current Deflector Average Cost	4	$ 2,060	EA	$ 8,240	$ 5,770	$ 14,000	$ 2,470	$ 16,500
					CD-SED	Current Deflector, Sediment Traps	1	$ 1,870	EA	$ 1,870	$ 1,310	$ 3,180	$ 11,200	$ 14,400
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	51,253	$ 1.34	SF	$ 68,700	$ 48,100	$ 117,000	$ 12,400	$ 129,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	400	$ 52.00	LF	$ 20,800	$ 14,600	$ 35,400	$ 6,240	$ 41,700
		MG01-11	Unnamed creek at RM 14.0 to unnamed creek at RM 13.7	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	1,150	$ 122	LF	$ 140,000	$ 98,200	$ 238,000	$ 42,100	$ 280,000
					CD-AVG	Current Deflector Average Cost	7	$ 2,060	EA	$ 14,400	$ 10,100	$ 24,500	$ 4,330	$ 28,800
					CD-SED	Current Deflector, Sediment Traps	1	$ 1,870	EA	$ 1,870	$ 1,310	$ 3,180	$ 11,200	$ 14,400

TABLE 12-8
Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Mainstem SFCDR Watershed
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	286,295	$ 1.34	SF	$ 384,000	$ 269,000	$ 653,000	$ 69,100	$ 722,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	1,150	$ 52.00	LF	$ 59,800	$ 41,900	$ 102,000	$ 17,900	$ 120,000
		MG01-12	Unnamed creek at RM 13.7 to unnamed creek at RM 13.1	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	1,100	$ 122	LF	$ 134,000	$ 93,900	$ 228,000	$ 40,300	$ 268,000
					CD-AVG	Current Deflector Average Cost	13	$ 2,060	EA	$ 26,800	$ 18,700	$ 45,500	$ 8,030	$ 53,500
					CD-SED	Current Deflector, Sediment Traps	2	$ 1,870	EA	$ 3,740	$ 2,620	$ 6,360	$ 22,400	$ 28,800
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	413,287	$ 1.34	SF	$ 554,000	$ 388,000	$ 942,000	$ 99,700	$ 1,040,000
					OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	54,392	$ 42.60	SY	$ 2,320,000	$ 1,620,000	$ 3,940,000	$ 417,000	$ 4,360,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	1,100	$ 52.00	LF	$ 57,200	$ 40,000	$ 97,200	$ 17,200	$ 114,000
		MG01-13	Unnamed creek at RM 13.1 to unnamed creek at RM 12.3	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	2,500	$ 122	LF	$ 305,000	$ 214,000	$ 519,000	$ 91,500	$ 611,000
					CD-AVG	Current Deflector Average Cost	21	$ 2,060	EA	$ 43,300	$ 30,300	$ 73,600	$ 13,000	$ 86,600
					CD-SED	Current Deflector, Sediment Traps	2	$ 1,870	EA	$ 3,740	$ 2,620	$ 6,360	$ 22,400	$ 28,800
					CH REAL-1	Channel Realignment	30,196	$ 42.20	SY	$ 1,270,000	$ 892,000	$ 2,160,000	$ 217,000	$ 2,380,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	255,132	$ 1.34	SF	$ 342,000	$ 239,000	$ 581,000	$ 61,500	$ 643,000
					OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	83,757	$ 42.60	SY	$ 3,570,000	$ 2,500,000	$ 6,070,000	$ 642,000	$ 6,710,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	2,500	$ 52.00	LF	$ 130,000	$ 91,000	$ 221,000	$ 39,000	$ 260,000
		MG01-14	Unnamed creek at RM 12.3 to unnamed creek at RM 12.0	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	758	$ 122	LF	$ 92,500	$ 64,700	$ 157,000	$ 27,700	$ 185,000
					CD-AVG	Current Deflector Average Cost	7	$ 2,060	EA	$ 14,400	$ 10,100	$ 24,500	$ 4,330	$ 28,800
					CD-SED	Current Deflector, Sediment Traps	1	$ 1,870	EA	$ 1,870	$ 1,310	$ 3,180	$ 11,200	$ 14,400
					CH REAL-1	Channel Realignment	10,103	$ 42.20	SY	$ 426,000	$ 298,000	$ 724,000	$ 72,500	$ 797,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	151,538.80	$ 1.34	SF	$ 203,000	$ 142,000	$ 345,000	$ 36,600	$ 382,000
					OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	4,207	$ 42.60	SY	$ 179,000	$ 125,000	$ 304,000	$ 32,300	$ 336,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	758	$ 52.00	LF	$ 39,400	$ 27,600	$ 67,000	$ 11,800	$ 78,800
		MG01-15	Unnamed creek at RM 12.0 to Big Creek	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	386	$ 122	LF	$ 47,100	$ 33,000	$ 80,100	$ 14,100	$ 94,200
					CD-AVG	Current Deflector Average Cost	17	$ 2,060	EA	$ 35,000	$ 24,500	$ 59,500	$ 10,500	$ 70,000
					CD-SED	Current Deflector, Sediment Traps	2	$ 1,870	EA	$ 3,740	$ 2,620	$ 6,360	$ 22,400	$ 28,800
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	38,636.58	$ 1.34	SF	$ 51,800	$ 36,200	$ 88,000	$ 9,320	$ 97,300
					OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	62,129	$ 42.60	SY	$ 2,650,000	$ 1,850,000	$ 4,500,000	$ 476,000	$ 4,980,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	386	$ 52.00	LF	$ 20,100	$ 14,100	$ 34,200	$ 6,020	$ 40,200
		MG01-16	Big Creek to Moon Creek	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	107	$ 122	LF	$ 13,100	$ 9,140	$ 22,200	$ 3,920	$ 26,200
					CD-AVG	Current Deflector Average Cost	10	$ 2,060	EA	$ 20,600	$ 14,400	$ 35,000	$ 6,180	$ 41,200
					CD-SED	Current Deflector, Sediment Traps	1	$ 1,870	EA	$ 1,870	$ 1,310	$ 3,180	$ 11,200	$ 14,400
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	14,503	$ 1.34	SF	$ 19,400	$ 13,600	$ 33,000	$ 3,500	$ 36,500
					OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	10,428	$ 42.60	SY	$ 444,000	$ 311,000	$ 755,000	$ 80,000	$ 835,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	107	$ 52.00	LF	$ 5,560	$ 3,890	$ 9,450	$ 1,670	$ 11,100
		MG01-17	Moon Creek to unnamed creek at RM 9.8	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	2,740	$ 122	LF	$ 334,000	$ 234,000	$ 568,000	$ 100,000	$ 668,000
					CD-AVG	Current Deflector Average Cost	24	$ 2,060	EA	$ 49,400	$ 34,600	$ 84,000	$ 14,800	$ 98,800
					CD-SED	Current Deflector, Sediment Traps	3	$ 1,870	EA	$ 5,610	$ 3,930	$ 9,540	$ 33,700	$ 43,200
					CH REAL-1	Channel Realignment	36,531	$ 42.20	SY	$ 1,540,000	$ 1,080,000	$ 2,620,000	$ 262,000	$ 2,880,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	390,045	$ 1.34	SF	$ 523,000	$ 366,000	$ 889,000	$ 94,100	$ 983,000
					OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	15,481	$ 42.60	SY	$ 659,000	$ 462,000	$ 1,120,000	$ 119,000	$ 1,240,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	2,740	$ 52.00	LF	$ 142,000	$ 99,700	$ 242,000	$ 42,700	$ 284,000
		MG01-18	Unnamed creek at RM 9.8 to Montgomery Creek	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	1,365	$ 122	LF	$ 167,000	$ 117,000	$ 284,000	$ 50,000	$ 334,000
					CD-AVG	Current Deflector Average Cost	12	$ 2,060	EA	$ 24,700	$ 17,300	$ 42,000	$ 7,420	$ 49,400
					CD-SED	Current Deflector, Sediment Traps	2	$ 1,870	EA	$ 3,740	$ 2,620	$ 6,360	$ 22,400	$ 28,800
					CH REAL-1	Channel Realignment	18,206	$ 42.20	SY	$ 768,000	$ 538,000	$ 1,310,000	$ 131,000	$ 1,440,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	400,562	$ 1.34	SF	$ 537,000	$ 376,000	$ 913,000	$ 96,600	$ 1,010,000
					OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	5,418	$ 42.60	SY	$ 231,000	$ 162,000	$ 393,000	$ 41,500	$ 435,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	1,365	$ 52.00	LF	$ 71,000	$ 49,700	$ 121,000	$ 21,300	$ 142,000
		MG01-4	Daly Gulch to Lake Creek	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	2,500	$ 122	LF	$ 305,000	$ 214,000	$ 519,000	$ 91,500	$ 611,000
					CD-AVG	Current Deflector Average Cost	26	$ 2,060	EA	$ 53,600	$ 37,500	$ 91,100	$ 16,100	$ 107,000
					CD-SED	Current Deflector, Sediment Traps	3	$ 1,870	EA	$ 5,610	$ 3,930	$ 9,540	$ 33,700	$ 43,200
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	1,167,443	$ 1.34	SF	$ 1,560,000	$ 1,100,000	$ 2,660,000	$ 282,000	$ 2,940,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	2,500	$ 52.00	LF	$ 130,000	$ 91,000	$ 221,000	$ 39,000	$ 260,000
		MG01-5	Lake Creek to Revenue Gulch	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	800	$ 122	LF	$ 97,600	$ 68,300	$ 166,000	$ 29,300	$ 195,000
					CD-AVG	Current Deflector Average Cost	6	$ 2,060	EA	$ 12,400	$ 8,650	$ 21,100	$ 3,710	$ 24,800
					CD-SED	Current Deflector, Sediment Traps	1	$ 1,870	EA	$ 1,870	$ 1,310	$ 3,180	$ 11,200	$ 14,400
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	26,149	$ 1.34	SF	$ 35,000	$ 24,500	$ 59,500	$ 6,310	$ 65,800
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	800	$ 52.00	LF	$ 41,600	$ 29,100	$ 70,700	$ 12,500	$ 83,200
		MG01-6	Revenue Gulch to Dry Gulch	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	3,150	$ 122	LF	$ 384,000	$ 269,000	$ 653,000	$ 115,000	$ 768,000
					CD-AVG	Current Deflector Average Cost	34	$ 2,060	EA	$ 70,000	$ 49,000	$ 119,000	$ 21,000	$ 140,000
					CD-SED	Current Deflector, Sediment Traps	4	$ 1,870	EA	$ 7,480	$ 5,240	$ 12,700	$ 44,900	$ 57,600
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	386,859	$ 1.34	SF	$ 518,000	$ 363,000	$ 881,000	$ 93,300	$ 974,000
					OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	22,440	$ 42.60	SY	$ 956,000	$ 669,000	$ 1,630,000	$ 172,000	$ 1,800,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	3,150	$ 52.00	LF	$ 164,000	$ 115,000	$ 279,000	$ 49,100	$ 328,000
		MG01-7	Dry Gulch to west end Osburn tailings pond	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	3,550	$ 122	LF	$ 433,000	$ 303,000	$ 736,000	$ 130,000	$ 866,000
					CD-AVG	Current Deflector Average Cost	9	$ 2,060	EA	$ 18,500	$ 13,000	$ 31,500	$ 5,560	$ 37,100
					CD-SED	Current Deflector, Sediment Traps	1	$ 1,870	EA	$ 1,870	$ 1,310	$ 3,180	$ 11,200	$ 14,400
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	330,430	$ 1.34	SF	$ 443,000	$ 310,000	$ 753,000	$ 79,700	$ 833,000
					OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	23,434	$ 42.60	SY	$ 998,000	$ 699,000	$ 1,700,000	$ 180,000	$ 1,880,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	3,550	$ 52.00	LF	$ 185,000	$ 129,000	$ 314,000	$ 55,400	$ 369,000
		MG01-8	West end tailings ponds to Twomile Creek	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	2,347	$ 122	LF	$ 286,000	$ 200,000	$ 486,000	$ 85,900	$ 572,000

TABLE 12-8

Selected Remedy: Summary of OU 3 Remedial Actions and Estimated Costs, Mainstem SFCDR Watershed

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Segment ID	Source Type Description	Source ID	Source Name	Trait Description (Waste Types)	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Cost UOM	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
					CD-AVG	Current Deflector Average Cost	21	$ 2,060	EA	$ 43,300	$ 30,300	$ 73,600	$ 13,000	$ 86,600
					CD-SED	Current Deflector, Sediment Traps	2	$ 1,870	EA	$ 3,740	$ 2,620	$ 6,360	$ 22,400	$ 28,800
					CH REAL-1	Channel Realignment	31,294	$ 42.20	SY	$ 1,320,000	$ 924,000	$ 2,240,000	$ 225,000	$ 2,470,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	13,391	$ 1.34	SF	$ 17,900	$ 12,600	$ 30,500	$ 3,230	$ 33,700
					OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	85,377	$ 42.60	SY	$ 3,640,000	$ 2,550,000	$ 6,190,000	$ 655,000	$ 6,845,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	2,347	$ 52.00	LF	$ 122,000	$ 85,400	$ 207,000	$ 36,600	$ 244,000
		MG01-9	Twomile Creek to W.F. Rosebud Creek	BioReach General Characteristics	BSBR-AVG	Bank Stabilization via Revetments - Average Cost	557	$ 122	LF	$ 68,000	$ 47,600	$ 116,000	$ 20,400	$ 136,000
					CD-AVG	Current Deflector Average Cost	5	$ 2,060	EA	$ 10,300	$ 7,210	$ 17,500	$ 3,090	$ 20,600
					CD-SED	Current Deflector, Sediment Traps	1	$ 1,870	EA	$ 1,870	$ 1,310	$ 3,180	$ 11,200	$ 14,400
					CH REAL-1	Channel Realignment	7,430	$ 42.20	SY	$ 314,000	$ 219,000	$ 533,000	$ 53,300	$ 586,000
					FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	227,919	$ 1.34	SF	$ 305,000	$ 214,000	$ 519,000	$ 55,000	$ 574,000
					VBS-AVG	Vegetative Bank Stabilization - Average Cost	557	$ 52.00	LF	$ 29,000	$ 20,300	$ 49,300	$ 8,690	$ 58,000
Total for Mainstem SFCDR Watershed										**$ 109,000,000**	**$ 77,600,000**	**$ 187,000,000**	**$ 15,500,000**	**$ 202,000,000**

Notes:

EA = each
GPM = gallons per minute
LF = lineal foot
LS = lump sum
CY = cubic yards
CY-MI = cubic yards per mile
TCD = typical conceptual design

O&M = operation and maintenance
NPV = net present value
AC = acres
SY = square yards
SF = square feet
UOM = units of measure

It is important to note that TCDs are only conceptual designs, and the constructed remedies at specific source sites may differ from the TCDs based on future site- and waste-specific characterization assessments and other pre-design activities.

Stream and riparian stabilization actions are specified by stream reach. See Figure 12-22 for the location of each stream reach.

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

TABLE 12-9

Selected Remedy: Summary of OU 2 (Bunker Hill Box) Remedial Actions and Estimated Costs

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Action	TCD	TCD Description	Direct Cost Quantity	Direct Capital Unit Cost	Unit	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
CIA Groundwater Drain	C15c	French Drain	1,150	$ 949	LF	$ 1,090,000	$ 764,000	$ 1,850,000	$ 21,800	$ 1,880,000
	C15d	French Drain	4,225	$ 1,210	LF	$ 5,110,000	$ 3,580,000	$ 8,690,000	$ 102,000	$ 8,790,000
	Pressure-Pipe-3	Pressurized Pipeline	7,000	$ 180.00	LF	$ 1,260,000	$ 882,000	$ 2,140,000	$ 252,000	$ 2,390,000
	PUMP-4	Pump Station	1	$ 1,188,000	EA	$ 1,190,000	$ 832,000	$ 2,020,000	$ 1,190,000	$ 3,210,000
	WT01	Centralized HDS Treatment at CTP	4,399		GPM	$ 2,960,000	$ 3,160,000	$ 6,120,000	$ 3,980,000	$ 10,100,000
CIA Groundwater Drain Total						**$ 11,600,000**	**$ 9,220,000**	**$ 20,800,000**	**$ 5,550,000**	**$ 26,400,000**
CTP Direct Discharge Pipeline	Pressure-Pipe-3	Pressurized Pipeline	2,500	$ 180.00	LF	$ 450,000	$ 315,000	$ 765,000	$ 90,000	$ 855,000
CTP Direct Discharge Pipeline Total						**$ 450,000**	**$ 315,000**	**$ 765,000**	**$ 90,000**	**$ 855,000**
Government Gulch	C11d	Hydraulic Isolation Using Slurry Wall	275	$ 522	LF	$ 144,000	$ 100,000	$ 244,000	$ -	$ 244,000
	C14b	Stream Lining	11,000	$ 505	LF	$ 5,560,000	$ 3,890,000	$ 9,450,000	$ 222,000	$ 9,670,000
	Pressure-Pipe-1	Pressurized Pipeline	1,500	$ 44.10	LF	$ 66,200	$ 46,300	$ 113,000	$ 13,200	$ 126,000
Government Gulch Total						**$ 5,770,000**	**$ 4,040,000**	**$ 9,810,000**	**$ 235,000**	**$ 10,000,000**
Lower Government Gulch	C17c	Extraction Well	5	y	EA	$ 365,000	$ 255,000	$ 620,000	$ 365,000	$ 985,000
Lower Government Gulch Total						**$ 365,000**	**$ 255,000**	**$ 620,000**	**$ 365,000**	**$ 985,000**
Reed/Russell Water Collection and Treatment	C10	Adit Drainage Collection	2	$ 9,680	LS	$ 19,400	$ 13,600	$ 33,000	$ 3,480	$ 36,500
	C20	Check Dam	2	$ 47,900	LS	$ 95,800	$ 67,100	$ 163,000	$ -	$ 163,000
	Pressure-Pipe-1	Pressurized Pipeline	2,000	$ 44.10	LF	$ 88,200	$ 61,700	$ 150,000	$ 17,600	$ 168,000
	Pressure-Pipe-4	Pressurized Pipeline	1,000	$ 155	LF	$ 155,000	$ 109,000	$ 264,000	$ 31,000	$ 295,000
	PUMP-1	Pump Station	1	$ 29,300	EA	$ 29,300	$ 20,500	$ 49,800	$ 29,300	$ 79,100
Reed/Russell Water Collection and Treatment Total						**$ 388,000**	**$ 272,000**	**$ 660,000**	**$ 81,400**	**$ 742,000**
Upper Government Gulch	C17b	Extraction Well	2	$ 68,600	EA	$ 137,000	$ 96,000	$ 233,000	$ 137,000	$ 370,000
Upper Government Gulch Total						**$ 137,000**	**$ 96,000**	**$ 233,000**	**$ 137,000**	**$ 370,000**
Total for OU 2 Portion of Selected Remedy						**$ 18,700,000**	**$ 14,200,000**	**$ 32,900,000**	**$ 6,460,000**	**$ 39,400,000**

Notes:

EA = each
GPM = gallons per minute
LF = lineal foot
LS = lump sum

O&M = operation and maintenance
NPV = net present value
OU 2 = Operable Unit 2
TCD = typical conceptual design

It is important to note that TCDs are only conceptual designs, and the constructed remedies at specific source sites may differ from the TCDs based on future site- and waste-specific characterization assessments and other pre-design activities.

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

TABLE 12-10

Selected Remedy: Estimated Average and Maximum Flow and Dissolved Zinc Loads for Water Treatment

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Source ID	Source Name	Trait Description	Average Flow (gpm)	Maximum Flow (gpm)	Average Zinc Concentration (µg/L)	Average Dissolved Zinc Load (lb/day)	Maximum Dissolved Zinc Load (lb/day)
Active Centralized HDS Treatment at CTP (WT01)								
Canyon Creek	BUR067	TAMARACK NO.7 (1200 LEVEL)	Adit drainage	709	1,414	1,437	12	24
Canyon Creek	BUR096	ANCHOR MINE	Adit drainage	3.6	7.3	22	9.67E-04	0.0019
Canyon Creek	BUR097	HIDDEN TREASURE MINE	Adit drainage	646	1,293	392	3.0	6.1
Canyon Creek	BUR098	HERCULES NO. 5	Adit drainage	880	1,346	1,693	18	27
Canyon Creek	BUR107	AJAX NO.3	Adit drainage	45	90	0	0	0
Canyon Creek	BUR112	GEM NO.2	Adit drainage	45	90	0	0	0
Canyon Creek	BUR121	BLACK BEAR FRACTION	Adit drainage	507	1,014	91	0.55	1.1
Canyon Creek	BUR129	TIGER-POORMAN MINE	Adit drainage	45	90	0	0	0
Canyon Creek	BUR190	GEM NO.3	Adit drainage	162	449	15,000	29	81
Canyon Creek - Woodland Park	WAL011	CANYON SILVER (FORMOSA) MINE	Adit drainage	45	90	208	0.11	0.22
Canyon Creek - Woodland Park	WP-OPTIONC	WOODLAND PARK GROUNDWATER DRAIN	Groundwater	539	673	18,101	117	182
Mainstem SFCDR	KLE040	SF CDA RIVER IMPACTED FLOODPLAIN: NO. 5	Groundwater	4.5	9.0	0	0	0
Mainstem SFCDR	OSB065	SF CDA RIVER IMPACTED FLOODPLAIN: NO. 3	Groundwater			1,814	87	134
Mainstem SFCDR	WAL002	WESTERN UNION LOWER ADIT	Adit drainage	0.36	0.90	0	0	0
Ninemile Creek	OSB039	DAYROCK MINE	Adit drainage	3.1	6.1	76	0.0028	0.0055
Ninemile Creek	OSB088	ALAMEDA MINE	Adit drainage	3,994 2.9	4,498 5.8	0	0	0
Ninemile Creek	OSB089	SUCCESS NO.3	Adit drainage	8.5	16	62,100	6.3	12
Upper SFCDR	LOK011	SNOWSTORM NO. 3	Adit drainage	2,576	5,386	12	0.37	0.77
Upper SFCDR	MUL012	STAR 1200 LEVEL	Adit drainage	193	312	7,010	16	26
Mainstem SFCDR (OU 2)	-	OU 2 GROUNDWATER COLLECTION[a]	Groundwater			24,452	1,146	1,350
			WT01 TOTALS	**14,309**	**21,189**	**8,360**	**1,436**	**1,844**
Semi-Passive Treatment using Lime Precipitation (WT02)								
Ninemile Creek	BUR051	SUNSET MINE	Adit drainage	3,900 45	4,400 90	28,400	15	31
Ninemile Creek	BUR058	TAMARACK NO.3	Adit drainage	45	90	0	0	0
Ninemile Creek	BUR170	TAMARACK 400 LEVEL	Adit drainage	37	75	111	0.050	0.099
Ninemile Creek	BUR171	TAMARACK NO.5	Adit drainage	14	27	195	0.034	0.064
Pine Creek	MAS012	LYNCH-PINE CREEK MINE	Adit drainage	45	90	15,900	8.6	17
Pine Creek	MAS014	HILARITY MINE	Adit drainage	45	90	6,230	3.4	6.7
Pine Creek	MAS014	HILARITY MINE	Seep	45	90	7,500	4.0	8.1
Pine Creek	MAS021	NEVADA-STEWART MINE	Adit drainage	33	50	9,833	3.9	5.9
Upper SFCDR	LOK004	SNOWSHOE NO. 2	Adit drainage	50	101	3.0	0.0018	0.0036
Upper SFCDR	LOK024	SILVER CABLE MINE	Adit drainage	45	90	1,100	0.59	1.2
Upper SFCDR	MUL052	COPPER KING MINE	Adit drainage	38	50	40	0.018	0.024
			WT02 TOTALS	**442**	**841**	**6,750**	**36**	**70**

TABLE 12-10

Selected Remedy: Estimated Average and Maximum Flow and Dissolved Zinc Loads for Water Treatment

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Source ID	Source Name	Trait Description	Average Flow (gpm)	Maximum Flow (gpm)	Average Zinc Concentration (µg/L)	Average Dissolved Zinc Load (lb/day)	Maximum Dissolved Zinc Load (lb/day)
Semi-Passive Treatment using SRBs (WT03)								
Pine Creek	MAS007	NABOB 1300 LEVEL	Adit drainage	23	33	7,665	2.1	3.1
Pine Creek	MAS011	IDAHO PROSPECT: NO. 2	Adit drainage	0.29	0.58	10,500	0.036	0.073
Pine Creek	MAS015	LITTLE PITTSBURG MINE: NO. 2	Adit drainage	0.78	3.0	8,150	0.076	0.29
Pine Creek	MAS016	LITTLE PITTSBURG MINE: NO. 1	Adit drainage	0.19	0.38	61,400	0.14	0.28
Pine Creek	MAS020	SIDNEY (RED CLOUD) MINE/MILLSITE	Adit drainage	8.1	40	43,700	4.2	21
Pine Creek	MAS054	MARMION OR SF FRACTION	Adit drainage	4.0	8.0	111	0.0053	0.011
Pine Creek	MAS078	HIGHLAND-SURPRISE MINE & MILLSITE	Adit drainage	17	34	2,853	0.58	1.2
Upper South Fork	MUL027	MORNING NO.4	Adit drainage	6.8	14	950	0.078	0.16
Upper South Fork	MUL028	MORNING NO.5	Adit drainage	25	39	1,616	0.48	0.77
			WT03 TOTALS	**85**	**172**	**7,610**	**7.7**	**27**

Notes:

µg/L = micrograms per liter

gpm = gallons per minute

lb/day = pounds per day

SFCDR = South Fork Coeur d'Alene River

[a]Includes flow from both the CIA groundwater drain and the extraction wells at the base of Government Gulch.

The average and peak flows for OU 2 and Woodland Park are based on the groundwater flow model results.

The Bunker Hill mine flows are based on the measured average flow and the design capacity of the Central Treatment Plant.

Adit flows with no record of measured flows were assigned an average flow of 45 gpm and and a peak flow of 90 gpm.

Limited data are available for many of the water sources included for treatment. In some cases, the "average" or "maximum" flow estimates provided in this table are based on only 1 or 2 data points. During the design phase, additional data will be collected on all water sources slated for treatment so that seasonal fluctuations and average flow rates can be more accurately assessed.

TABLE 12-11

Selected Remedy: Summary of Estimated Costs by Operable Unit and Watershed

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Total Direct Cost	Total Indirect Cost	Total Capital Cost	O&M Cost (30-Year NPV)	O&M Cost (Annual Average)	Total Cost (30-Year NPV)
OU 3						
Upper SFCDR	$ 40,700,000	$ 29,900,000	$ 70,600,000	$ 10,800,000	$ 870,000	$ 81,400,000
Canyon Creek	$ 35,400,000	$ 26,200,000	$ 61,600,000	$ 7,700,000	$ 621,000	$ 69,300,000
Canyon Creek - Woodland Park	$ 21,000,000	$ 14,900,000	$ 35,900,000	$ 2,720,000	$ 219,000	$ 38,600,000
Ninemile Creek	$ 36,500,000	$ 25,500,000	$ 62,000,000	$ 10,700,000	$ 862,000	$ 72,800,000
Big Creek	$ 7,580,000	$ 5,310,000	$ 12,900,000	$ 1,060,000	$ 85,400	$ 14,000,000
Moon Creek	$ 1,790,000	$ 1,250,000	$ 3,040,000	$ 540,000	$ 43,500	$ 3,580,000
Pine Creek	$ 11,700,000	$ 8,200,000	$ 19,900,000	$ 9,700,000	$ 782,000	$ 29,600,000
Mainstem SFCDR	$ 109,000,000	$ 77,600,000	$ 187,000,000	$ 15,500,000	$ 1,250,000	$ 202,000,000
OU 3 Subtotal	*$ 264,000,000*	*$ 189,000,000*	*$ 453,000,000*	*$ 58,700,000*	*$ 4,730,000*	*$ 511,000,000*
OU 2						
Bunker Hill Box	$ 18,700,000	$ 14,200,000	$ 32,900,000	$ 6,460,000	$ 521,000	$ 39,400,000
OU 2 Subtotal	*$ 18,700,000*	*$ 14,200,000*	*$ 32,900,000*	*$ 6,460,000*	*$ 521,000*	*$ 39,400,000*
Combined Cost, OU 2 and OU 3						
OU 3 Subtotal	*$ 264,000,000*	*$ 189,000,000*	*$ 453,000,000*	*$ 58,700,000*	*$ 4,730,000*	*$ 511,000,000*
OU 2 Subtotal	*$ 18,700,000*	*$ 14,200,000*	*$ 32,900,000*	*$ 6,460,000*	*$ 521,000*	*$ 39,400,000*
Sludge Disposal Cell [a]			*$ 7,330,000*	*$ 397,000*	*$ 32,000*	*$ 7,730,000*
Roads and Bridges [b]						*$ 42,400,000*
Remedy Protection Actions			*$ 24,600,000*	*$ 9,160,000*	*$ 738,000*	*$ 33,800,000*
TOTAL SELECTED REMEDY COST			$ 518,000,000	$ 74,700,000	$ 6,020,000	**$ 635,000,000**

Notes:

[a]Capital costs for sludge disposal cell include construction of new cell and closure of existing cell in year 3.

[b]Roads and bridges costs are estimated at 15 percent of the Total Direct Capital Cost for OU 3 and OU 2 remedial actions

O&M = operation and maintenance
NPV = net present value
OU 2 = Operable Unit 2
OU 3 = Operable Unit 3

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

The NPV Sludge Disposal Cell closure costs includes closure of the existing sludge disposal cell.
The NPV Sludge Disposal Cell closure costs are based on the time for the existing sludge disposal cell to reach capacity.
The O&M Cost (Annual Average) is calculated by dividing the O&M Cost (30-Year NPV) by a factor of 12.409 to account for the 30 years at 7 percent.

TABLE 12-12

Selected Remedy: Summary of Estimated Costs by TCD

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

TCD	TCD Description	Quantity	Direct Capital Unit Cost	Unit	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
BSBR-AVG	Bank Stabilization via Revetments - Average Cost	63,700	$122	LF	$7,770,000	$5,440,000	$13,200,000	$2,330,000	$15,500,000
C01	Excavation	3,180,000	$4.28	CY	$9,080,000	$6,350,000	$15,400,000	$0	$15,400,000
C01b	Excavation (60% dry/40% wet)	4,390,000	$13.50	CY	$25,500,000	$17,800,000	$43,300,000	$0	$43,300,000
C02a	Regrade/Consolidate/Revegetate	13	$84,300	AC	$1,140,000	$796,000	$1,930,000	$148,000	$2,080,000
C02b	Regrade/Consolidate/Revegetate	-	$167,000	AC	$165,000	$116,000	$281,000	$21,500	$303,000
C03	Low-Permeability Cap	102	$225,000	AC	$21,200,000	$14,800,000	$36,100,000	$2,540,000	$38,600,000
C04	Low-Permeability Cap w/Seepage Collection	6	$254,000	AC	$1,730,000	$1,210,000	$2,950,000	$400,000	$3,350,000
C07	Waste Consolidation Area Above Flood Level	1,990,000	$14.70	CY	$26,400,000	$18,500,000	$44,800,000	$5,800,000	$50,600,000
C08a	Repository	4,200,000	$17.70	CY	$30,300,000	$21,200,000	$51,600,000	$4,250,000	$55,800,000
C09	Impoundment Closure	13	$246,000	AC	$3,310,000	$2,320,000	$5,630,000	$661,000	$6,290,000
C10	Adit Drainage Collection	37	$9,680	LS	$358,000	$251,000	$609,000	$64,400	$673,000
C11d	Hydraulic Isolation Using Slurry Wall	275	$522	LF	$144,000	$100,000	$244,000	$0	$244,000
C11j	Hydraulic Isolation Using Slurry Wall	3,500	$1,590	LF	$11,100,000	$7,790,000	$18,900,000	$223,000	$19,100,000
C14b	Stream Lining	13,700	$505	LF	$6,920,000	$4,840,000	$11,800,000	$277,000	$12,000,000
C15b	French Drain	7,800	$907	LF	$7,070,000	$4,950,000	$12,000,000	$141,000	$12,200,000
C15c	French Drain	5,750	$949	LF	$5,460,000	$3,820,000	$9,280,000	$109,000	$9,390,000
C15d	French Drain	4,230	$1,210	LF	$5,110,000	$3,580,000	$8,690,000	$102,000	$8,790,000
C17b	Extraction Well	2	$68,600	EA	$137,000	$96,000	$233,000	$137,000	$370,000
C17c	Extraction Well	5	$72,900	EA	$365,000	$255,000	$620,000	$365,000	$985,000
C20	Check Dam	2	$47,900	LS	$95,800	$67,100	$163,000	$0	$163,000
CD-AVG	Current Deflector Average Cost	996	$2,060	EA	$2,050,000	$1,440,000	$3,490,000	$615,000	$4,100,000
CD-SED	Current Deflector, Sediment Traps	115	$1,870	EA	$214,000	$150,000	$364,000	$1,280,000	$1,650,000
CH REAL-1	Channel Realignment	335,000	$42.20	SY	$14,100,000	$9,890,000	$24,000,000	$2,400,000	$26,400,000
FP/RP-AVG	Floodplain and Riparian Replanting - Average Cost	9,730,000	$1.34	SF	$13,000,000	$9,130,000	$22,200,000	$2,350,000	$24,500,000
HAUL-2	Haul to Repository	22,100,000	$1.10	CY-MI	$10,700,000	$7,470,000	$18,100,000	$0	$18,100,000
HH-2	Upland Waste Pile Soil Cover	15	$58,443	AC	$876,000	$614,000	$1,490,000	$114,000	$1,600,000
HH-3	Millsite Decontamination	3	$135,800	EA	$408,000	$285,000	$693,000	$20,400	$714,000
OFFCH-AVG	Off-Channel Hydrologic Feature Average Cost	389,000	$42.60	SY	$16,600,000	$11,600,000	$28,200,000	$2,980,000	$31,200,000
Pipe-1	Gravity Pipeline	275	$58.70	LF	$16,100	$11,300	$27,400	$1,290	$28,700
PIPE-1	Gravity Pipeline-6"	55,700	$58.70	LF	$3,270,000	$2,290,000	$5,560,000	$262,000	$5,820,000
PIPE-2	Gravity Pipeline-12"	1,960	$86.20	LF	$169,000	$118,000	$288,000	$13,500	$301,000
PIPE-3	Gravity Pipeline-24"	62,600	$139	LF	$8,700,000	$6,090,000	$14,800,000	$695,000	$15,500,000
PIPE-4	Gravity Pipeline-36"	114,000	$180.00	LF	$20,500,000	$14,400,000	$34,900,000	$1,640,000	$36,500,000
PRESSURE-PIPE-1	Pressurized Pipeline	3,500	$44.10	LF	$154,000	$108,000	$262,000	$30,800	$293,000
PRESSURE-PIPE-3	Pressurized Pipeline	9,500	$180.00	LF	$1,710,000	$1,200,000	$2,910,000	$342,000	$3,250,000
PRESSURE-PIPE-4	Pressurized Pipeline	1,000	$155	LF	$155,000	$109,000	$264,000	$31,000	$295,000
PUMP-1	Pump Station	1	$29,300	EA	$29,300	$20,500	$49,800	$29,300	$79,100
PUMP-4	Pump Station	1	$1,188,000	EA	$1,190,000	$832,000	$2,020,000	$1,190,000	$3,210,000
VBS-AVG	Vegetative Bank Stabilization - Average Cost	72,500	$52.00	LF	$3,770,000	$2,640,000	$6,410,000	$1,130,000	$7,540,000
WT01	Centralized HDS Treatment at CTP[1]	21,200	--	GPM	$14,200,000	$15,200,000	$29,500,000	$14,600,000	$44,100,000
WT02	Onsite Semi-Passive Treatment Using Lime Addition[2]	841	--	GPM	$5,040,000	$3,530,000	$8,570,000	$12,900,000	$21,400,000
WT03	Onsite Semi-Passive Treatment Using SRB[3]	172	--	GPM	$2,310,000	$1,620,000	$3,920,000	$4,990,000	$8,910,000
	TOTAL FOR REMEDIAL ACTIONS IN SELECTED REMEDY				**$ 283,000,000**	**$ 203,000,000**	**$ 65,200,000**	**$ 486,000,000**	**$ 551,000,000**

TABLE 12-12

Selected Remedy: Summary of Estimated Costs by TCD

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

TCD	TCD Description	Quantity	Direct Capital Unit Cost	Unit	2009 Total Direct Capital Cost	2009 Indirect Capital Cost	2009 Total Direct and Indirect Capital Cost	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)

Notes:

AC = acres

CY = cubic yards

CY-MI = cubic yards per mile

EA = each
GPM = gallons per minute
LF = lineal foot
LS = lump sum
NPV = net present value
O&M = operation and maintenance
OU 2 = Operable Unit 2
OU 3 = Operable Unit 3
SF = square feet
SY = square yards
TCD = typical conceptual design
UOM = units of measure

[1]Direct capital unit costs for WT01 are a function of gpm and are equal to = 672*(gpm)

[2]Direct capital unit costs for WT02 are a function of gpm and are equal to = 778.64*(gpm)+179913

[3]Direct capital unit costs for WT03 are a function of gpm and are equal to = 6482.4*(gpm)+132414

It is important to note that TCDs are only conceptual designs, and the constructed remedies at specific source sites may differ from the TCDs based on future site- and waste-specific characterization assessments and other pre-design activities.

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

The O&M Cost (Annual Average) is calculated by dividing the O&M Cost (30-Year NPV) by a factor of 12.409 to account for the 30 years at 7 percent.

TABLE 12-13

Selected Remedy: Summary of Estimated Total Costs

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Action	Total Capital Cost	O&M Cost (30-Year NPV)	O&M Cost (Annual Average)	Total Cost (30-Year NPV)
OU 3 Remedial Actions	$ 453,000,000	$ 58,700,000	$ 4,730,000	$ 511,000,000
OU 2 Remedial Actions	$ 32,900,000	$ 6,460,000	$ 521,000	$ 39,400,000
Sludge Disposal Cell[a]	$ 7,330,000	$ 397,000	$ 32,000	$ 7,730,000
Remedy Protection Actions	$ 24,600,000	$ 9,160,000	$ 738,000	$ 33,800,000
Subtotal [b]	$ 518,000,000	$ 74,700,000	$ 6,020,000	$ 593,000,000
Roads and Bridges [c]				*$ 42,400,000*
TOTAL SELECTED REMEDY COST				**$ 635,000,000**

Notes:

[a]Capital costs for sludge disposal cell include construction of new cell and closure of existing cell in year 3.

[b]Total NPV Costs for this row were totalled by adding total capital cost and 30-yr NPV of O&M (horizontally). If summed vertically (by adding total 30-yr NPV of OU3 and OU2), the sum is different by $1 million due to issues with the significant figures of the values used in the summation. The difference is insignificant and can be attributed to "rounding error".

[c]Roads and bridges costs are estimated at 15 percent of the Total Direct Capital Cost for OU 3 and OU 2 remedial actions.

O&M = operation and maintenance
NPV = net present value
OU 2 = Operable Unit 2
OU 3 = Operable Unit 3

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

The NPV Sludge Disposal Cell closure costs includes closure of the existing sludge disposal cell.
The NPV Sludge Disposal Cell closure costs are based on the time for the existing sludge disposal cell to reach capacity.
The O&M Cost (Annual Average) is calculated by dividing the O&M Cost (30-Year NPV) by a factor of 12.409 to account for the 30 years at 7 percent.

TABLE 12-14

Selected Remedy: Summary of Remedy Protection Actions and Estimated Costs

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Community	Drainage	Brief Description of Project	Drainage Capital Cost	Total Capital Cost	O&M Cost (Annual Average)	O&M Cost (30-Year NPV)	Total Cost (30-Year NPV)
Pinehurst				$ 2,300,000	$ 68,000	$ 844,000	$ 3,140,000
	Little Pine Creek	Channel hydraulic capacity improvements and culvert replacement	$ 2,300,000				
Smelterville				$ 1,700,000	$ 50,000	$ 620,000	$ 2,320,000
	Grouse Creek	Channel hydraulic capacity improvements (including concrete walls)	$ 1,700,000				
Kellogg				$ 277,000	$ 12,000	$ 149,000	$ 429,000
	Jackass Creek	Channel hydraulic capacity improvements and stabilization with riprap	$ 28,900				
	Italian Gulch[1]	Visual observation and documentation	$ -				
	Portland Road	Asphalt-lined ditches and pipe culvert installation	$ 248,000				
	Localized Drainages[1]	Visual observation and documentation	$ -				
Wardner				$ 110,000	$ 8,000	$ 99,000	$ 209,000
	Milo Creek	High-capacity stormwater inlets and associated below-grade piping	$ 110,000				
Osburn				$ 2,110,000	$ 60,000	$ 745,000	$ 2,860,000
	Shields Gulch	Channel hydraulic capacity improvements, culvert replacement, and new channel alignment	$ 449,000				
	Rosebud Gulch	Channel hydraulic capacity improvements and culvert replacement	$ 409,000				
	Meyer Creek	Below-grade bypass drainage network	$ 1,250,000				
	McFarren[1]	Visual observation and documentation	$ -				
Silverton				$ 4,030,000	$ 108,000	$ 1,340,000	$ 5,370,000
	Revenue Gulch	High-flow bypass drainage network and stormwater drainage network.	$ 3,940,000				
	Unnamed Creek	Channel hydraulic capacity improvements and culvert replacement	$ 93,000				
Wallace				$ 100,000	$ 8,000	$ 99,000	$ 199,000
	Printer's Creek	New inlet structure and drainage system maintenance improvements	$ 100,000				
	Placer Creek[1]	Visual observation and documentation	$ -				
Mullan				$ 3,110,000	$ 87,000	$ 1,080,000	$ 4,190,000
	Mill Creek	Rolling dip, channel hydraulic capacity improvements, concrete-lined channel, and culvert replacement	$ 1,300,000				
	Tiger Creek	Diversion structure, channel stabilization, culvert replacement, and asphalt-lined ditch	$ 129,000				
	Neighborhood Surface Flow Issues[2]	Asphalt-lined ditches, pipe culvert installation, and stormwater catch basins	$ 1,680,000				
Side Gulches	Various	Approximate costs based on assumptions developed from the remedy protection actions identified in the eight Upper Basin communities.[3]	NA	$ 10,900,000	$ 337,000	$ 4,180,000	$ 15,100,000
TOTAL				**$ 24,600,000**	**$ 738,000**	**$ 9,160,000**	**$ 33,800,000**

Notes:

[1] These only actions are visual observation and documentation. No capital cost. These costs are accounted for in community operation and maintenance (O&M) costs.

[2] Alternative RP-2 includes remedy protection for neighborhood surface flow issues in the following Mullan neighborhoods: 3rd Street, Mill Street, Dewey Street Area, Copper Street, and the south end of 2nd Street.

[3] See the Upper Basin Focused Feasibility Study (FFS) Report (EPA, 2012) for additional details about the remedy protection cost estimate for the side gulches.

The above costs are presented rounded to three significant figures.

The above cost opinion is a feasibility-study-level estimate with a nominal accuracy of –30 percent to +50 percent. (–30/+50%).

The above cost opinion is in 2009 dollars and does not include future escalation. The cost opinion shown has been prepared for guidance in project evaluation from the information available at the time of preparation. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, the final project scope, the final project schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs must be carefully reviewed prior to making specific financial decisions or establishing final budgets.

TABLE 13-1
Chemical-Specific ARARs and TBCs for Human Health and Ecological Receptors in the Upper Basin
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Citation	Summary of Requirements	Evaluation
Groundwater		
Idaho Water Quality Standards and Wastewater Treatment Requirements (IDAPA 58.01.02)	Designates uses for waters of the state and water quality standards protective of those uses. This regulation adopts water quality criteria for individual chemicals based on protection of beneficial uses.	Applicable where more stringent than federal water quality standards, and as they apply to the operation of and discharges from remedial activities that involve the collection, treatment, and discharge of groundwater and surface water.
Idaho Rules for Public Drinking Water Systems (IDAPA 58.01.08)	Adopts national primary drinking water regulations that are no less stringent than the federal regulations in effect under 40 CFR Part 141. These rules provide a degree of assurance that public systems that use either groundwater or surface water are protected from contamination and maintained free from contaminants.	Surface water and groundwater may be used as drinking water within areas of the Upper Basin and, to the extent that the Idaho Rules for Public Drinking Water Systems are more stringent than federal law, they are relevant and appropriate for the Upper Basin. However, because the Selected Remedy is an interim remedy that is not intended to fully address surface water and groundwater contamination, the Idaho Rules for Public Drinking Water Systems are outside the scope of, and need not be attained by, the Selected Remedy.
Safe Drinking Water Act (SDWA) of 1974 (42 U.S.C. 300(f) et seq.), National Primary Drinking Water Standards, 40 CFR 141.61, and Maximum Contaminant Levels for Inorganic Contaminants, 40 CFR 141.62	Establishes maximum contaminant levels (MCLs) as criteria for groundwater and surface water that are or may be used for drinking water. The standards are designed to protect human health from the adverse effects of organic contaminants in the drinking water.	Surface water and groundwater may be used as drinking water within areas of the Upper Basin, and the SWDA, the National Primary Drinking Water Standards, and the MCLs for inorganic contaminants are relevant and appropriate for the Upper Basin. However, because the Selected Remedy is an interim remedy that is not intended to fully address surface water and groundwater contamination, the SWDA and indentified regulations are outside the scope of, and need not be attained by, the Selected Remedy.
Surface Water		
Idaho Water Quality Standards and Wastewater Treatment Requirements—Salmonid Sight Feeding Standard (IDAPA 58.01.02.250 and 284)	This standard (50 NT acute and 25 NT chronic above background) is often used to assess the effectiveness of erosion abatement efforts. South Fork Coeur d'Alene River subbasin aquatic life criteria for cadmium, lead, and zinc.	Applicable where more stringent than federal water quality standards, and as they apply to the operation of and discharges from remedial activities that involve the collection, treatment, and discharge of groundwater and surface water. In addition, these standards, to the extent that they are more stringent than federal standards are relevant and appropriate as cleanup standards for surface water within the Upper Basin. However, because the Selected Remedy is an interim remedy that is not intended to fully address surface water contamination, these standards are

Citation	Summary of Requirements	Evaluation
		outside the scope of, and need not be attained by, the Selected Remedy.
Clean Water Act (33 U.S.C. 1251 et seq.), "Water Quality Standards," 40 CFR 131, National Recommended Water Quality Criteria—2006	Establishes numeric water quality criteria for the protection of human health and aquatic organisms. Toxic criteria for the protection of aquatic life are provided in the water quality criteria regulations [40 CFR 131.36(b)(1)], which supersede criteria adopted by the state except where the state criteria are more stringent than the federal criteria.	Relevant and appropriate as they apply to the operation of and discharges from remedial activities that involve the collection, treatment, and discharge of groundwater and surface water. In addition, these standards are relevant and appropriate as cleanup standards for surface water within the Upper Basin. However, because the Selected Remedy is an interim remedy that is not intended to fully address surface water contamination, these standards are outside the scope of, and need not be attained by, the Selected Remedy.
Soil		
None		
Sediments		
None		

Notes:

CFR – *Code of Federal Regulations*
IDAPA – Idaho Administrative Procedures Act
SWDA – Safe Drinking Water Act
TBC – to be considered
U.S.C. – United States Code

TABLE 13-2
Location-Specific ARARs and TBCs for Ecological Receptors in the Upper Basin
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Citation	Summary of Requirement	Evaluation
Federal		
American Indian Religious Freedom Act (42 U.S.C. 1996 et seq.)	Protects religious, ceremonial, and burial sites and the free practice of religions by Native American groups.	The substantive requirements are applicable to those areas where remedial action is selected that include religious, ceremonial, and burial sites.
Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 et seq., 43 CFR 10)	Protects Native American burial sites and funerary objects. If Native American graves are discovered within remediation areas, project activities must cease and consultation must take place with the affected Tribe. Covered objects may be repatriated by the Tribe.	The substantive requirements are applicable to those areas where remedial action is selected that includes Native American burial sites and funerary objects.
National Historic Preservation Act [16 U.S.C. 470 et seq.; 36 CFR Parts 60, 63, 800; 40 CFR 6.301(b)]	Federal agencies must identify possible effects of proposed remedial activities on historic properties (cultural resources). If historic properties or landmarks eligible for, or included in, the National Register of Historic Places exist within remediation areas, remediation activities must be designed to minimize the effect on such properties or landmarks.	The substantive requirements are applicable to those areas where remedial actions are undertaken that include historic properties, cultural resources, or landmarks that are eligible for, or included in, the National Register of Historic Places.
Endangered Species Act (16 U.S.C. 1531 et seq.)	Requires federal agencies to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of species designated as threatened or endangered by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.	Applicable to areas where remedial action is selected that may provide habitat to threatened or endangered species.
Migratory Bird Treaty Act (16 U.S.C. 703 et seq.)	Protects all migratory bird species. It shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, any migratory bird, any part, nest, or egg of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof.	The prohibition is relevant and appropriate to areas of the Site where remedial action is selected that may provide habitat to migratory birds.
Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (66 FR 3853)	Encourages federal agencies to integrate migratory bird conservation principles into plans and actions.	TBC

TABLE 13-2
Location-Specific ARARs and TBCs for Ecological Receptors in the Upper Basin
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Citation	Summary of Requirement	Evaluation
Bald and Golden Eagle Protection Act (16 U.S.C. 668; 50 CFR 22)	Provides for the protection of the bald eagle and the golden eagle by prohibiting the unpermitted taking, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg [16 U.S.C. 668(a); 50 CFR 22]. "Take" includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb [16 U.S.C. 688(c); 50 CFR 22.3].	The prohibition is relevant and appropriate to those areas where remedial action is selected that provide habitat to Bald and Golden Eagles.
Fish and Wildlife Conservation Act of 1980 [16 U.S.C. 661 et seq.; 40CFR 6.302(g)]	Requires consultation with the U.S. Fish and Wildlife Service (and the Idaho Department of Fish and Game) when any modification of a stream or other waterbody greater than 10 hectares is proposed; requires adequate provisions for protection of fish and wildlife, including permanent or temporary mitigation.	The substantive requirements are applicable to remedial actions that cause a modification of a stream or other waterbody that is greater than 10 hectares to ensure the protection of fish, and may include actions necessary to protect fish and wildlife from impacts associated with such modification.
Rivers and Harbors Act of 1899 (33 U.S.C. 401 et seq.; 33 CFR 320-330)	Prohibits unauthorized obstruction or alteration of navigable waters.	The substantive requirements are applicable to remedial actions in or near navigable waters and prohibit unauthorized obstruction or alteration of navigable waters; and include remedial actions that entail excavation, dredging, and/or disposal activities in navigable waters of the United States as well as remedial actions that may alter or modify the course, condition, location, or capacity of a navigable water of the United States.
Clean Water Act of 1977 (Sections 404 and 401) - Dredge or Fill Requirements (33 U.S.C. 1251-1376; 33 CFR Parts 320-330; 40 CFR Part 230)	Establishes requirements that limit the discharge of dredged or fill material into navigable waters and associated wetlands. EPA guidelines for discharge of dredged or fill materials in 40 CFR Part 230 specify consideration of alternatives that have less adverse impacts and prohibit discharges that would result in exceedance of surface water quality standards, exceedance of toxic effluent standards, and jeopardy of threatened or endangered species. Special consideration required for "special aquatic sites" defined to include wetlands.	The substantive requirements are applicable to remedial actions in or near navigable waters of the United States.
Protection of Wetlands [Executive Order 11990; 40 CFR 6.302(a); 40 CFR Part 6, Appendix A]	Requires federal agencies to take action to avoid adversely impacting wetlands, minimize wetland destruction, and preserve the value of wetlands. Also provides for wetlands enhancement and restoration.	TBC

TABLE 13-2
Location-Specific ARARs and TBCs for Ecological Receptors in the Upper Basin
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Citation	Summary of Requirement	Evaluation
Considering Wetlands at CERCLA Site Guidance (OSWER 9280.03, May 1994)	Provides guidance for considering potential impacts of response actions on wetlands at CERCLA sites.	TBC
Protection of Floodplains [Executive Order 11988; 40 CFR 6.302(b); 40 CFR Part 6, Appendix A]	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.	TBC
RCRA: Location Standards for Hazardous Waste Facilities-100 Year Floodplains [42 U.S.C. 6901; 40 CFR 264.18(b)]	Hazardous waste treatment, storage, and disposal facilities (TSDFs) located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any 100-year floodplain.	The substantive requirements are relevant and appropriate to the siting, design, construction, and operations of repositories within the 100-year floodplain to prevent washout.
State		
Idaho Water Quality and Wastewater Treatment—Hazardous and Deleterious Material Storage [Idaho Statute 39-105 and 39-3601 et seq.; IDAPA 58.01.02.800]	Hazardous and deleterious materials must not be stored, disposed of, or accumulated adjacent to or in the immediate vicinity of state waters, unless adequate measures and controls are provided to ensure that those materials will not enter state waters as a result of high water, precipitation runoff, wind, storage facility failure, accidents in operation, or unauthorized third-party activities.	The substantive requirement that are more stringent than federal requirements are relevant and appropriate to remedial actions that result in the consolidation of mine waste containing hazardous substances in repositories or otherwise buried beneath protective barriers (e.g., capped).
Idaho Siting of Hazardous Waste Disposal Facility (Idaho Code 39-5801 et seq.) and Idaho Rules and Standards for Hazardous Waste (IDAPA 58.01.05)	The remedial action will be designed to satisfy some of the technical criteria in the Idaho Hazardous Waste Siting Management Plan as adopted by the Idaho State Legislature. Consideration will be given in remedy design to general considerations referenced by the Hazardous Waste Facility Siting Act. However, a siting license for an onsite hazardous waste disposal facility is not required.	The substantive requirements that are more stringent than federal requirements are relevant and appropriate to the design and siting of repositories.
Idaho Classification and Protection of Wildlife (Idaho Statute 36-201 and IDAPA 13.01.06)	The Idaho Department of Fish and Game classifies wildlife as game, protected non-game, endangered, threatened, and species of special concern. None of the protected non-game species of special concern, threatened, or endangered species may be taken or possessed.	The substantive requirements that are more stringent than federal requirements are relevant and appropriate to remedial actions undertaken in areas that provide habitat for threatened, endangered, or protected non-game species of special concern,
Idaho Preservation of Historical Sites (Idaho Statute 67-4601 et seq.) and Idaho State Historical Society (Idaho Statute 67-4101 et seq.)	Covers historical sites and districts within the State of Idaho and the excavation of archaeological resources. The Idaho State Historical Society is a state agency. It publishes the National Register of Historic Places for Idaho.	The substantive requirement that are more stringent than federal requirements are applicable to historical sites and districts within the Upper Basin where remedial action is undertaken.

Citation	Summary of Requirement	Evaluation

Notes:

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
CFR – *Code of Federal Regulations*
EPA – U.S. Environmental Protection Agency
FR – Federal Register
IDAPA – Idaho Administrative Procedures Act
OSWER – Office of Solid Waste and Emergency Response
RCRA – Resource Conservation and Recovery Act
TSDF – treatment, storage, and disposal facility
TBC – to be considered
U.S.C. = United States Code

TABLE 13-3
Action-Specific ARARs and TBCs for Ecological Receptors in the Upper Basin
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Citation	Summary of Requirement	Evaluation
Federal		
RCRA: Subtitle C—Hazardous Waste Characteristics (40 CFR 261.20)	Generators of solid waste must determine whether the waste is hazardous. A solid waste is hazardous if it exhibits the toxicity characteristic (based on extraction procedure Method 1311).	Applicable to characterization of unknown waste that may be encountered during remediation (e.g., buried drums.)
RCRA: Subtitle C—Hazardous Remediation Waste Management Requirements (HWIR-Media) (40 CFR 264.554)	The use of staging piles can facilitate short-term storage of remediation wastes so that sufficient volumes can be accumulated for shipment to an offsite treatment facility or for efficient onsite treatment. The regulations contain performance standards for these piles.	The substantive requirements of 40 CFR. 264.554 are applicable to remedial actions that involve the accumulation of hazardous waste prior to shipment offsite and are relevant and appropriate to remedial actions that involve the temporary consolidation and accumulation of contaminated mining waste prior to transport to a repository located within the Upper Basin.
RCRA Subtitle C—Hazardous Waste Treatment and Storage (40 CFR 264 Subparts L and N)	Requirements for storing or treating hazardous wastes in landfills and waste piles. Subpart F addresses groundwater monitoring at hazardous waste treatment, storage, and disposal facilities (TSDFs). Closure requirements for hazardous waste repositories are covered under Subpart G. Hazardous waste landfills must meet minimum design standards under Subpart N.	The substantive requirements related to the design, construction and operation and maintenance are relevant and appropriate to remedial actions that include or result in the storage and/or disposal of hazardous substances in landfills or waste piles. These regulations are applicable if the subject remedial actions involve the storage and/or disposal of hazardous wastes in landfills, or waste piles.
RCRA: Subtitle D—RCRA Criteria for Classification of Solid Waste Disposal Facilities and Practices (42 U.S.C. 6901 et seq.; 40 CFR 257)	Certain criteria are required to be met by solid waste disposal facilities and practices, such as not restricting the base flow of the floodplain, not taking threatened or endangered species, and not causing a discharge to navigable waters.	The substantive requirements are relevant and appropriate to remedial actions that involve the consolidation of mine wastes in repositories or beneath protective barriers.
RCRA Subtitle D—Disposal of Nonhazardous Solid Waste (42 U.S.C. 6901 et	Provides criteria for cover material, run-on/runoff control systems, access control, and liquid restrictions.	The substantive requirements are relevant and appropriate

TABLE 13-3
Action-Specific ARARs and TBCs for Ecological Receptors in the Upper Basin
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Citation	Summary of Requirement	Evaluation
seq.; 40 CFR Part 258)		to remedial actions that involve the consolidation of mine wastes in repositories or beneath protective barriers.
Best Management Practices for Soil Treatment Technologies (OSWER, 1997)	Provides technologies for controlling cross-media transfer of contaminants during materials handling activities.	TBC during excavation of contaminated soil.
Clean Water Act/Water Pollution Control Act (33 U.S.C. 1251) Effluent Limitations (Sections 301-302) Water Quality Standards (Section 303) Federal Water Quality Criteria (Section 304) National Performance Standards (Section 306) National Pollutant Discharge Elimination System (Section 402)	These regulations govern water quality, including water discharged as part of a remedial process. Section 401—Water Quality Certification requires that EPA receive a water quality certification from a state that a given project requiring a federal permit that may result in a discharge to navigable water will comply with the state's water quality standards. Section 402—The NPDES program establishes a comprehensive framework for addressing processing water and stormwater discharges under the program. Requires that point-source discharges not cause the exceedance of surface water quality standards outside the mixing zone. Specifies requirements under 40 CFR 122.26 for point-source discharge of stormwater from construction sites to surface water and provides for Best Management Practices such as erosion control for removal and management of sediment to prevent run-on and runoff.	The substantive requirements are applicable as they apply to the operation of and discharges from remedial activities that involve the collection, treatment, and discharge of groundwater, surface water, stormwater, or other wastewaters.
Clean Air Act (42 U.S.C. 7401 et seq.)	Requires minimization of the harmful effects to air quality from excavation, construction, and other removal activities.	The substantive requirements of these regulations are relevant and appropriate to remedial actions that may involve the generation of fugitive dust (e.g., removal, transport, and consolidation of contaminated soil, waste rock, or sediments.
Surface Mining Control and Reclamation Act of 1977 (SMCRA) (30 U.S.C. 1201 et seq., 30 CFR 816)	Requires the protection of human health and the environment from the adverse effects of current and past surface coal mining operations. Some of the potentially relevant and appropriate requirements for the removal of contaminated surface soil include: -- Stabilization of all exposed surface areas to effectively control erosion and air pollution attendant to erosion (30 CFR 816.95). -- Use of best technology currently available to (1) minimize disturbances to and adverse impacts on fish, wildlife, and related environmental values and to achieve enhancement of such if possible; (2) conduct no activity that may jeopardize the	The substantive requirements are relevant and appropriate to the remediation of mine sites.

TABLE 13-3
Action-Specific ARARs and TBCs for Ecological Receptors in the Upper Basin
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Citation	Summary of Requirement	Evaluation
	continued existence of endangered species or that is likely to destroy or adversely modify their critical habitat; and (3) avoid disturbances to, enhance where practicable, or restore or replace wetlands, riparian vegetation, and habitats for fish and wildlife (30 CFR 816.97).	
National Emissions Standards for Asbestos (40 CFR Sections 60.147 and 60.152)	Any asbestos-containing materials encountered in mill demolition must be removed and disposed of in accordance with these regulations.	The substantive requirements are relevant and appropriate to remedial actions that involve the removal of asbestos-containing material
State		
Idaho Solid Waste Management Rules and Standards (IDAPA 58.01.06)	Requires all solid waste be managed to prevent human health hazards, public nuisances, or pollution of the environment. Elements relating to landfill cover, surface water management, and erosion control may be ARARs.	The substantive requirements that are more stringent than federal requirements are relevant and appropriate to remedial actions that include the removal, transport, consolidation, and/or disposal of contaminated mine wastes.
Mine and Mill Waste Remedial Guidelines and Best Management Practices (Coeur d'Alene Basin Restoration Project)	Design and implementation of selected response actions should consider a number of factors and techniques for protecting water quality, fish and wildlife habitat, while minimizing the potential for human exposure.	TBC
Best Management Practices and Guidelines for Mine Tailings Repositories	Provides guidelines for location, design, construction, and management of mine waste repositories.	TBC
Idaho Rules Governing Exploration and Surface Mining—Best Management Practices, Reclamation (IDAPA 20.03.02.060, .140, .160)	Reclamation requirements include best management practices for the protection of water quality, non-point sediment control, clearing and grubbing operations, overburden and topsoil requirements to enhance revegetation of disturbed areas, and road construction requirements to minimize erosion. Additional best management practices are specified for backfilling and grading and revegetation activities.	The substantive requirements that are more stringent than federal requirements are relevant and appropriate to remedial actions that include clearing and grubbing operations.
Idaho Mine Tailings Impoundment Structure Rules (IDAPA 37.03.05)	Design elements of the regulation may be relevant and appropriate to construction of regional repositories. Construction, enlargement, and alteration of mine tailings impoundments must conform to specific design specifications, spillways or diversion structures, cutoff walls, filters, and embankment slopes.	The substantive requirements of these regulations that are more stringent than federal requirements are relevant and appropriate to remedial actions that involve the consolidation of mine wastes in

TABLE 13-3
Action-Specific ARARs and TBCs for Ecological Receptors in the Upper Basin
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Citation	Summary of Requirement	Evaluation
		repositories or beneath protective barriers.
Idaho Stream Channel Alteration Rules (IDAPA 37.03.07)	Governs the alteration of stream channels in Idaho.	The requirements that are more stringent than federal requirements are applicable to remedial actions that involve the alteration of stream channels.
Idaho Water Quality Standards and Wastewater Treatment Requirements (IDAPA 58.01.02.800)	Restrictions are placed on the discharge of wastewaters and on human activities that may adversely affect water quality in state waters. Under IDAPA 58.01.02.800, hazardous and deleterious materials must not be stored, disposed of, or accumulated adjacent to or in the immediate vicinity of state waters unless adequate measures and controls are provided to ensure that those materials will not enter state waters. Deleterious materials are defined as any non-toxic substances that may cause the tainting of edible species of fish, taste and odors in drinking water supplies, or the reduction of the usability of water without causing physical injury to water users or aquatic and terrestrial organisms. Non-point source activities conducted in a manner that demonstrates a knowledgeable and reasonable effort to minimize resulting adverse water quality impacts are not subject to conditions or legal actions (IDAPA 58.01.02.350.02.a).	The substantive requirements that are more stringent than federal requirements and as they apply to the operation of and discharges from remedial activities that involve the collection, treatment, and discharge of groundwater and surface water are relevant and appropriate to remedial actions that result in the consolidation of mine waste containing hazardous substances in repositories or otherwise buried beneath protective barriers (e.g., capped).
Idaho Non-Point Source Management Plan, Final (December 1999)	Remedial activities should be consistent with the state's goal of restoration, maintenance, and protection of the beneficial uses of both surface water and groundwater. Long-term goals include design and implementation of Best Management Practices for surface water and groundwater.	TBC
Idaho Air Pollution Control Rules (IDAPA 58.01.01)	Requires that remedial activities be designed to take all reasonable precautions to prevent particulate matter from becoming airborne, including the use of water or chemicals as dust suppressants, the covering of trucks, and the prompt removal and handling of excavated materials.	The substantive requirements that are more stringent than federal requirements are applicable to remedial actions that may involve the generation of fugitive dust (e.g., removal, transport, and consolidation of contaminated soil, waste rock, or sediments.
Idaho Land Remediation Rules (IDAPA 58.01.18.027)	Institutional controls may be used in instances where residual concentrations of chemicals exceed risk-based health standards, or when they are required to ensure the continued protection of human health and	The substantive requirements that are more stringent than federal requirements are applicable to remedial

Citation	Summary of Requirement	Evaluation
	the environment or the integrity of the cleanup action.	actions that do not result in a cleanup that is protective of un-restricted use of the property and are not otherwise covered by the Institutional Controls Program.
Idaho Water Law (Title 42 of the 2011 Idaho State Statute)	Evaluation of whether: withdrawal of water is for a beneficial use; the new use will damage existing water rights; water supply is sufficient for the purpose of the new use; the application was made in good faith and is not speculative; the applicant has sufficient resources to complete the project; the use does not conflict with local public interests; and the project is consistent with the conservation of water in Idaho.	The substantive requirements that are more stringent than federal requirements are applicable to remedial actions that include the collection of contaminated water that is conveyed to a downstream location for treatment.

Notes:

ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
EPA = U.S. Environmental Protection Agency
FR = Federal Register
HWIR = Hazardous Waste Identification Rule
IDAPA = Idaho Administrative Procedures Act
LDR = Land Disposal Restriction
NPDES = National Pollutant Discharge Elimination System
OSWER = Office of Solid Waste and Emergency Response
RCRA = Resource Conservation and Recovery Act
TBC = to be considered

TABLE 14-1

Mine and Mill Sites Included in the Preferred Alternative and Rationale for Removal from the Selected Remedy

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Source ID	Source Name	Alternative 3+ Site Included in or Removed from Selected Remedy	Rationale for Removal from Selected Remedy
Big Creek	KLE025	SUNSHINE TAILINGS POND: NO. 2	Removed	Active Facility
Big Creek	KLE026	SILVER SYNDICATE	Removed	Active Facility
Big Creek	KLE027	NORTH AMERICAN MINE	Removed	Active Facility
Big Creek	KLE053	NORTH AMERICAN/SILVER SYNDICATE MINE	Removed	Active Facility
Big Creek	KLE054	CRESCENT/HOOPER TUNNEL	Removed	Active Facility
Big Creek	POL001	SUNSHINE CONSOLIDATED ROCKFORD GROUP	Removed	Contingent Removal
Big Creek	POL002	SILVER DALE AND BIG HILL MINE	Removed	Contingent Removal
Big Creek	POL008	GLOBE MINE	Removed	Contingent Removal
Big Creek	POL010	WESTERN STAR MINE	Removed	Contingent Removal
Big Creek	POL011	WOLFSON MINE	Removed	Contingent Removal
Big Creek	POL022	FIRST NATIONAL MINE	Removed	Contingent Removal
Big Creek	POL044	UNNAMED PROSPECT	Removed	Contingent Removal
Big Creek	POL052	LUCKY BOY MINE	Removed	Contingent Removal
Big Creek	POL067	UNNAMED ADIT	Removed	Contingent Removal
Big Creek	POL068	UNNAMED ADIT	Removed	Contingent Removal
Big Creek	KLE047	BIG CK IMPACTED RIPARIAN: NO. 1	Included	
Big Creek	KLE071	BIG CK IMPACTED RIPARIAN: NO. 3	Included	
Big Creek	KLE073	BIG CK IMPACTED RIPARIAN: NO. 2	Included	
Big Creek	POL066	UNNAMED ADIT	Removed	2011 Focused Characterization
Canyon Creek	BUR066	MOONLIGHT MINE	Removed	Contingent Removal
Canyon Creek	BUR068	HEADLIGHT MINE	Removed	Contingent Removal
Canyon Creek	BUR088	AJAX NO.2	Removed	Contingent Removal
Canyon Creek	BUR099	BENTON MINE	Removed	Contingent Removal
Canyon Creek	BUR105	OOM PAUL NO. 2	Removed	Contingent Removal
Canyon Creek	BUR125	MIDWAY SUMMIT MINE	Removed	Contingent Removal
Canyon Creek	BUR134	ALCIDES PROSPECT & IMPERIAL MINE	Removed	Contingent Removal
Canyon Creek	BUR135	SONORA MINE	Removed	Contingent Removal
Canyon Creek	BUR176	UNNAMED ADIT	Removed	Contingent Removal
Canyon Creek	BUR185	WEST MAMMOTH MINE	Removed	Contingent Removal
Canyon Creek	BUR189	DULUTH MINE CANYON CK	Removed	Contingent Removal
Canyon Creek	BUR204	UNNAMED ROCK DUMP	Removed	Contingent Removal
Canyon Creek	BUR067	TAMARACK NO.7 (1200 LEVEL)	Included	
Canyon Creek	BUR072	STANDARD-MAMMOTH NO.4	Included	
Canyon Creek	BUR073	STANDARD-MAMMOTH CAMPBELL ADIT	Included	
Canyon Creek	BUR075	SHERMAN 1000 LEVEL (OREANO ADIT)	Included	
Canyon Creek	BUR087	HERCULES NO. 3	Included	
Canyon Creek	BUR090	HERCULES NO. 4	Included	
Canyon Creek	BUR094	SHERMAN 600 LEVEL	Included	
Canyon Creek	BUR096	ANCHOR MINE	Included	
Canyon Creek	BUR097	HIDDEN TREASURE MINE	Included	
Canyon Creek	BUR098	HERCULES NO. 5	Included	
Canyon Creek	BUR107	AJAX NO.3	Included	
Canyon Creek	BUR109	OOM PAUL NO. 1	Included	
Canyon Creek	BUR112	GEM NO.2	Included	
Canyon Creek	BUR117	FRISCO MILLSITE	Included	
Canyon Creek	BUR118	FRISCO NO.2 & NO.1	Included	
Canyon Creek	BUR119	BLACK BEAR NO.4	Included	
Canyon Creek	BUR120	SILVER MOON MINE	Included	
Canyon Creek	BUR121	BLACK BEAR FRACTION	Included	
Canyon Creek	BUR122	FLYNN MINE	Included	
Canyon Creek	BUR124	OMAHA MINE	Included	
Canyon Creek	BUR128	HECLA-STAR MINE & MILLSITE COMPLEX	Included	

TABLE 14-1
Mine and Mill Sites Included in the Preferred Alternative and Rationale for Removal from the Selected Remedy
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Source ID	Source Name	Alternative 3+ Site Included in or Removed from Selected Remedy	Rationale for Removal from Selected Remedy
Canyon Creek	BUR129	TIGER-POORMAN MINE	Included	
Canyon Creek	BUR130	MARSH MINE	Included	
Canyon Creek	BUR141	CANYON CK IMPACTED FLOODPLAIN	Included	
Canyon Creek	BUR142	GEM MILLSITE	Included	
Canyon Creek	BUR143	CANYON CK IMPACTED RIPARIAN	Included	
Canyon Creek	BUR144	STANDARD-MAMMOTH LOADING AREA	Included	
Canyon Creek	BUR145	ONEILL GULCH UNNAMED ROCK DUMP	Included	
Canyon Creek	BUR146	GORGE GULCH IMPACTED RIPARIAN	Included	
Canyon Creek	BUR149	AJAX NO.2 ADJACENT ROCK DUMP	Included	
Canyon Creek	BUR150	CANYON CK GARBAGE DUMP	Included	
Canyon Creek	BUR153	CANYON CK IMPACTED FLOODPLAIN (CCSeg02 & CCSeg04)	Included	
Canyon Creek	BUR177	JOE MATT MINE	Included	
Canyon Creek	BUR178	WEST HECLA MINE	Included	
Canyon Creek	BUR180	STANLEY MINE	Included	
Canyon Creek	BUR190	GEM NO.3	Included	
Canyon Creek	BUR191	FRISCO NO.3	Included	
Canyon Creek	BUR192	BLACK BEAR MILLSITE	Included	
Canyon Creek	OSB047	CANYON CK FORMOSA REACH SVNRT REHAB	Included	
Canyon Creek	WAL009	HECLA-STAR TAILINGS PONDS	Included	
Canyon Creek	WAL010	CANYON CK POND REACH SVNRT REHAB	Included	
Canyon Creek	WAL011	CANYON SILVER (FORMOSA) MINE	Included	
Canyon Creek	WAL039	STANDARD-MAMMOTH MILLSITE	Included	
Canyon Creek	WAL040	CANYON CK IMPACTED FLOODPLAIN	Included	
Canyon Creek	WAL041	CANYON CK REPOSITORY REACH SVNRT REHAB	Included	
Canyon Creek	WAL042	CANYON CK TAILINGS REPOSITORY SVNRT	Included	
Canyon Creek	WAL081	WALLACE OLD PRIVATE LANDFILL	Included	
Canyon Creek	BUR089	IDAHO AND EASTERN MINE	Removed	2011 Focused Characterization
Canyon Creek	BUR132	GERTIE MINE	Removed	2011 Focused Characterization
Canyon Creek	BUR133	RUSSEL MINE	Removed	2011 Focused Characterization
Canyon Creek	BUR166	UNNAMED ADIT	Removed	2011 Focused Characterization
Canyon Creek	BUR187	UNNAMED ADIT	Removed	2011 Focused Characterization
Canyon Creek	THO023	UNNAMED ADIT	Removed	2011 Focused Characterization
Mainstem SFCDR	KLE075	SILVER SUMMIT MILLSITE (Polaris)	Removed	Active Facility
Mainstem SFCDR	OSB119	OSBURN ZANETTI GRAVEL OPERATION	Removed	Active Facility
Mainstem SFCDR	WAL001	OSBURN TAILINGS PONDS	Removed	Active Facility
Mainstem SFCDR	WAL020	CALADAY MINE	Removed	Active Facility
Mainstem SFCDR	KLE016	SYNDICATE MINING & EXPLORATION CO.	Removed	Contingent Removal
Mainstem SFCDR	KLE020	NEW HILARITY MINE	Removed	Contingent Removal
Mainstem SFCDR	KLE021	ALHAMBRA MINE	Removed	Contingent Removal
Mainstem SFCDR	KLE033	POLARIS MINE	Removed	Contingent Removal
Mainstem SFCDR	KLE051	FLORENCE MINE	Removed	Contingent Removal
Mainstem SFCDR	KLE066	RHODE ISLAND NO.1 & NO.2 & ASSOC.ADITS	Removed	Contingent Removal
Mainstem SFCDR	KLE068	UNNAMED ADIT (St. Joe No. 2)	Removed	Contingent Removal
Mainstem SFCDR	MUL085	VIENNA INTERNATIONAL MINE	Removed	Contingent Removal
Mainstem SFCDR	MUL086	WIBBERDING-GOLDEN SLIPPER MINES	Removed	Contingent Removal
Mainstem SFCDR	OSB025	CAPITOL SILVER-LEAD: NO. 3	Removed	Contingent Removal
Mainstem SFCDR	OSB070	SILVERORE-INSPIRATION MINE	Removed	Contingent Removal
Mainstem SFCDR	OSB072	WESTERN UNION UPPER ADIT	Removed	Contingent Removal
Mainstem SFCDR	OSB074	ST. JOE NO.1	Removed	Contingent Removal
Mainstem SFCDR	OSB076	UNNAMED ADIT (May Claim)	Removed	Contingent Removal
Mainstem SFCDR	OSB078	UNNAMED ADIT (Hardscrabble Claim)	Removed	Contingent Removal

TABLE 14-1

Mine and Mill Sites Included in the Preferred Alternative and Rationale for Removal from the Selected Remedy

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Source ID	Source Name	Alternative 3+ Site Included in or Removed from Selected Remedy	Rationale for Removal from Selected Remedy
Mainstem SFCDR	POL021	ECLIPSE MINE	Removed	Contingent Removal
Mainstem SFCDR	POL064	UNNAMED ADIT	Removed	Contingent Removal
Mainstem SFCDR	WAL016	ARGENTINE MINE	Removed	Contingent Removal
Mainstem SFCDR	WAL034	SHIELDS GULCH IMPACTED RIPARIAN	Removed	Contingent Removal
Mainstem SFCDR	WAL035	OSBURN ROCKPIT ALONG I-90: NO. 2	Removed	Contingent Removal
Mainstem SFCDR	KLE011	SILVER CRESCENT TAILINGS	Included	
Mainstem SFCDR	KLE034	SILVER DOLLAR MINE	Included	
Mainstem SFCDR	KLE035	SILVER SUMMIT MINE	Included	
Mainstem SFCDR	KLE040	SF CDA RIVER IMPACTED FLOODPLAIN: NO. 5	Included	
Mainstem SFCDR	KLE048	SF CDA RIVER SVNRT REHAB	Included	
Mainstem SFCDR	KLE049	SF CDA RIVER IMPACTED RIPARIAN (MidGradSeg01 & MidGradSeg02)	Included	
Mainstem SFCDR	KLE067	ST. JOE NO.4	Included	
Mainstem SFCDR	KLE069	ST. JOE NO.3	Included	
Mainstem SFCDR	OSB065	SF CDA RIVER IMPACTED FLOODPLAIN: NO. 3	Included	
Mainstem SFCDR	OSB117	OSBURN ZANETTI STOCKPILED TAILINGS	Included	
Mainstem SFCDR	OSB118	OSBURN NORTH TAILINGS AREA	Included	
Mainstem SFCDR	OSB120	SF CDA RIVER IMPACTED FLOODPLAIN: NO. 4	Included	
Mainstem SFCDR	WAL002	WESTERN UNION LOWER ADIT	Included	
Mainstem SFCDR	WAL004	SF CDA RIVER RAILROAD YARDS & IMP FLDP	Included	
Mainstem SFCDR	WAL014	ST. ELMO MINE	Included	
Mainstem SFCDR	KLW061	BH NO. 2	Removed	Contingent Removal
Mainstem SFCDR	KLW062	BLUEBIRD MINE & GUY CAVE AREA	Removed	Contingent Removal
Mainstem SFCDR	KLW070	MILO CK IMPACTED RIPARIAN: NO. 1	Removed	Contingent Removal
Mainstem SFCDR	KLW095	PHIL SHERIDAN MINE	Removed	Contingent Removal
Mainstem SFCDR	KLE042	MOON CK POND AT MOUTH	Removed	Remediated Site
Mainstem SFCDR	KLE062	OSBURN FLATS BUREAU OF MINES TESTPLOTS	Removed	Remediated Site
Mainstem SFCDR	KLE074	COEUR D ALENE MILLSITE	Removed	Remediated Site
Mainstem SFCDR	POL018	MERGER MINE	Removed	Remediated Site
Mainstem SFCDR	POL019	COEUR D ALENE MINE	Removed	Remediated Site
Mainstem SFCDR	WAL036	LAKE CK IMPACTED RIPARIAN	Removed	Remediated Site
Mainstem SFCDR	WAL037	HERCULES MILLSITE	Removed	Remediated Site
Mainstem SFCDR	KLE023	PIONEER MINES INC. PROPERTY	Removed	2011 Focused Characterization
Mainstem SFCDR	KLE070	UNNAMED ADIT	Removed	2011 Focused Characterization
Mainstem SFCDR	OSB030	SILVERTON PROSPECT UPPER ADIT	Removed	2011 Focused Characterization
Mainstem SFCDR	OSB073	SILVERTON PROSPECT LOWER ADIT	Removed	2011 Focused Characterization
Mainstem SFCDR	OSB075	UNNAMED ADIT	Removed	2011 Focused Characterization
Mainstem SFCDR	WAL024	WAR EAGLE MINE	Removed	2011 Focused Characterization
Mainstem SFCDR	WAL046	DAY MINES CLAIMS	Removed	2011 Focused Characterization
Mainstem SFCDR	WAL055	UNNAMED ADIT	Removed	2011 Focused Characterization
Mainstem SFCDR	WAL056	PEERLESS GROUP (OSCEOLA)	Removed	2011 Focused Characterization
Mainstem SFCDR	WAL057	PEERLESS GROUP	Removed	2011 Focused Characterization
Mainstem SFCDR	WAL058	UNNAMED ADIT	Removed	2011 Focused Characterization
Mainstem SFCDR	WAL062	UNNAMED ADIT	Removed	2011 Focused Characterization
Mainstem SFCDR	WAL064	UNNAMED ADIT	Removed	2011 Focused Characterization
Mainstem SFCDR	WAL072	UNNAMED ADIT	Removed	2011 Focused Characterization
Mainstem SFCDR	WAL073	UNNAMED ADIT	Removed	2011 Focused Characterization
Moon Creek	KLE061	UNNAMED TUNNEL	Removed	Contingent Removal
Moon Creek	KLE064	UNNAMED ADIT	Removed	Contingent Removal
Moon Creek	KLE014	ROYAL ANNE MINE	Included	
Moon Creek	KLE041	MOON CK IMPACTED RIPARIAN	Included	
Moon Creek	KLE008	MAINE-STANDARD MINE	Removed	2011 Focused Characterization

TABLE 14-1
Mine and Mill Sites Included in the Preferred Alternative and Rationale for Removal from the Selected Remedy
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Source ID	Source Name	Alternative 3+ Site Included in or Removed from Selected Remedy	Rationale for Removal from Selected Remedy
Moon Creek	KLE063	UNNAMED ADIT	Removed	2011 Focused Characterization
Moon Creek	KLE065	UNNAMED ADITS	Removed	2011 Focused Characterization
Ninemile Creek	BUR051	SUNSET MINE	Included	
Ninemile Creek	BUR053	INTERSTATE-CALLAHAN MINE/ROCK DUMPS	Included	
Ninemile Creek	BUR055	INTERSTATE MILLSITE	Included	
Ninemile Creek	BUR056	TAMARACK ROCK DUMPS	Included	
Ninemile Creek	BUR058	TAMARACK NO.3	Included	
Ninemile Creek	BUR139	REX NO.1	Included	
Ninemile Creek	BUR140	NINEMILE CREEK IMPACTED FLOODPLAIN	Included	
Ninemile Creek	BUR160	INTERSTATE-CALLAHAN LOWER ROCK DUMPS	Included	
Ninemile Creek	BUR170	TAMARACK 400 LEVEL	Included	
Ninemile Creek	BUR171	TAMARACK NO.5	Included	
Ninemile Creek	BUR172	TAMARACK UNNAMED ADIT	Included	
Ninemile Creek	BUR173	TAMARACK MILLSITE	Included	
Ninemile Creek	OSB038	CALIFORNIA NO.4	Included	
Ninemile Creek	OSB039	DAYROCK MINE	Included	
Ninemile Creek	OSB040	EF NINEMILE CK HECLA REHAB	Included	
Ninemile Creek	OSB044	SUCCESS MINE ROCK DUMP	Included	
Ninemile Creek	OSB048	AMERICAN MINE	Included	
Ninemile Creek	OSB052	DAYROCK MINE TLGS PILE/SVNRT REPOSITORY	Included	
Ninemile Creek	OSB056	EF NINEMILE CK IMPACTED RIPARIAN	Included	
Ninemile Creek	OSB057	EF NINEMILE CK IMPACTED RIPARIAN	Included	
Ninemile Creek	OSB058	EF NINEMILE CK SVNRT REHAB	Included	
Ninemile Creek	OSB059	NINEMILE CK BELOW DAYROCK MINE	Included	
Ninemile Creek	OSB060	NINEMILE CK SVNRT REHAB NEAR BLACKCLD	Included	
Ninemile Creek	OSB082	MONARCH MINE BLACKCLOUD CK	Included	
Ninemile Creek	OSB088	ALAMEDA MINE	Included	
Ninemile Creek	OSB089	SUCCESS NO.3	Included	
Ninemile Creek	OSB115	OPTION MINE	Included	
Ninemile Creek	WAL033	NINEMILE CK POTENTIAL TAILINGS DEPOSIT	Included	
Ninemile Creek	BUR054	REX NO.2 / SIXTEEN-TO-ONE MINE	Removed	Remediated Site
Ninemile Creek	OSB061	BLACKCLOUD CK MILLSITE	Removed	Remediated Site
Ninemile Creek	BUR052	LITTLE SUNSET MINE	Removed	2011 Focused Characterization
Ninemile Creek	OSB032	DULUTH MINE BLACKCLOUD CK	Removed	2011 Focused Characterization
Ninemile Creek	OSB033	RUTH MINE	Removed	2011 Focused Characterization
Ninemile Creek	OSB084	BLACKCLOUD CK IMPACTED RIPARIAN	Removed	2011 Focused Characterization
Ninemile Creek	OSB085	BLACKCLOUD CK IMPACTED RIPARIAN	Removed	2011 Focused Characterization
Ninemile Creek	WAL006	NORTHSIDE MINE	Removed	2011 Focused Characterization
Pine Creek	KLW083	LIBERAL KING PART OF TUNNEL: NO. 2	Removed	Contingent Removal
Pine Creek	MAS009	SHETLAND MINING CO-NABOB SILVER-LEAD	Removed	Contingent Removal
Pine Creek	MAS023	BLUE EAGLE MINE	Removed	Contingent Removal
Pine Creek	MAS028	LON CHANEY GROUP	Removed	Contingent Removal
Pine Creek	MAS030	TRAPPER CREEK SILVER	Removed	Contingent Removal
Pine Creek	MAS031	TRAPPER MINING & SMELTING COMPANY LTD.	Removed	Contingent Removal
Pine Creek	MAS032	L AND J PROSPECT	Removed	Contingent Removal
Pine Creek	MAS033	COEUR D ALENE PREMIER	Removed	Contingent Removal
Pine Creek	MAS052	OWL/FRED MINE	Removed	Contingent Removal
Pine Creek	MAS055	UNNAMED ADIT	Removed	Contingent Removal
Pine Creek	MAS057	UNNAMED ADIT	Removed	Contingent Removal
Pine Creek	MAS065	UNNAMED PROSPECT	Removed	Contingent Removal
Pine Creek	MAS068	UNNAMED ADIT	Removed	Contingent Removal
Pine Creek	TWI006	MANHATTAN MINE	Removed	Contingent Removal

TABLE 14-1

Mine and Mill Sites Included in the Preferred Alternative and Rationale for Removal from the Selected Remedy

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Source ID	Source Name	Alternative 3+ Site Included in or Removed from Selected Remedy	Rationale for Removal from Selected Remedy
Pine Creek	TWI012	KC PROSPECT	Removed	Contingent Removal
Pine Creek	TWI014	GREAT DUNKARD MINE	Removed	Contingent Removal
Pine Creek	TWI027	UNNAMED PROSPECT	Removed	Contingent Removal
Pine Creek	TWI030	UNNAMED ADIT	Removed	Contingent Removal
Pine Creek	KLW075	MATCHLESS MINE	Included	
Pine Creek	KLW079	GOLD EAGLE MINING CO.	Included	
Pine Creek	KLW082	CARBONATE MINE: NO. 2	Included	
Pine Creek	KLW085	CARBONATE MINE: NO. 1	Included	
Pine Creek	MAS003	LIBERAL KING MINE & MILLSITE	Included	
Pine Creek	MAS007	NABOB 1300 LEVEL	Included	
Pine Creek	MAS011	IDAHO PROSPECT: NO. 2	Included	
Pine Creek	MAS012	LYNCH-PINE CREEK MINE	Included	
Pine Creek	MAS013	NABOB 600 LEVEL (300 Level)	Included	
Pine Creek	MAS014	HILARITY MINE	Included	
Pine Creek	MAS015	LITTLE PITTSBURG MINE: NO. 2	Included	
Pine Creek	MAS016	LITTLE PITTSBURG MINE: NO. 1	Included	
Pine Creek	MAS020	SIDNEY (RED CLOUD) MINE/MILLSITE	Included	
Pine Creek	MAS021	NEVADA-STEWART MINE	Included	
Pine Creek	MAS022	SURPRISE MINE & UPPER ROCK DUMP	Included	
Pine Creek	MAS025	DOUGLAS MINE & MILLSITE	Included	
Pine Creek	MAS029	BIG IT MINE	Included	
Pine Creek	MAS035	NABOB 600 LEVEL SHAFT	Included	
Pine Creek	MAS036	DENVER CK TAILINGS PILE	Included	
Pine Creek	MAS040	DENVER CK IMPACTED RIPARIAN: NO. 2	Included	
Pine Creek	MAS041	DENVER CK IMPACTED RIPARIAN: NO. 3	Included	
Pine Creek	MAS042	DENVER CK IMPACTED RIPARIAN: NO. 4	Included	
Pine Creek	MAS043	DENVER CK IMPACTED RIPARIAN: NO. 1	Included	
Pine Creek	MAS045	HIGHLAND CK IMPACTED RIPARIAN	Included	
Pine Creek	MAS046	HIGHLAND & RED CLOUD CK IMPACTED RIPAR	Included	
Pine Creek	MAS054	MARMION OR SF FRACTION	Included	
Pine Creek	MAS078	HIGHLAND-SURPRISE MINE & MILLSITE	Included	
Pine Creek	MAS083	NABOB MILLSITE	Included	
Pine Creek	MAS084	DOUGLAS MINESITE TAILINGS REPOSITORY	Included	
Pine Creek	KLW077	GENERAL MINE	Removed	Remediated Site
Pine Creek	MAS006	NABOB TAILINGS POND	Removed	Remediated Site
Pine Creek	MAS008	NABOB 600 LEVEL (Crystalite)	Removed	Remediated Site
Pine Creek	MAS017	SIDNEY (DENVER) 500 LEVEL	Removed	Remediated Site
Pine Creek	MAS018	DENVER MINE (NABOB ADIT)	Removed	Remediated Site
Pine Creek	MAS019	STAR ANTIMONY LOWER ADIT	Removed	Remediated Site
Pine Creek	MAS072	UNNAMED ADIT	Removed	Remediated Site
Pine Creek	MAS079	HIGHLAND-SURPRISE LOWER ROCK DUMP	Removed	Remediated Site
Pine Creek	KLW080	BOBBY ANDERSON MINE	Removed	Remediated Site
Pine Creek	MAS027	CONSTITUTION LOWER MINE & ROCK DUMP	Removed	Remediated Site
Pine Creek	MAS048	CONSTITUTION LOWER MILLSITE & TAILINGS	Removed	Remediated Site
Pine Creek	MAS049	CONSTITUTION UPPER TAILINGS (non-BLM land)	Removed	Remediated Site
Pine Creek	MAS050	CONSTITUTION UPPER TUNNEL & ROCK DUMP	Removed	Remediated Site
Pine Creek	MAS081	SIDNEY (RED CLOUD) ROCK DUMP	Removed	Remediated Site
Pine Creek	MAS053	UNNAMED ADITS	Removed	2011 Focused Characterization
Pine Creek	TWI002	PALISADE MINE LOWER WORKINGS	Removed	2011 Focused Characterization
Pine Creek	TWI008	WEST PINE CREEK DEPOSIT	Removed	2011 Focused Characterization
Pine Creek	TWI009	EQUITABLE PROSPECT	Removed	2011 Focused Characterization
Pine Creek	TWI011	UNNAMED ADIT	Removed	2011 Focused Characterization

TABLE 14-1
Mine and Mill Sites Included in the Preferred Alternative and Rationale for Removal from the Selected Remedy
Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Source ID	Source Name	Alternative 3+ Site Included in or Removed from Selected Remedy	Rationale for Removal from Selected Remedy
Pine Creek	TWI013	BLUEBIRD PROSPECT (HANNIBAL)	Removed	2011 Focused Characterization
Pine Creek	TWI018	UNNAMED PROSPECT	Removed	2011 Focused Characterization
Pine Creek	TWI020	UNNAMED ADIT	Removed	2011 Focused Characterization
Pine Creek	TWI029	UNNAMED ADIT	Removed	2011 Focused Characterization
Upper SFCDR	LOK008	IDAHO SILVER NO. 2	Removed	Active Facility
Upper SFCDR	LOK050	DAISY GULCH TAILINGS POND	Removed	Active Facility
Upper SFCDR	LOK051	DAISY GULCH OLD LANDFILL	Removed	Active Facility
Upper SFCDR	MUL019	MORNING NO.6	Removed	Active Facility
Upper SFCDR	MUL020	LUCKY FRIDAY TAILINGS POND No. 3	Removed	Active Facility
Upper SFCDR	MUL042	GOLD HUNTER NO. 5	Removed	Active Facility
Upper SFCDR	LOK001	LUCKY CALUMET NO. 1	Removed	Contingent Removal
Upper SFCDR	LOK002	LUCKY CALUMET NO. 2	Removed	Contingent Removal
Upper SFCDR	LOK005	LUCKY BOY NO. 2	Removed	Contingent Removal
Upper SFCDR	LOK006	LUCKY BOY NO. 1	Removed	Contingent Removal
Upper SFCDR	LOK007	BUTTE & COEUR D ALENE (IDAHO SILVER)	Removed	Contingent Removal
Upper SFCDR	LOK010	HASH HOUSE MINE	Removed	Contingent Removal
Upper SFCDR	LOK017	BEACON LIGHT	Removed	Contingent Removal
Upper SFCDR	LOK048	SNOWSTORM APEX	Removed	Contingent Removal
Upper SFCDR	LOK053	UNNAMED ADIT	Removed	Contingent Removal
Upper SFCDR	MUL006	SQUARE DEAL MINE	Removed	Contingent Removal
Upper SFCDR	MUL008	ALICE MINE	Removed	Contingent Removal
Upper SFCDR	MUL009	SILVER SHAFT	Removed	Contingent Removal
Upper SFCDR	MUL013	WE LIKE MINE	Removed	Contingent Removal
Upper SFCDR	MUL014	GROUSE MINE	Removed	Contingent Removal
Upper SFCDR	MUL015	WEST STAR MINE	Removed	Contingent Removal
Upper SFCDR	MUL022	SUNSHINE PREMIER MINE	Removed	Contingent Removal
Upper SFCDR	MUL023	FANNY GREMM MINE	Removed	Contingent Removal
Upper SFCDR	MUL029	NORTH FRANKLIN MINE	Removed	Contingent Removal
Upper SFCDR	MUL030	WALL STREET MINE	Removed	Contingent Removal
Upper SFCDR	MUL031	CINCINNATI MINE	Removed	Contingent Removal
Upper SFCDR	MUL033	AMERICAN COMMANDER NO.2	Removed	Contingent Removal
Upper SFCDR	MUL043	SILVER REEF MINE	Removed	Contingent Removal
Upper SFCDR	MUL047	LOTTIE L. MINE	Removed	Contingent Removal
Upper SFCDR	MUL048	ALMA MINE	Removed	Contingent Removal
Upper SFCDR	MUL049	COPPER PLATE MINE	Removed	Contingent Removal
Upper SFCDR	MUL051	PILOT MINE	Removed	Contingent Removal
Upper SFCDR	MUL056	COUGHLIN MINE	Removed	Contingent Removal
Upper SFCDR	MUL057	BUTTE AND COEUR D ALENE MINE	Removed	Contingent Removal
Upper SFCDR	MUL059	ROCK CREEK MINE ROCK DUMP	Removed	Contingent Removal
Upper SFCDR	MUL060	ROCK CREEK MINE	Removed	Contingent Removal
Upper SFCDR	MUL063	GEM STATE MINE	Removed	Contingent Removal
Upper SFCDR	MUL065	MOE MINE	Removed	Contingent Removal
Upper SFCDR	MUL073	ATLAS MINE (CARBONATE HILL)	Removed	Contingent Removal
Upper SFCDR	MUL081	REINDEER QUEEN MINE	Removed	Contingent Removal
Upper SFCDR	MUL083	COPPER QUEEN MINE	Removed	Contingent Removal
Upper SFCDR	MUL103	MISSOULA MINE	Removed	Contingent Removal
Upper SFCDR	MUL119	UNNAMED ADIT	Removed	Contingent Removal
Upper SFCDR	MUL135	UNNAMED ADIT	Removed	Contingent Removal
Upper SFCDR	MUL136	UNNAMED ADIT	Removed	Contingent Removal
Upper SFCDR	MUL139	UNNAMED ADIT	Removed	Contingent Removal
Upper SFCDR	MUL141	MILL CK IMPACTED RIPARIAN No. 3	Removed	Contingent Removal
Upper SFCDR	MUL145	MILL CK IMPACTED RIPARIAN No. 2	Removed	Contingent Removal

TABLE 14-1

Mine and Mill Sites Included in the Preferred Alternative and Rationale for Removal from the Selected Remedy

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Source ID	Source Name	Alternative 3+ Site Included in or Removed from Selected Remedy	Rationale for Removal from Selected Remedy
Upper SFCDR	MUL146	MORNING NO.3	Removed	Contingent Removal
Upper SFCDR	MUL149	MILL CK IMPACTED RIPARIAN No. 1	Removed	Contingent Removal
Upper SFCDR	MUL150	DEADMAN GULCH IMPACTED RIPARIAN	Removed	Contingent Removal
Upper SFCDR	MUL153	DEADMAN GULCH IMPACTED RIPARIAN	Removed	Contingent Removal
Upper SFCDR	THO020	BULL FROG MINE	Removed	Contingent Removal
Upper SFCDR	WAL013	GRANADA MINE	Removed	Contingent Removal
Upper SFCDR	LOK004	SNOWSHOE NO. 2	Included	
Upper SFCDR	LOK009	SNOWSTORM NO. 4	Included	
Upper SFCDR	LOK011	SNOWSTORM NO. 3	Included	
Upper SFCDR	LOK024	SILVER CABLE MINE	Included	
Upper SFCDR	MUL012	STAR 1200 LEVEL	Included	
Upper SFCDR	MUL018	MULLAN METALS MINE	Included	
Upper SFCDR	MUL021	INDEPENDENCE MINE	Included	
Upper SFCDR	MUL027	MORNING NO.4	Included	
Upper SFCDR	MUL028	MORNING NO.5	Included	
Upper SFCDR	MUL045	HOMESTAKE MINE	Included	
Upper SFCDR	MUL052	COPPER KING MINE	Included	
Upper SFCDR	MUL053	NATIONAL MINE	Included	
Upper SFCDR	MUL054	UNNAMED ADIT	Included	
Upper SFCDR	MUL071	ATLAS MINE	Included	
Upper SFCDR	MUL120	BANNER MINE NO. 02	Included	
Upper SFCDR	MUL129	ATLAS MINE ROCK DUMP	Included	
Upper SFCDR	MUL132	NATIONAL MILLSITE ADJACENT TAILINGS	Included	
Upper SFCDR	MUL142	GROUSE GULCH IMPACTED RIPARIAN	Included	
Upper SFCDR	WAL038	SF CDA RIVER IMPACTED FLOODPLAIN: NO. 1	Included	
Upper SFCDR	WAL076	MARY D CLAIM WORKINGS	Included	
Upper SFCDR	WAL077	GOLCONDA TAILINGS	Included	
Upper SFCDR	MUL001	GOLCONDA MINESITE	Removed	Remediated Site
Upper SFCDR	MUL002	GOLCONDA MILLSITE	Removed	Remediated Site
Upper SFCDR	MUL037	LUCKY FRIDAY TAILINGS POND No. 2	Removed	Hecla Site
Upper SFCDR	MUL038	GOLD HUNTER NO. 6	Removed	Hecla Site
Upper SFCDR	MUL058	LUCKY FRIDAY TAILINGS POND No.1	Removed	Hecla Site
Upper SFCDR	MUL131	NATIONAL MILLSITE	Removed	Hecla Site
Upper SFCDR	MUL004	UNITED LEAD ZINC MINE	Removed	2011 Focused Characterization
Upper SFCDR	MUL007	WONDER MINE	Removed	2011 Focused Characterization

Note:

SFCDR = South Fork Coeur d'Alene River

TABLE 14-2

Sites not Included in the Selected Remedy based on 2011 Focused Characterization Sampling Results [a]

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

BLM Site ID	Site Name	<2.0 mm Soil Fraction		2.0-4.0 mm Soil Fraction	
		Arsenic (mg/kg)	Lead (mg/kg)	Arsenic (mg/kg)	Lead (mg/kg)
Upper SFCDR Watershed					
MUL004	United Lead Zinc Mine	5.9	22.7	U	4.4
MUL007	Wonder Mine	6.3	53.6	U	11
Moon Creek Watershed					
KLE008	Maine-Standard Mine	55.1	33.1	14	9.6
KLE063	Unnamed Adit	22.5	58.4	23.4	34
KLE065	Unnamed Adits	40.5	54.8	14	11
Big Creek Watershed					
POL066	Unnamed Adit	5.9	14.0	U	3.2
Ninemile Creek Watershed					
WAL006	Northside Mine	6.8	44.7	U	16.1
BUR052	Little Sunset Mine	26.2	98.2	U	7.7
OSB032	Duluth Mine Blackcloud Creek	U	26.5	U	6.0
OSB033	Ruth Mine	6.4	23.8	U	6.9
OSB084	Blackcloud Creek Impacted Riparian	U	17.1	U	13.2
OSB085	Blackcloud Creek Impacted Riparian	4.9	325	U	465
Canyon Creek Watershed					
BUR089	Idaho and Eastern Mine	9.9	34.9	U	12.4
BUR132	Gertie Mine	8.6	19.5	U	6.0
BUR133	Russel Mine	4.9	33.3	U	11
BUR166	Unnamed Adit	24.5	187	11	45.9
BUR187	Unnamed Adit	5.1	21.2	4.9	31.4
THO023[b]	Unnamed Adit	--	--	--	--
East Fork Pine Creek Watershed					
MAS053	Unnamed Adits	8.7	32.3	7.2	15.7
West Fork Pine Creek Watershed					
TWI002	Palisade Mine Lower Workings	U	11.0	7.2	7.3
TWI008	West Pine Creek Deposit	5	22.5	4.9	6.1
TWI009	Equitable Prospect	5.7	11.0	U	U
TWI011	Unnamed Adit	5	18.3	U	3.5
TWI013	Bluebird Prospect (Hannibal)	76.3	46.3	85.5	27.9
TWI018	Unnamed Prospect	26.9	33.7	8.5	4.4
TWI020	Unnamed Adit	30.3	117	28	78.5
TWI029	Unnamed Adit	24.9	70.8	24.3	52.3
Mainstem SFCDR Watershed					
KLE023	Pioneer Mines Inc. Property	9.5	45.5	9.4	27
KLE070	Unnamed Adit	19	44	16	20
WAL024	War Eagle Mine	16	12.9	13	7.7
WAL046	Day Mines Claims	32.4	234	19	79.9
WAL055	Unnamed Adit	26.9	55.4	21	18.8
WAL056	Peerless Group (Osceola)	15	28	13	11
		26.3	9.2	12	U

TABLE 14-2

Sites not Included in the Selected Remedy based on 2011 Focused Characterization Sampling Results [a]

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

BLM Site ID	Site Name	<2.0 mm Soil Fraction		2.0-4.0 mm Soil Fraction	
		Arsenic (mg/kg)	Lead (mg/kg)	Arsenic (mg/kg)	Lead (mg/kg)
WAL057	Peerless Group	16	26.5	7	12
WAL058	Unnamed Adit	9.9	15.9	5.8	U
WAL062[b]	Unnamed Adit	--	--	--	--
WAL064	Unnamed Adit	6.1	56.3	U	28.6
WAL072[b]	Unnamed Adit	--	--	--	--
WAL073	Unnamed Adit	5.9	29.9	U	4.3
OSB030	Silverton Prospect Upper Adit	5.2	51.3	U	8.4
OSB073	Silverton Prospect Lower Adit	11	115	9.5	45.3
		12	50.8	U	5.2
OSB075	Unnamed Adit	26.4	100	24.9	43.1

Notes:

[a] Decision criteria established in the Upper Coeur d'Alene Basin Focused Characterization Sampling Quality Assurance Project Plan (QAPP) consisted of the following: (1) if there is no evidence of ore production and soil concentrations are greater than 530 mg/kg lead and/or 100 mg/kg arsenic, the site will be retained in the Upper Basin Selected Remedy; (2) if there is no evidence of ore production and soil concentrations are less than 530 mg/kg lead and/or 100 mg/kg arsenic, the site will be removed from the Upper Basin Selected Remedy.

[b] No waste piles or other mining disturbances were observed in the vicinity of the documented site location; therefore, the site is a candidate for removal from the Upper Basin Selected Remedy.

-- = Not sampled
BLM = Bureau of Land Management
mg/kg = milligram(s) per kilogram
mm = millimeter
U = Nondetect

TABLE 14-3

Summary of Differences between the Preferred Alternative and the Selected Remedy: Hydraulic Isolation Actions along the SFCDR between Wallace and Elizabeth Park

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

		Actions Included in Preferred Alternative				Actions Included in Selected Remedy			
Source ID	Trait Description	TCD	TCD Description	Quantity	Units	TCD	TCD Description	Quantity	Units
KLE048	Floodplain Sediments	C14c	Stream Lining	3,000	linear feet	C14c	Stream Lining	0	linear feet
KLE048	Floodplain Sediments	C15b	French Drain	3,000	linear feet	C15b	French Drain	0	linear feet
KLE048	Groundwater	WT01	Centralized HDS Treatment at CTP	598	gpm	WT01	Centralized HDS Treatment at CTP	0	gpm
KLE049	Floodplain Sediments	C14c	Stream Lining	2,500	linear feet	C14c	Stream Lining	0	linear feet
KLE049	Floodplain Sediments	C15b	French Drain	2,500	linear feet	C15b	French Drain	0	linear feet
KLE049	Groundwater	WT01	Centralized HDS Treatment at CTP	598	gpm	WT01	Centralized HDS Treatment at CTP	0	gpm
OSB065	Floodplain Sediments	C14c	Stream Lining	22,000	linear feet	C14c	Stream Lining	0	linear feet
OSB065	Floodplain Sediments	C15b	French Drain	22,000	linear feet	C15c	French Drain	4,600	linear feet
OSB065	Groundwater	WT01	Centralized HDS Treatment at CTP	598	gpm	WT01	Centralized HDS Treatment at CTP	3,900	gpm
OSB120	Floodplain Sediments	C14c	Stream Lining	14,000	linear feet	C14c	Stream Lining	0	linear feet
OSB120	Floodplain Sediments	C15b	French Drain	14,000	linear feet	C15b	French Drain	0	linear feet
OSB120	Groundwater	WT01	Centralized HDS Treatment at CTP	598	gpm	WT01	Centralized HDS Treatment at CTP	0	gpm
WAL004	Floodplain Sediments	C14c	Stream Lining	8,500	linear feet	C14c	Stream Lining	0	linear feet
WAL004	Floodplain Sediments	C15b	French Drain	8,500	linear feet	C15b	French Drain	0	linear feet
WAL004	Groundwater	WT01	Centralized HDS Treatment at CTP	598	gpm	WT01	Centralized HDS Treatment at CTP	0	gpm

Notes:

CTP = Central Treatment Plant
gpm = gallons per minute
HDS = high-density sludge

TABLE 14-4

Summary of Differences between the Preferred Alternative and the Selected Remedy: Ninemile Creek Remedial Action TCDs and Quantities

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Source ID	Source Name	Trait Description (Waste Types)	Direct Capital Cost Quantity in Preferred Alternative (CY)	TCD in Selected Remedy	Direct Capital Cost Quantity in Selected Remedy (CY)
BUR053	INTERSTATE-CALLAHAN MINE/ROCK DUMPS	Upland waste rock (erosion potential)	692,000	C01+C07+HAUL-2	111,500
BUR055	INTERSTATE MILLSITE	Floodplain sediments	5,500	C01b+C07+HAUL-2	30,700
BUR055	INTERSTATE MILLSITE	Upland tailings	14,000	C01+C07+HAUL-2	78,200
BUR056	TAMARACK ROCK DUMPS	Upland waste rock (potential intermixed tailings)	293,000	C01+C07+HAUL-2	253,600
BUR058	TAMARACK NO.3	Upland waste rock	23,000	C01+C07+HAUL-2	13,500
BUR139	REX NO.1	Upland waste rock	-	C01+C07+HAUL-2	5,500
BUR140	NINEMILE CREEK IMPACTED FLOODPLAIN	Floodplain sediments	10,000	C01b+C07+HAUL-2	10,000
BUR160	INTERSTATE-CALLAHAN LOWER ROCK DUMPS	Upland waste rock (erosion potential)	-	C01+C07+HAUL-2	74,100
BUR170	TAMARACK 400 LEVEL	Upland waste rock (potential intermixed tailings)	11,000	C01+C07+HAUL-2	17,700
BUR171	TAMARACK NO.5	Upland waste rock (potential intermixed tailings)	-	C01+C07+HAUL-2	6,500
BUR172	TAMARACK UNNAMED ADIT	Upland waste rock	-	C01+C07+HAUL-2	4,300
BUR173	TAMARACK MILLSITE	Upland tailings	-	C01+C07+HAUL-2	5,200
OSB038	CALIFORNIA NO.4	Floodplain waste rock	31,000	C01+C07+HAUL-2	15,100
OSB039	DAYROCK MINE	Floodplain sediments	22,000	C01b+C07+HAUL-2	22,000
OSB039	DAYROCK MINE	Upland tailings	11,000	C01+C07+HAUL-2	11,000
OSB040	EF NINEMILE CK HECLA REHAB	Floodplain sediments	19,000	C01b+C07+HAUL-2	19,000
OSB044	SUCCESS MINE ROCK DUMP	Floodplain sediments	10,000	C01b+C07+HAUL-2	4,300
OSB044	SUCCESS MINE ROCK DUMP	Upland waste rock	17,000	C01+C07+HAUL-2	7,300
OSB044	SUCCESS MINE ROCK DUMP	Upland tailings (jig tailings)	360,000	C01+C07+HAUL-2	155,100
OSB056	EF NINEMILE CK IMPACTED RIPARIAN	Floodplain sediments	1,600	C01b+C07+HAUL-2	1,600
OSB057	EF NINEMILE CK IMPACTED RIPARIAN	Floodplain sediments	13,000	C01b+C07+HAUL-2	13,000
OSB058	EF NINEMILE CK SVNRT REHAB	Floodplain sediments	1,600	C01b+C07+HAUL-2	1,600
OSB059	NINEMILE CK BELOW DAYROCK MINE	Floodplain sediments	33,000	C01b+C07+HAUL-2	33,000
OSB060	NINEMILE CK SVNRT REHAB NEAR BLACKCLD	Floodplain sediments	800	C01b+C07+HAUL-2	800
OSB082	MONARCH MINE BLACKCLOUD CK	Floodplain waste rock	13,000	C01+C07+HAUL-2	13,000
OSB115	OPTION MINE	Upland waste rock (erosion potential)	200	C01+C07+HAUL-2	300
WAL033	NINEMILE CK POTENTIAL TAILINGS DEPOSIT	Floodplain sediments	34,000	C01b+C07+HAUL-2	34,000

Notes:

[a] The Preferred Alternative in the Proposed Plan was Alternative 3+.

The source IDs, names, trait descriptions, and estimated quantities are based on the inventory of source sites conducted by the Bureau of Land Management (BLM) in 1999 in support of the Remedial Investigation/Feasibility Study (RI/FS) for the Coeur d'Alene Basin (U.S. Environmental Protection Agency, 2001c, 2001d).

CY = cubic yards

Typical Conceptual Design (TCD) Codes

C01 = Excavation (dry)

C01b = Excavation (60% dry, 40% wet)

C02a = Regrade/Consolidate/Revegetate: Lower Part of Pile in 100-Year Floodplain

C03 = Low-Permeability Cap

C04 = Low-Permeability Cap with Seepage Collection

C07 = Waste Consolidation Area Above Flood Level

C08a = Repository, 1 million cy

NONE = No Action

HAUL-2 = Haul to Repository

TABLE 14-5

Summary of Differences between the Preferred Alternative and the Selected Remedy: Stream and Riparian Actions

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Segment ID	Stream and Riparian Reach Included in Preferred Alternative	Stream and Riparian Reach Included in or Removed from Selected Remedy	Rationale for Removal from Selected Remedy
Big Creek	BigCrkSeg04	BIG04-2	Removed	No remedial actions included in Selected Remedy.
Big Creek	BigCrkSeg04	BIG04-3	Included	
Moon Creek	MoonCrkSeg01	MC01-2	Removed	No remedial actions included in Selected Remedy.
Moon Creek	MoonCrkSeg02	MC02-2	Included	
Moon Creek	MoonCrkSeg02	MC02-3	Included	
Moon Creek	MoonCrkSeg02	MC02-4	Included	
Pine Creek	PineCrkSeg03	PC03-1	Removed	No sediment removal actions included in Selected Remedy.
Pine Creek	PineCrkSeg03	PC03-2	Removed	No sediment removal actions included in Selected Remedy.
Pine Creek	PineCrkSeg03	PC03-3	Removed	No sediment removal actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-4	Removed	No remedial actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-5	Removed	No remedial actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-6	Removed	No remedial actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-7	Removed	No remedial actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-8	Removed	No remedial actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-9	Removed	Limited remedial action and sediment removal actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-10	Removed	No remedial actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-11	Removed	No remedial actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-12	Removed	Limited remedial action and sediment removal actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-13	Removed	Limited remedial action and sediment removal actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-14	Removed	Limited remedial action and sediment removal actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-15	Removed	Limited remedial action and sediment removal actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-16	Removed	Limited remedial action and sediment removal actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-17	Removed	Limited remedial action and sediment removal actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-18	Removed	Limited remedial action and sediment removal actions included in Selected Remedy.
Upper SFCDR	UpperSFCDRSeg01	UG01-19	Removed	Limited remedial action and sediment removal actions included in Selected Remedy.
Canyon Creek	CCSeg02	CC02-1	Included	
Canyon Creek	CCSeg04	CC04-1	Included	
Canyon Creek	CCSeg05	CC05-1	Included	
Canyon Creek	CCSeg05	CC05-2	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-1	Removed	Infrastructure through Wallace. No sediment removal actions will occur.
Mainstem SFCDR	MIDGradSeg01	MG01-2	Removed	Infrastructure through Wallace. No sediment removal actions will occur.
Mainstem SFCDR	MIDGradSeg01	MG01-3	Removed	Infrastructure through Wallace. No sediment removal actions will occur.
Mainstem SFCDR	MIDGradSeg01	MG01-4	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-5	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-6	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-7	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-8	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-9	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-10	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-11	Included	

TABLE 14-5

Summary of Differences between the Preferred Alternative and the Selected Remedy: Stream and Riparian Actions

Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Segment ID	Stream and Riparian Reach Included in Preferred Alternative	Stream and Riparian Reach Included in or Removed from Selected Remedy	Rationale for Removal from Selected Remedy
Mainstem SFCDR	MIDGradSeg01	MG01-12	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-13	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-14	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-15	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-16	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-17	Included	
Mainstem SFCDR	MIDGradSeg01	MG01-18	Included	
Mainstem SFCDR	MIDGradSeg02	MG02-10	Removed	No remedial actions included in Selected Remedy.
Mainstem SFCDR	MIDGradSeg02	MG02-11	Removed	No remedial actions included in Selected Remedy.
Mainstem SFCDR	MIDGradSeg02	MG02-12	Removed	No remedial actions included in Selected Remedy.
Ninemile Creek	NMSeg01	NM01-1	Included	
Ninemile Creek	NMSeg02	NM02-1	Included	
Ninemile Creek	NMSeg03	NM03-1	Removed	No remedial actions included in Selected Remedy.
Ninemile Creek	NMSeg04	NM04-1	Included	
Ninemile Creek	NMSeg04	NM04-2	Included	
Ninemile Creek	NMSeg04	NM04-3	Included	

Notes:

See Figures 12-18 through 12-22 for the locations of the reaches that are included in the Selected Remedy. For the Pine Creek and Upper SFCDR Watersheds, see the Focused Feasibility Study (FFS) Report (EPA, 2012) for the locations of stream and riparian reaches.

SFCDR = South Fork Coeur d'Alene River

Part 3
Responsiveness Summary

Contents

Part 3—Responsiveness Summary

1.0 Overview and Background on Community Involvement

The U.S. Environmental Protection Agency (EPA) is committed to meaningful community participation throughout the Superfund process in the Coeur d'Alene Basin. Over the years, EPA has engaged the public through all phases of its work. Most importantly, EPA has encouraged the public to be involved in selection of the remedies for Operable Units (OUs) 1, 2, and 3 and, most recently, the Selected Remedy for the Upper Basin.

During the Focused Feasibility Study (FFS) for the Upper Basin, EPA met regularly with the Basin Environmental Improvement Project Commission's (the Basin Commission's) Upper Basin Project Focus Team (PFT), a group focused on technical issues related to cleanup. The PFT members include interested citizens and representatives from the State of Idaho, Shoshone County, the U.S. Department of the Interior Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service (USFWS), the U.S. Forest Service (USFS), the Coeur d'Alene and Spokane Tribes, and the State of Washington. Additional stakeholders participated in some of these meetings, including mining industry representatives. Together, EPA and the Upper Basin PFT developed the remedial alternatives that were evaluated in the FFS Report for the Upper Basin[1] (EPA, 2012).[2] Variations on these alternatives were carefully considered and screened by the PFT prior to development of the final alternatives. EPA has continued to work closely with the PFT during development of the Selected Remedy for the Upper Basin and associated implementation planning. The PFT was instrumental in helping prioritize actions to include in the Selected Remedy. The PFT continues to work with EPA on implementation planning for the remedy.

In addition to its meetings with the Upper Basin PFT, EPA has provided a wide range of opportunities for community participation in the selection of a remedy for the Upper Basin. Since late 2008, EPA has hosted and/or attended approximately 75 meetings to share information and gather input for development of the FFS Report and the Upper Basin Proposed Plan (EPA, 2010a). EPA has engaged local residents, elected officials, community groups, and many other stakeholders in the decision-making process. This outreach has included working with the Basin Commission, its Technical Leadership Group (TLG), and the Citizens' Coordinating Council (CCC). EPA also submitted drafts of the FFS Report to stakeholders and the Upper Basin PFT for review and comment to assist EPA in preparing the final report.

For the Proposed Plan, in response to high public interest, EPA set an initial public comment period of 45 days instead of the usual 30 days. Based on subsequent requests from the public, the comment period was extended 90 more days, for a total of 135 days for public and stakeholder comment on both the Proposed Plan and the Draft Final FFS Report

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[1] The Draft Final FFS Report (CH2M HILL, 2010) was available for public review concurrently with EPA's Proposed Plan for the Upper Basin (EPA, 2010a).

[2] The references cited in this Responsiveness Summary overview are provided in full in Section 15.0 of the Decision Summary in Part 2 of this Upper Basin ROD Amendment,

(CH2M HILL, 2010). During the comment period, EPA held three informal open houses, hosted a formal public comment meeting and transcribed its proceedings, attended numerous community meetings, and hosted a public tour of some of the sites included in the Proposed Plan. EPA also participated in U.S. Senator Crapo's Town Hall meeting in Kellogg and the Wallace Town Hall meeting sponsored by the mayors of Upper Basin communities.

In addition, EPA created a Record of Decision (ROD) Amendment webpage for the public. It features fact sheets, technical memoranda, meeting handouts and presentations, community involvement materials, and draft documents. The webpage is regularly updated and widely advertised.

EPA's efforts to provide opportunities for public participation more than satisfy the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, the Superfund law) and the National Oil and Hazardous Substances Pollution Contingency Plan (known as the NCP). The input EPA has received from the public has been instrumental in the changes made to the Upper Basin cleanup plan since the Proposed Plan was issued. The ongoing involvement of the community will be an important part of the cleanup as it moves forward.

2.0 Changes Made to the Selected Remedy Based on Public and Stakeholder Comments

Following consideration of comments on and discussions of the Proposed Plan, EPA has significantly reduced the scope of the Selected Remedy and is not including all the remedial actions that were presented in EPA's Preferred Alternative for the Upper Basin in the Proposed Plan. Changes made to the Selected Remedy are described in detail in Section 14.0 of the Decision Summary in Part 2 of this ROD Amendment and are summarized here. No changes were made to the remedy protection actions included in Selected Remedy. As described in Section 12.0 of the Decision Summary, EPA has selected an interim, not a final, remedy for the Upper Basin. The Selected Remedy includes actions at 145 mine and mill sites rather than the 345 sites[3] included in the Preferred Alternative. Remedial actions included in the Selected Remedy are focused on geographic areas within the Upper Basin where water quality is most degraded and where the greatest overall benefits to water quality can be achieved. These focus areas primarily include Canyon Creek, Ninemile Creek, and the non-populated areas of the Bunker Hill Box (OU 2). In addition, the Selected Remedy does not include all the Preferred Alternative's groundwater collection and treatment actions along the South Fork of the Coeur d'Alene River (SFCDR) between Wallace and Elizabeth Park. The Selected Remedy does include the remedy protection actions and OU 2 remedial actions described in the Preferred Alternative. Because of the significant reduction in scope, the Selected Remedy is not expected to fully address surface

[3] The Proposed Plan (EPA, 2010) stated that the Preferred Alternative for OU 3 (Alternative 3+) included 348 sites. This total erroneously included three sites in Canyon Creek (WAL007, WAL008, and WAL012) that were in Alternative 4+, but not Alternative 3+. Therefore, the correct number of sites in the Preferred Alternative should have been 345.

water contamination at all locations in the Upper Basin, nor is it intended to fully address groundwater contamination.

The Selected Remedy is expected to result in significant improvements to surface water quality in the Upper Basin and may achieve ambient water quality criteria (AWQC) applicable or relevant and appropriate requirements (ARARs) under the Clean Water Act at many locations; however, the remedy may not achieve these AWQC ARARs at all locations. Furthermore, although the Selected Remedy is expected to result in significant improvements to groundwater quality, it is not intended to achieve groundwater maximum contaminant level (MCL) ARARs under the Safe Drinking Water Act throughout the Upper Basin. Similarly, although the Selected Remedy will provide additional safe habitat for special-status species and is intended to achieve ARARs under the Migratory Bird Treaty Act and the Endangered Species Act (ESA) where remedial actions are taken, it will not achieve these ARARs at all locations. The remedial actions included in the Selected Remedy are expected to result in the achievement of cleanup levels for soil and sediments where actions are taken.

Consistent with 40 *Code of Federal Regulations* (CFR) 300.430(a)(ii)(B) and 40 CFR 300.430(f)(1)(ii)(C)(1), this Selected Remedy, an interim action, is neither inconsistent with nor precludes implementation of a final remedy that will attain ARARs. The final remedy will be identified in subsequent decision documents.

Significant changes from EPA's Preferred Alternative identified in the Proposed Plan to the Selected Remedy described in this ROD Amendment include the following:

- **Reduction in scope from 345 mine and mill sites to 145.** The scope of the Selected Remedy has been significantly reduced from the Preferred Alternative. A site-by-site review was conducted to identify the highest-priority sites for remedial action, and those are included in the Selected Remedy. The PFT helped prioritize the actions to include in the Selected Remedy. This site-by-site review is described in detail in the FFS Report (EPA, 2012). Key considerations for this review included: (1) prior remedial actions and the effectiveness of those actions; (2) current active land use; (3) potential human health risks; (4) downstream water quality; (5) site-specific data such as location, contaminant concentrations,[4] riparian acreage, and erosion potential; and (6) the volume of waste material.

- **Changes to estimated contaminant volumes and typical conceptual designs (TCDs) for Ninemile Creek.** In keeping with EPA's adaptive management approach for the Upper Basin, pre-design investigation work was conducted in the Ninemile Creek drainage in the summer of 2011. The results of this investigation are detailed in the FFS Report (EPA, 2012). The investigation identified areas within the Ninemile Creek drainage that could serve as local waste consolidation areas. Local consolidation helps reduce the volume of contaminated material trucked to a regional repository. Waste consolidation areas will differ from the centrally located repositories discussed in the

[4] The review of site-specific contaminant concentrations included data collected following the publication of the Proposed Plan in the summer of 2011 at select source sites in the Upper Basin. The results of this sampling effort are documented in the FFS Report (EPA, 2012).

Proposed Plan. Waste consolidation areas will be set up in tributary watersheds (e.g., the Ninemile and Canyon Creek Watersheds) where significant volumes of waste are already present from historical mine and mill site operations, and enough space is available to dispose of the waste for long-term protectiveness. Data collected during the pre-design investigation work also provided updated, more accurate estimates of contaminated waste volumes at specific sites. Site data and associated costs have been updated based on this new information.

- **Changes to the water collection actions between Wallace and Elizabeth Park.** Hydraulic isolation and groundwater collection actions along the SFCDR between Wallace and Elizabeth Park (a reach over 10 miles long) were included in the Preferred Alternative in the Proposed Plan. These remedial actions are not included in the Selected Remedy. Instead, the Selected Remedy will include construction of a groundwater interception drain only in the Osburn area (a reach less than 1 mile long). Sediment removal actions included in the Preferred Alternative are retained in the Selected Remedy for the Osburn area and selected areas along the mainstem of the SFCDR. It is expected that sediment removal actions through the Osburn area will be implemented prior to construction of the groundwater interception drain.
- **Removal of sites with active facilities from the Selected Remedy.** The Selected Remedy does not include remedial actions at active facilities. Active facilities include mining operations as well as other types of commercial and industrial active land use.
- **Removal of sites where previous cleanup actions have been implemented.** There are a number of sites within the Upper Basin where cleanup actions have previously been conducted as a removal action or as part of the 2002 ROD for OU 3 (EPA, 2002), but the effectiveness of those cleanup actions is still being evaluated through routine monitoring and the CERCLA-required Five-Year Review process. Most of these sites were included in the Preferred Alternative but are not included in the Selected Remedy. The potential need for additional cleanup actions at these sites will be evaluated through the Five-Year Review process, consistent with the NCP. If it is determined that more actions are needed, they will be implemented by EPA under the existing authority of the 2002 ROD.
- **Additional mine and mill site characterization**. Following EPA's consideration of stakeholder comments on the Proposed Plan and input from the Basin Commission and the Upper Basin PFT, additional characterization of a number of sites within the Upper Basin was conducted during the summer of 2011. Based on the results of the focused characterization sampling, 42 sites where contaminant concentrations in soil samples were found to be below screening levels were removed from the Selected Remedy.
- **Updates to stream and riparian cleanup actions**. Following its consideration of public and stakeholder comments received on the Proposed Plan, and as part of its effort to reduce the scope of the Preferred Alternative, EPA further evaluated reaches of the SFCDR designated for sediment removal and follow-on stream and riparian stabilization actions. These included seven reaches of the SFCDR between Mullan and Wallace, three reaches of the SFCDR through Wallace, and two reaches of the SFCDR through Kellogg in the Bunker Hill Box. Based on this evaluation, EPA decided to change certain components of these proposed actions. The FFS Report (EPA, 2012) documents the re-

evaluation and the changes made to the stream and riparian stabilization TCDs that had been included in the Draft Final FFS Report (CH2M HILL, 2010) and the Proposed Plan.

3.0 Responsiveness Summary Overview

This section provides responses to general categories of comments received during the public comment period. For each category, there is a comment summary followed by the response from EPA. For more complex categories, a simple summary response is followed by the complete and detailed response. Section 4.0 of this Responsiveness Summary contains specific responses to individual comments.

3.1 Community Involvement and Community Concerns

3.1.1 Community Participation in the Remedy Selection Process

Comment Summary: Comments were received questioning whether EPA has allowed for sufficient community participation. Some of those comments criticized the length of the initial comment period and the fact that only one public meeting was scheduled.

EPA Response: EPA's efforts towards meaningful community participation are described in Section 1.0 above. The length of the initial comment period on the Proposed Plan was set by EPA at 45 days instead of the usual 30 days, largely because EPA recognized that there would be a high level of community interest in the Proposed Plan. Based on requests from the public after the Proposed Plan was issued, the comment period was extended 90 additional days, for a total of 135 days. During the comment period EPA held three informal open houses, hosted a formal public comment meeting that was transcribed, attended community meetings, and hosted a public tour of some of the sites included in the Proposed Plan. EPA also participated in U.S. Senator Crapo's Town Hall meeting in Kellogg and the Wallace Town Hall meeting sponsored by the mayors of Upper Basin communities.

Between the time that the Proposed Plan comment period ended and publication of this ROD Amendment, EPA carefully considered comments received on the Proposed Plan and made the decision to significantly reduce the scope of the Selected Remedy. EPA will continue to work with the Basin Commission, the Upper Basin PFT, and other stakeholders during implementation of the Selected Remedy.

3.1.2 Future Development and Land Use in the Silver Valley

Comment Summary: Comments were received stating that the cleanup plan will have a negative impact on development in the Silver Valley. Additional comments stated that the plan gives EPA too much control over the future of the Silver Valley.

EPA Response: EPA believes that the cleanup will benefit the local economy in a variety of ways. The Selected Remedy will boost economic growth by significantly improving the environment for residents and tourists, creating jobs with the money that will be spent on the Upper Basin cleanup, and providing opportunities for currently contaminated land to be redeveloped. Retail development in Smelterville, the Galena Ridge golf community, and the Trail of the Coeur d'Alenes are examples of the types of redevelopment that can occur on remediated properties.

Since 1985, millions of dollars have been spent on cleanup, primarily for yard remediation and cleanup in the Upper Basin, including the Bunker Hill Box. Significant spending will continue for the cleanup actions in the Upper Basin. EPA encourages the hiring of local businesses and workforce for the cleanup work.

Cleanup of additional properties in the Silver Valley will provide opportunities for development that do not currently exist. EPA is committed to working with the mining industry and Silver Valley businesses and landowners to conduct the cleanup in ways that are consistent with the current and future land uses desired by the community. Throughout the cleanup, there have been and will continue to be timely opportunities for the public and local government to provide input through the established Basin Commission process.

3.1.3 Working with the Mining Industry

Comment Summary: Comments were received expressing concern that the cleanup would threaten current and future mining jobs. Some of those comments requested that EPA protect current and future mining opportunities.

EPA Summary Response: EPA is confident that cleanup and mining can continue together in the Upper Basin. Where Superfund cleanup is planned in areas that are being currently mined, developed, or expanded, EPA will coordinate its work with the property owners. This approach will limit disruption to active facilities.

EPA Response: EPA is confident that cleanup and mining can coexist. The Upper Basin cleanup will address *historical* contamination from mining activities that began in the 1880s. Historical mine waste disposal practices were much different than they are today. For example, until 1968, significant amounts of mine wastes were discharged directly into creeks and rivers. This widespread contamination from past mining and smelting activities led to the necessity of CERCLA cleanup actions. Today, ongoing mining activities are regulated by state and federal laws other than CERCLA.

In response to public comments and concerns, this Upper Basin ROD Amendment clarifies the decision process for whether CERCLA cleanup actions will be conducted at "Active Facilities" (i.e., mining facilities, among others). This process was developed through cooperation among EPA, the Idaho Department of Environmental Quality (IDEQ), and the community members and stakeholders involved in the Basin Commission's Upper Basin PFT. For the purposes of this ROD Amendment, an Active Facility is defined as a property where the owner is actively managing the risk of a release, or potential release, of a hazardous substance through regulatory mechanisms outside CERCLA that enforce compliance to protect human health and the environment. Active Facilities will continue to operate under those governing regulations and will be required to address the release of hazardous substances, as necessary, under those governing regulations. The Selected Remedy does not include Active Facilities, and CERCLA cleanup actions will not be conducted at Active Facilities unless data indicate that a release of hazardous substances has occurred or is occurring from a facility that poses risks to human health or the environment, and that this release is not being satisfactorily managed or addressed by the facility under an existing regulatory program.

EPA is confident that cleanup and mining can continue together in the Upper Basin. One of the provisions of the Consent Decree between Hecla and EPA is for both parties to attend an annual planning meeting to coordinate the cleanup with ongoing exploration or development by Hecla. EPA is willing to coordinate with other mining companies in the Upper Basin in a similar way, and welcomes further discussions with them.

Cleanup is not expected to restrict future mining and exploration in the Silver Valley. EPA is aware that mining has been an important part of the history and economy of the Silver Valley and will continue to be in the future. EPA also understands that mining companies need certainty for planning and investing, and is committed to completing cleanup actions in ways that allow mining operations to continue in compliance with environmental regulations.

3.2 Risk and the Cleanup

3.2.1 Ecological Risks

Comment Summary: Comments were received stating that EPA has not proven the need for protection of the environment, particularly in the areas upstream from the community of Wallace.

EPA Summary Response: Millions of tons of contaminated mine wastes are spread across the Upper Basin. These historical mine wastes contain heavy metals like lead, arsenic, cadmium, and zinc. A proven and documented risk to human health and the environment exists. Many stream areas have metal levels high enough to kill and/or prohibit a healthy fish population. Many fish have high levels of metals in their tissue. Birds die every year from poisoning as the result of swallowing lead. Heavy metals also harm mammals, amphibians, and plants. EPA has a regulatory responsibility to address these risks.

EPA Response: EPA is required under CERCLA, the Superfund law, to address unacceptable risks to human health and the environment at the Bunker Hill Superfund Site. Protecting human health remains EPA's highest priority. While significant cleanup to address human health risks has taken place in the Upper Basin, there is still contamination in soil, sediments, groundwater, and surface water that poses risks to people, wildlife, and the environment. The levels of contamination significantly exceed regulatory and site-specific water quality standards. Contaminants include lead, zinc, cadmium, arsenic, and other metals. Millions of tons of old mill tailings, mine waste rock, and ore concentrates are spread across the Upper Basin. There is substantial documentation of the contamination levels and the risks posed.[5]

For example, the results of the 2001 Ecological Risk Assessment (EcoRA, CH2M HILL and URS Greiner, 2001), as well as more recent monitoring, show that most watersheds in which mining has occurred and a large portion of the Upper Basin downgradient from mining areas are ecologically degraded as a direct or secondary effect of mining-related hazardous substances. This ecological degradation has resulted in demonstrated, observable effects in the Basin. The results of the EcoRA also show that if remediation is not conducted in the

[5] See the Remedial Investigation and Feasibility Study Reports for the Coeur d'Alene Basin (EPA, 2001b, 2001c); *Superfund and Mining Megasites: Lessons from the Coeur d'Alene Basin* (National Academy of Sciences, 2005); the 2010 Five-Year Review Report for the Bunker Hill Superfund Site (EPA, 2010b); and the Focused Feasibility Study (FFS) Report for the Upper Basin (EPA, 2012).

Basin, effects can be expected to continue for the foreseeable future. High concentrations of metals are pervasive in the soil, sediments, and surface water. These metals pose substantial risks to the animals and plants that inhabit the Basin. Impacts were evaluated for more than 80 different species, representing many trophic levels and hundreds of exposed species. Species evaluated included "special-status species," such as those listed by USFWS as endangered or threatened under the ESA. The overall conclusion is that heavy metals, primarily lead and zinc, present significant ecological risks to most ecological receptors throughout the Basin, including fish, birds, mammals, amphibians, terrestrial and aquatic plants, soil invertebrates, and microbial soil processes.

Fish and birds were determined to be most vulnerable receptor classes, as noted below.

3.2.2 Fish and Aquatic Organisms

- Based on historical information, approximately 20 miles of the SFCDR and 13 miles of its tributaries are unable to sustain reproducing fish populations. Some areas are essentially devoid of fish and other aquatic life in the area of the mining impacts.
- Impacted species include the native bull trout, which is listed as "threatened" under the ESA.
- Some expected fish species (e.g., sculpin) are absent from areas due to high metals concentrations.
- Exposure of aquatic organisms to metals was confirmed by the presence of elevated concentrations of metals in fish tissue.
- Based upon comparison of metals concentrations to acute AWQC, surface waters are commonly lethal to some aquatic life in several areas.
- Based upon comparison of metals concentrations in surface waters to chronic AWQC, growth and reproduction of surviving aquatic life would be substantially reduced in numerous areas.
- Site-specific toxicity testing and/or biological surveys indicate lethal effects of waters or reduced populations of aquatic life.
- Bull trout and westslope cutthroat trout are evaluated on an individual level due to ESA concerns. The toxicity for some individuals can occur at levels below the AWQC, particularly in areas with low hardness.
- Toxic effects of contaminated sediments are believed to contribute to adverse effects on aquatic life.

3.2.3 Birds

- Risks to health and survival from at least one metal in at least one area were identified for 21 of 24 avian representative species.
- Potential risks to fish-eating birds are noted in the Upper Basin.
- Lead and zinc present the greatest risks to birds in the Coeur d'Alene Basin.

- Lead poisoning has been documented in Basin waterfowl year-round in the floodplain stretching from Smelterville to Coeur d'Alene Lake.
- In the Lower Basin of the Coeur d'Alene River, lead poisoning (primarily due to ingestion of contaminated sediments) is responsible for 96 percent of the total tundra swan mortality, compared to 20 to 30 percent (primarily due to ingestion of lead shot) at the Pacific flyway and national level.
- Risks to health and survival from at least one metal in at least one area were identified for 21 of 24 avian receptor species (CH2M HILL and URS Greiner, 2001a).
- The number of waterfowl carcasses found in 1997 represents the largest documented die-off in the Lower Basin since 1953. The Upper Basin is a significant source of contaminated sediments that are deposited in the Lower Basin. Deaths by lead poisoning from the ingestion of contaminated soil and sediments are expected to continue.
- The USFWS songbird study (Hansen, 2007; Hansen et al., 2011; USFWS, 2008b), and focused EcoRAs (CH2M HILL, 2006d; Sample et al., 2011) confirmed that ground-feeding songbirds in the Coeur d'Alene Basin are accumulating lead in blood and liver tissue from ingesting lead-contaminated soil at levels that show injury to songbirds.
- EPA made a risk management decision to use a site-specific protective value of 530 milligrams per kilogram (mg/kg) lead in soil and sediments as the benchmark cleanup level for the protection of waterfowl that would also be protective of songbirds.

The Upper Basin cleanup is essential to reducing these risks. That said, EPA recognizes that some areas of the Upper Basin have higher levels of contamination than others. This fact is reflected in the prioritization of remedial actions for the interim Selected Remedy, with the majority of the work expected to occur in Ninemile and Canyon Creeks, Osburn, and the Bunker Hill Box.

3.2.4 Human Health Risks

Comment Summary: Comments were received questioning whether there is a substantial risk to human health, and concluding that cleanup actions are not warranted.

EPA Summary Response: There are serious risks to human health from heavy metal contamination in the Basin. The risks are well documented, and EPA has a regulatory responsibility to address these risks. Lead is of most concern, especially for young children and pregnant women. Though some cleanup has been done, there is more work to do to protect human health. Cleaning up contamination in the Upper Basin will reduce the amount of metals that flows downstream into communities. Also, some of the work done under this ROD Amendment will help keep cleaned-up areas clean. For example, it will address tributary flooding, which can spread contamination.

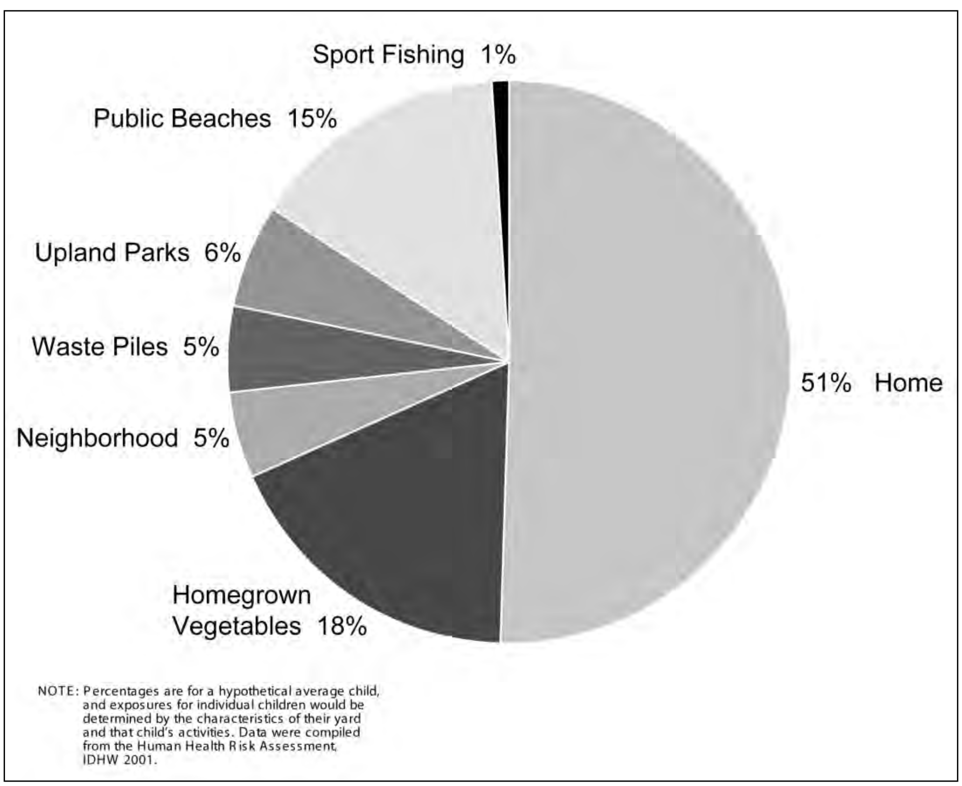
EPA Response: EPA and other agencies have done many studies over the years that document the human health risks posed by contamination in the Coeur d'Alene Basin.[6] The

[6] See footnote 5.

primary human health concern in the Upper Basin is excessive lead in the blood of young children and pregnant women. Site-specific analysis of blood lead data paired with environmental lead data demonstrate that complex exposure pathways exist. There is a direct correlation between exposure to lead in soil and dust and blood lead levels. For example, children's blood lead levels can be predicted based on the level of lead in the soil of their yard (von Lindern et al., 2003). It is also known that short-term (such as weekend) exposures to lead contamination along the Coeur d'Alene River have caused elevated blood lead levels.

The effect of greatest concern is lead's potential to cause adverse neurological developmental effects in children. The 2001 Human Health Risk Assessment (HHRA, Idaho Department of Health and Welfare [IDHW], 2001) described contributions that the various exposure pathways and media made to the lead risk by showing the percentages that each pathway or medium would contribute to the average child's exposure. The pie chart below shows the percentage of lead that an average hypothetical child would have received from each of the lead sources in the entire Coeur d'Alene Basin at that time (2001). Since this chart was developed, the contributions to lead exposure from the home have decreased significantly as the result of the implementation of the portions of the existing Selected Remedies focusing on protection of human health for OUs 1, 2, and 3. However, the chart remains useful in indicating that the combination of outside areas (which, for the most part, have not yet been remediated), such as parks, beaches, fishing sites, and waste sites, represented approximately 30 percent of the total lead exposure scenario to this hypothetical child. This exposure potential supports the point that not only ecological receptors, but also human health, remain at risk from the widespread contamination present in the Upper Basin environment.

AVERAGE CHILD'S BASIN-WIDE LEAD EXPOSURE



In response to risks posed by lead, EPA has prioritized cleanup actions to reduce human health exposures in residential areas. Although risks have been greatly reduced through cleanup activities completed to date, more work is needed to address the continued transport of lead from Upper Basin sources, along the SFCDR floodplain and into Coeur d'Alene Lake. EPA is committed and required by CERCLA to address the remaining unacceptable human health risks in the Upper Basin.

In addition, CERCLA Five-Year Reviews have found that some of the existing Selected Remedies focusing on human health for OUs 1, 2, and 3 (EPA, 1991a, 1992, and 2002, respectively) are vulnerable to degradation due to tributary flooding (EPA, 2010b). The remedy protection actions included in the Upper Basin Selected Remedy will protect these existing remedies from SFCDR tributary flooding and maintain the protective barriers needed to reduce risks to human health in residential areas. Basin-wide flooding issues (including SFCDR and Pine Creek flooding) are discussed further in Section 3.3.2.

3.2.5 Human Health Risks Already Addressed in the 2002 ROD for OU 3

Comment Summary: Comments were received stating that of the large amount of money projected for cleanup in the Upper Basin, only $3 million will be spent on new projects designed to protect human health. Some of those comments also stated that EPA identified human health risks in the 2002 ROD for OU 3 that are already being addressed through work that is nearly complete.

EPA Summary Response: Protecting human health is still EPA's highest priority. The Selected Remedy will spend nearly $34 million on remedy protection work that is designed to safeguard people's health in residential areas. Other parts of the cleanup will result in cleaner, healthier recreational areas. The "ecological" cleanup work also will benefit public health by reducing the amount of contamination that flows downstream into communities and recreational areas.

EPA Response: EPA has consistently stated and shown that protection of human health in the Coeur d'Alene Basin is its highest priority. Since the ROD for OU 3 was issued in 2002, EPA has carried out the majority of the Selected Human Health Remedy identified in that ROD in the residential areas of the Upper Basin. In addition, to date, millions of dollars have been spent implementing the remedies focused on the protection of human health described in the RODs for OUs 1, 2, and 3. The Selected Remedy for OU 1 focusing on protection of human health, described in the 1991 ROD and performed by the Upstream Mining Group under a 1994 Consent Decree, has been certified complete. Additional human health actions in the Upper Basin are ongoing. Although human health is the highest priority, EPA is (as noted above) also required to address the significant risks to the environment that still exist.

It is not correct that "only $3 million" will be spent on new projects designed to protect human health." The Upper Basin Selected Remedy includes an estimated $33.8 million for remedy protection work in the Upper Basin. Remedy protection is intended to protect the existing human health clean soil barriers (e.g., remediated yards and rights of way) within Upper Basin communities from tributary flooding and high-precipitation events. In addition to the remedy protection work, cleanup actions that address mine waste contamination within drainage areas accessible for recreational use will protect human health and improve surface water quality. Common recreational activities in the Coeur d'Alene Basin include hiking, fishing, hunting, boating, swimming, and all-terrain-vehicle riding. As noted in Section 3.2.2, exposure to lead contamination can cause elevated blood lead levels and resulting adverse neurological effects. EPA has also found that elevated blood lead levels can occur within relatively short exposure periods (such as through recreational exposure to contamination located along the SFCDR, on waste piles, etc.). The Selected Remedy will provide clean surface soil in contaminated areas and reduce particulate lead loading to surface water. In these ways, the Selected Remedy will further reduce the risks people may be exposed to during recreational activities.

3.3 Scope and Role of Cleanup Actions

3.3.1 Scope of Cleanup Actions

Comment Summary: Comments were received stating that EPA claims the cleanup actions will protect drinking water, but the cleanup plan is not about drinking water.

EPA Response: The State of Idaho has identified drinking water as a designated beneficial use for the surface water of the Idaho portion of the Coeur d'Alene Basin. A deep groundwater aquifer and clean surface water tributaries are used as drinking water sources in the Upper Basin. EPA has not focused the Selected Remedy for the Upper Basin on drinking water. Past cleanup plans described in the RODs for OUs 1, 2, and 3 (EPA, 1991a, 1992, and 2002, respectively) have already addressed immediate residential drinking water issues.

The Upper Basin Selected Remedy is expected to result in significant improvements to surface water quality in the SFCDR and its tributaries. In the case of the SFCDR, the ARARs that will protect the environment include site-specific AWQC. These criteria were developed by the State of Idaho to protect aquatic life. The water quality standards to protect the environment are more stringent than drinking water standards (i.e., MCLs) for contaminants of concern in the Basin. There is one exception—mercury— but it has not been found to be prevalent in the Upper Basin. Therefore, EPA believes that achieving ARARs will inherently have a potential drinking water benefit. Furthermore, although the Selected Remedy is expected to result in significant improvement to groundwater quality, it is not intended to achieve groundwater MCL ARARs under the Safe Drinking Water Act at all locations in the Upper Basin.

3.3.2 Basin-Wide Flooding Concerns

Comment Summary: Comments were received stating that EPA should address potential flooding concerns associated with the SFCDR and Pine Creek to protect the existing protective barriers.

EPA Summary Response: EPA's cleanup program does not have the regulatory authority to do comprehensive flood control. But where there is a direct connection to the remedy, EPA can make contributions to local flood control work. EPA will work with local jurisdictions to identify ways to coordinate efforts.

EPA Response: Comprehensive flood control is a complex multi-jurisdictional issue that exceeds the expertise and regulatory authority of EPA's CERCLA cleanup program. EPA is eager to ensure the long-term performance of the protective barriers implemented to protect human health and understands that local communities are concerned about flood insurance requirements and development restrictions associated with updated Flood Insurance Rate Maps (FIRMs). EPA is therefore committed to working with local, state, and federal entities with an interest in SFCDR and Pine Creek flooding issues to help craft solutions. EPA can and will contribute to efforts to understand SFCDR and Pine Creek flooding issues and may select actions, consistent with EPA's authority, that complement broader flood control measures. CERCLA requires that EPA's contribution to flood control work must have a direct connection to the CERCLA remedy. The inclusion of remedy protection projects in the Upper Basin Selected Remedy is an example of EPA and IDEQ working with local communities to identify flood control projects directly tied to the existing Selected Remedies focusing on human health for OUs 1, 2, and 3.

During site characterization and remedial design of remedy protection, source control, and water quality projects, EPA will continue to coordinate with local communities and flood control authorities, the Basin Commission, the U.S. Army Corp of Engineers (USACE), and the Federal Emergency Management Agency (FEMA). This coordination will ensure that cleanup actions do not exacerbate flooding concerns along the SFCDR and Pine Creek, and will leverage future work by the various entities involved in SFCDR and Pine Creek activities. Where planning and logical work sequencing allow, EPA will work collaboratively with other entities performing flood control projects to coordinate the cleanup work in a manner that provides joint benefits.

In addition, EPA will implement the Upper Basin Selected Remedy in compliance with ARARs and will refer to information "to be considered" (TBC), including official documents that address flooding such as Executive Order 11988, Protection of Floodplains. Among other things, Executive Order 11988 requires federal agencies performing actions within a floodplain to minimize potential harm to or within the floodplain and to avoid long- and short-term adverse impacts caused by floodplain modifications. Thus, as cleanup work is carried out within the floodplains of the SFCDR and Pine Creek, efforts will be made to comply with the mandate of that Executive Order.

There is also an important role for state and local leaders to play. For example, the Idaho Department of Water Resources (IDWR) can make an important contribution through work under its Risk Mapping, Assessment, and Planning (MAP) grant administered by FEMA. Via this program, IDWR is prioritizing drainage areas within the State of Idaho for additional data gathering to support FIRM updates. IDWR's support to prioritize SFCDR data needs is a vital step toward ensuring accurate FIRM mapping. A key to understanding flood risks throughout the complex SFCDR Watershed is performance by USACE of a General Investigation/Feasibility Study (GI/FS), a currently unfunded project. The GI is an established, and a most appropriate, process to gain Basin-wide understanding of the hydrology, hydraulics, flood risks, and measures to mitigate those risks. This understanding is vital to promoting a river system whose flood mitigation structures will not adversely impact other portions of the system. Because EPA is interested in ensuring the long-term performance of all Selected Remedies within the Bunker Hill Superfund Site, EPA will continue to work with those entities whose missions and expertise address large-scale flooding.

3.4 Remedial Action Objectives

3.4.1 Biological Aquatic Benchmarks and Water Quality Criteria

Comment Summary: Comments were received recommending the use of biological benchmarks in addition to or instead of the surface water quality criteria.

EPA Response: In addition to cleanup levels as discussed in Section 12.1.4.1 of the Decision Summary in Part 2 of this ROD Amendment, EPA, in collaboration with the Natural Resource Restoration Team (the Coeur d'Alene Tribe, BLM, USFWS, USFS, and the State of Idaho) has developed ecological response metrics for evaluating remedial progress during the implementation period for the Selected Remedy (Stratus Consulting, 2012). The AWQC remain the ARARs for surface water and the basis for quantitative cleanup levels. Ecological response metrics are refined in part from the fishery tiers included in the 2002 ROD for OU 3, and reflect the current understanding of the river system. Fishery tiers were developed to provide a relationship between dissolved metals concentrations in surface water and the health of fisheries (i.e., the abundance of fish species, age of fish, fish migration, etc.) in the Upper Basin (CH2M HILL and URS Greiner, 2001b).

Identification of measurable ecological response metrics will provide EPA with a means to evaluate, predict, and report on environmental improvements associated with remedial actions planned and implemented in the Upper Basin. The ecological response metrics are intended to serve as estimated measures of change and are not considered ARARs. The intent of such ecological response metrics is limited to providing EPA and the public with the following:

- Tools to estimate potential environmental and ecological improvements that could result from specific remedial actions;
- Target receptors to evaluate environmental recovery; and
- A means for measuring environmental recovery and progress toward cleanup levels during and after the implementation of remedial actions.

For more information on the ecological response metrics, see Section 12.3.6 of the Decision Summary in Part 2 of this ROD Amendment.

3.4.2 Water Quality Criteria

Comment Summary: Comments were received expressing doubt as to whether the cleanup actions could ever achieve the site-specific water quality criteria. Some of those comments recommended that EPA pursue an ARAR waiver.

EPA Summary Response: The Selected Remedy will improve surface water quality in the Upper Basin. However, it may not achieve ARARs at all locations. If EPA determines that aquatic life is being protected by cleanup criteria that are less stringent than the applicable water quality standards, an ARAR waiver may be proposed. However, it is not appropriate to seek an ARAR waiver now, before any substantive cleanup has taken place.

EPA Response: EPA is required by CERCLA to carry out the cleanup to meet ARARs unless these are waived. An ARAR can only be waived if the waiver results in a cleanup that is protective of human health and the environment. In the case of the Upper Basin cleanup, water quality standards have been identified as ARARs to protect aquatic life.

The ARARs for protection of the environment in the Upper Basin are the site-specific surface water quality standards for cadmium, lead, and zinc developed by the State of Idaho (Idaho Administrative Procedures Act [IDAPA] 58.01.02.285). The site-specific criteria for lead and zinc are higher than the federal and state-wide criteria for protection of aquatic life, although they have been demonstrated to provide a comparable level of protectiveness within the SFCDR Watershed. The site-specific cadmium criterion is lower than the federal and state-wide criteria.

As described in Sections 4.0 and 12.0 of the Decision Summary in Part 2 of this ROD Amendment, EPA has decided to reduce the scope of its Preferred Alternative (identified in the Proposed Plan) in the Upper Basin Selected Remedy. As a result of this reduction in scope, the Selected Remedy is not expected to fully address surface water contamination at all locations in the Upper Basin. The Selected Remedy is an interim, not a final, remedy for the Upper Basin. The Selected Remedy is expected to result in significant improvements to surface water quality in the Upper Basin and may achieve AWQC ARARs under the Clean Water Act in many locations following periods of natural recovery; however, it may not achieve these ARARs at all locations.

The Selected Remedy satisfies CERCLA's protectiveness criteria as applied to an interim remedy. The level of protectiveness provided by an interim remedy is evaluated by the scope of its actions. Accordingly, the Selected Remedy, by its nature, need not be as protective as the final remedy is required to be under the statute. The level of protection that the Selected Remedy will provide is commensurate with the scope of the remedy, and the Selected Remedy will be protective in the context of its scope, even though it does not, by itself, meet the statutory protectiveness standard that a final remedy would meet. Subsequent actions may need to be taken for the overall remedy for the Upper Basin to be considered final. Consistent with 40 CFR 300.430(a)(ii)(B) and 40 CFR 300.430(f)(1)(ii)(C)(1), this Selected Remedy, an interim action, is neither inconsistent with nor precludes implementation of a final remedy that will attain ARARs. The final remedy will be identified in subsequent decision documents.

In EPA's experience at complex sites such as the Bunker Hill Superfund Site, it is reasonable to expect that considerable time will be necessary to achieve cleanup. Significant uncertainty is associated with predicting cleanup times at such sites. For complex sites like these, EPA typically examines the magnitude and extent of contamination, selects and implements remedies, and then collects empirical data over time to assess the effectiveness of the remedies. EPA uses interim benchmarks and ongoing monitoring to assess water quality and aquatic life. If EPA determines that aquatic life is being protected by cleanup criteria that are less stringent than the water quality standards, an ARAR waiver can be pursued. Although it is possible that future data may indicate that ARAR waivers are appropriate in the Upper Basin, it is not appropriate to attempt to invoke them now before any substantive cleanup has taken place and before data are collected to show that the cleanup is protective.

Benefits to aquatic life will begin much sooner than when AWQC are finally met. As cleanup actions move forward, reducing metals concentrations, aquatic conditions will improve and benefits will accrue as concentrations drop further over time. Such benefits will occur much sooner with more aggressive cleanup actions. Although the results of early cleanup actions will likely not achieve AWQC or fully support aquatic life, the reduced dissolved metals concentrations will bring a substantial improvement to the health of the fisheries and the overall ecosystem. The populations and species diversity of fish and aquatic organisms will continue to improve as cleanup progresses in the Upper Basin.

3.5 Remedy Selection Process

3.5.1 State Legislator Input

Comment Summary: Comments were received requesting that EPA allow sufficient time and opportunity for the Idaho State Legislature to formally review the cleanup plan.

EPA Response: EPA's decision-making process was a careful and collaborative effort consistent with the NCP and included input from state and local governments, Tribes, other federal agencies, the Basin Commission, and the public. Details of EPA's efforts to obtain public and stakeholder input are provided in Section 3.1.1. As required, EPA received public comments on its Proposed Plan. CERCLA requires an initial public comment period of 30 days for proposed plans; however, anticipating high public interest, EPA set the initial public comment period for the Upper Basin Proposed Plan at 45 days. In response to requests for an extension, EPA increased the comment period an additional 90 days, for a total of 135 days. During that time, some members of the Idaho State Legislature reviewed and submitted formal comments on the Proposed Plan. EPA has responded to those comments in Section 4.0 of this Responsiveness Summary.

3.5.2 National Academy of Sciences Recommendations

Comment Summary: Comments were received expressing concern that the cleanup plan ignored recommendations from the National Academies of Sciences (NAS) review completed in 2005.

EPA Summary Response: EPA carefully considered the NAS report and its recommendations. Furthermore, EPA collected additional data and conducted studies to address some of the key NAS recommendations. The results of those efforts are reflected in the Upper Basin Selected Remedy.

EPA Response: In 2002, Congress instructed EPA to ask the National Research Council (NRC) to conduct an independent evaluation of the Bunker Hill Superfund Site. The NRC established the Committee on Superfund Site Assessment and Remediation in the Coeur d'Alene Basin to evaluate the 2002 ROD for OU 3 (EPA, 2002) and supporting documents, and to examine EPA's scientific and technical practices at the Site. NAS issued its resulting report in 2005 (NAS, 2005).

The report's conclusions and recommendations cover the remedial investigation, human health risk assessment, and ecological risk assessment of the Coeur d'Alene Basin, and remediation objectives and approaches. Many of the recommendations relate to EPA's approach to protection of the environment presented in the 2002 ROD for OU 3 and the 2001 Feasibility Study (FS) Report (EPA, 2001c). The NAS review validated much of the 2002 ROD for OU 3, and the recommendations for areas of improvement primarily focused on ecological protection. EPA carefully considered the NAS report and its recommendations, and conducted studies and evaluations to address the major recommendations. The results of those efforts are reflected in the actions identified in the Upper Basin Selected Remedy. EPA believes the Selected Remedy presented in the ROD Amendment addresses the NAS report's recommendations, while recognizing EPA's statutory obligations under CERCLA.

Since the ROD for OU 3 was issued in 2002 and the NAS report in 2005, EPA has continued to collect environmental data and conduct additional studies throughout the Coeur d'Alene Basin, particularly in the Upper Basin. The additional data and studies have improved EPA's understanding of the Upper Basin and enabled EPA to address key NAS recommendations involving the fate and transport of dissolved metals in the subsurface; the role that groundwater plays in contaminant loading to surface water; approaches to groundwater treatment; the development of predictive tools to assess the effectiveness of remedial actions; evaluation of the SFCDR Watershed as a whole, including the Bunker Hill Box; and improving the use of the adaptive management approach.

3.6 Remedy Effectiveness

3.6.1 Predictive Analysis

Comment Summary: Comments were received questioning the use of the Predictive Analysis (PA) to estimate remedial effectiveness and stating that it has fundamental flaws in its assumptions and methodology.

EPA Summary Response: The PA uses a straightforward accounting process to sum up the contributions of upstream sources to downstream metal loads. The analysis combines existing information about the Upper Basin with scientific understanding of environmental processes. Detailed historical monitoring data on stream flows, contamination levels, and other environmental conditions are limited for the purposes of analyzing and predicting natural conditions. As a result, professional judgment is required to interpret data and to help estimate values, which is standard practice in scientific and regulatory modeling. EPA believes that the PA is an appropriate tool for comparing the relative effectiveness of remedial alternatives for the Upper Basin.

EPA Response: The PA is a tool that can be used to estimate how effective proposed remedial actions will be in relation to projected improvements to surface water quality. The PA was first developed to support the evaluation of alternatives in the 2001 FS Report (EPA, 2001c). It was later used to support evaluations in the ROD for OU 3 (EPA, 2002) and the FFS Report for the Upper Basin (EPA, 2012). The Upper Basin covers a large geographic area, and predicting the potential effectiveness of hundreds of individual remedial actions across the entire Upper Basin presents a significant challenge. The PA provided a means of addressing this challenge. Using the basic principle of mass balance (i.e., if 10 lb. of zinc are present at a site and 9 are removed, 1 lb. remains), the PA provided estimates of remedial effectiveness on an Upper-Basin-wide scale that could be used in comparing alternatives.

The development of the PA (referred to as the Probabilistic Analysis at the time of the 2002 ROD for OU 3) was first documented in a 2001 technical memorandum, *Probabilistic Analysis of Post-Remediation Metal Loading* (URS Greiner, 2001). The PA and associated documentation were reviewed as part of the NAS review (NAS, 2005, Appendix F). That review raised questions about the methods and assumptions used to develop the PA. Following the NAS review, EPA sought an independent review of the PA by a well-known leader in the field of probabilistic modeling, Dr. Gregory B. Baecher, University of Maryland, A.J. Clark School of

Engineering (College Park, Maryland). The purpose of Dr. Baecher's review was to address questions raised by the NAS review.

Dr. Baecher's review validated EPA's use of the PA in the evaluation and comparison of remedial alternatives. This review culminated in a second memorandum, *A Predictive Analysis of Post-Remediation Metals Loading* (EPA, 2007), which provided clarification and additional documentation related to the PA. However, the fundamentals of the analysis have remained unchanged since it was first developed for the 2001 FS. The following is an excerpt from Dr. Baecher's transmittal letter for the 2007 memorandum, which summarizes his findings related to the PA:

> *"In my opinion, the Predictive Analysis strikes a reasonable balance between the needs of the Remedial Investigation and Feasibility Study (RI/FS) to chart a course forward, and the difficulty of acquiring sufficient data on the basin from which to analyze conditions in a statistically exhaustive way. The approach taken by the Predictive Analysis is the traditional one of using professional judgment – both engineering and scientific – to form assumptions and to make estimates of parameter values, boundary conditions, and initial conditions. In my opinion, this is sound engineering practice."*

The PA was used in the FFS to provide approximations of the aggregated effects of specific upstream remedial alternatives on downstream metal loadings at two locations (Elizabeth Park and Pine Creek) for use in evaluating and comparing the alternatives considered. A comparative analysis of remedial alternatives is required under the NCP when EPA is selecting a remedy.

Modifications to the original PA used in 2002 were necessary to support the evaluation of alternatives in the FFS. These modifications were as follows:

- Add Elizabeth Park as a modeled location.
- Update "current" water quality conditions.
- Update source types, volumes, and remedial actions.
- Integrate estimates of load reduction from groundwater models (where appropriate).

The analysis uses a straightforward accounting scheme to sum up the contributions of upstream sources to downstream metal loads. The effect of varying remedial actions at the sources is taken into account by modifying the contributions of each source of metals entering the river. The combined effect of each of the remedial alternatives is forecast by aggregating the contributions over all the sources.

The PA combines existing information about the Upper Basin with scientific understanding of environmental processes, but neither the existing information nor the scientific understanding of environmental processes is perfect. Detailed historical monitoring data on stream flows, levels of contamination, and other environmental conditions are limited for the purposes of analyzing and predicting natural conditions in the Upper Basin. As a result, professional judgment is required to interpret data and to help estimate parameter values, which is standard practice in scientific and regulatory modeling.

Limitations in the empirical monitoring data (including sources, source volumes, and dissolved metals loading), coupled with the assignment of model parameters such as relative loading potential and treatment effectiveness (based on best professional judgment), result in estimation uncertainties. The PA uses a probabilistic approach to capture such uncertainties and propagate their combined effects through to the forecast. The known uncertainties were quantified by mathematically propagating the uncertainty of the input variables, as measured by their coefficients of variation, through the PA model to the output variables. The results are engineering approximations based on a synthesis and interpretation of available information that provide a sound basis for informed decision-making for comparing alternatives and assisting in the selection of a remedy.

EPA continues to believe that the PA is a useful tool and was appropriate for use in the comparison of the relative effectiveness of the remedial alternatives for the Upper Basin. EPA will implement the Selected Remedy in the Upper Basin using an adaptive management approach, which includes prioritization of cleanup actions. As implementation of the Selected Remedy occurs, EPA will collect considerable monitoring data which, coupled with existing data, will assist in making increasingly improved predictions regarding cleanup effectiveness. Post-ROD Amendment data collected and interpreted over time to monitor the results of remediation will be used to define changes in water quality. Such data can be compared to modeled predictions to refine the predictive process. Furthermore, as part of the adaptive management approach, EPA will evaluate the use of additional ecological response metrics to measure, predict, and report environmental cleanup progress in the Upper Basin. These findings will all be used to further refine the prioritization of cleanup actions.

3.6.2 Role of Potential New Technologies

Comment Summary: Comments were received questioning whether EPA could implement potential new technologies over the course of the cleanup to enhance the effectiveness of remedial actions.

EPA Response: The Selected Remedy will allow for the use of emergent technologies. As the cleanup is put into action, EPA will use the remedial design process combined with an adaptive management approach, periodically reviewing new information as the cleanup moves forward. "New information" may include the effectiveness of implemented remedial actions, the fate and transport of contaminants, and review of new technologies that may be applicable to the Upper Basin. Through ongoing remedial design efforts, adaptive management, and the CERCLA-required Five-Year Review process, EPA anticipates using the information gained to make adjustments to the Implementation Plan and to evaluate and implement new technologies where appropriate. Where changes to the Selected Remedy are significant, EPA will provide opportunities for public participation consistent with the requirements of Section 113(k) of CERCLA and 40 CFR Section 300.435(c). Depending on the significance of the changes in cleanup approach, there may be additional opportunities for public input.

3.7 Water Treatment

3.7.1 Stream Liners and Groundwater Collection Drains Between Wallace and Elizabeth Park

Comment Summary: Comments were received questioning whether stream liners and groundwater collection drains between Wallace and Elizabeth Park would be feasible to implement.

EPA Summary Response: Stream liners and groundwater collection drains are established technologies but, after further technical review and consideration of public and stakeholder comments, EPA has decided to change the groundwater action between Wallace and Elizabeth Park. This smaller action includes a groundwater collection drain (about 4,600 feet long) that will only be located in the Osburn area.

EPA Response: Lining streams with a synthetic geomembrane to reduce surface water flow into contaminated subsurface material, then collecting contaminated groundwater using drains before it flows into a stream, is an established technical approach called "hydraulic isolation."

In consideration of public and stakeholder comments on the Proposed Plan, EPA decided to review this part of the Preferred Alternative and decided to modify the hydraulic isolation action in this reach of the SFCDR, as documented in this ROD Amendment. The full length of the SFCDR stream liner has been eliminated. In addition, the groundwater collection drain has been shortened significantly to extend only through the Osburn area (about 4,600 feet). Interactions between surface water and groundwater and metals loading to the SFCDR are relatively well understood in this area. This is because more investigations have been conducted for the Osburn area compared to the remaining reaches of the SFCDR between Wallace and Elizabeth Park. This information has enabled actions in that area to be refined. The development of these modified actions is documented in the FFS Report (EPA, 2012).

Sediment removal actions are also included in the Selected Remedy for the Osburn vicinity and other areas along the mainstem of the SFCDR. The initial phase of remedial action in the mainstem of the SFCDR will consist of sediment removal actions followed by construction of the groundwater interception drain near Osburn to collect and convey contaminated groundwater to the CTP for active treatment.

EPA will monitor and evaluate the effectiveness of the modified approach as the remedy is carried out using the adaptive management process. Similarly, the remaining SFCDR reaches between Wallace and Elizabeth Park will be monitored to determine whether any additional action(s) may be needed to meet water quality standards or acceptable aquatic benchmarks. Any additional actions will be documented in future decision documents.

3.7.2 Value of Water Treatment as a Component of the Selected Remedy

Comment Summary: Comments were received questioning whether water treatment is needed to achieve cleanup goals and suggesting that source control actions be conducted instead of water treatment. Commenters stated that the water treatment component of the Selected Remedy is too large, too costly, and not needed.

EPA Summary Response: Water treatment will immediately improve water quality, removing a significant source of metals at relatively low cost. It also will help address the problem of contamination that cannot be removed because it is too deep or located below structures.

EPA Response: Water treatment is a key part of the Selected Remedy because it will (1) address subsurface materials too deep or impractical to be removed, (2) generally provide a high degree of metals load reduction for a relatively low cost, and (3) achieve immediate improvements to water quality.

Where feasible, source control actions will be implemented first and the effectiveness of those actions monitored and evaluated before water treatment actions are conducted in the same area. A good example of this is the groundwater interception drain in the Osburn area. Sediment removal actions will be conducted along the mainstem of the SFCDR prior to water treatment actions.

Much of the infrastructure and numerous communities within the Upper Basin have been built on top of significant amounts of mine waste, which is a major source of groundwater contamination. This underlying mine waste cannot be removed without significantly disrupting the populated communities in the Upper Basin. Many of these inaccessible sources contribute substantial dissolved metals loading to groundwater, which ultimately leads to surface water contamination. Hence, intercepting and treating this otherwise inaccessible contamination is warranted.

The NAS review recommended that groundwater "be addressed directly if loading to the groundwater is determined to stem from subsurface materials too deep or impractical to be removed" (NAS, 2005). In addition, the NAS review urged EPA to continue research into low-cost innovative groundwater treatment systems. Since the NAS review, EPA has conducted studies to evaluate groundwater-surface water interactions and characterize aquifer properties in key areas of the Upper Basin (CH2M HILL, 2007b, 2009a through 2009l); conducted pilot studies for groundwater treatment (CH2M HILL, 2006c; McCloskey, 2005); and evaluated the cost of implementing various groundwater treatment technologies (EPA, 2007). These studies found that for some areas within the Upper Basin, collection of groundwater and treatment at the CTP in Kellogg represent the lowest-cost treatment option.

Contaminated groundwater is one type of water that will be collected for treatment under the Selected Remedy. Contaminated adit discharges[7] are another. Some of the adit discharges will be treated onsite near the point of collection from the adit, and the treated water will be discharged to the nearest surface water body. Others will be collected and conveyed to the CTP for treatment. The decision to treat a specific contaminated water onsite or at the CTP will be made based on lowest cost. In general, the more remote sites will be treated onsite and the contaminated groundwater at sites nearer to major roadways will be treated at the CTP.

[7] An adit is a nearly horizontal entrance to a mine that is used for access or drainage. Many adits within the Upper Basin have a seasonal or continuous flow of water coming out of them. In most cases, these adit drainages contain elevated levels of metals.

3.7.3 Impacts on Stream Flows

Comment Summary: Comments were received expressing concern that water collected from the SFCDR and tributaries in the Upper Basin could reduce stream flows and adversely impact fishery conditions.

EPA Summary Response: Under average-flow conditions, the reductions are estimated to only be about 1 percent in Canyon Creek and 5 percent in the SFCDR. Further, this reduction will only occur for a small stretch of river. Problems from reduced stream flow are not expected. EPA will perform additional study and remedial design to ensure that stream flows are not reduced to a point that will have negative effects on water rights holders or aquatic life.

EPA Response: Collection of contaminated groundwater for treatment will reduce surface water flows in Canyon Creek and the SFCDR, but not significantly. EPA has modeled these reductions during low-flow and average-flow conditions. The modeling estimates that the maximum stream flow reductions in Canyon Creek and the SFCDR during extreme low-flow conditions[8] would be about 10 percent and 16 percent, respectively. To put this in perspective, in a "typical" year, dry season flow rates, as represented by flows in the 10 percentile, have been shown to fluctuate by 21 percent on average over the period of record. Therefore, a fluctuation of 16 percent is within the range of average natural low flow fluctuation from year to year. Under average-flow conditions, the reductions are estimated to only be about 1 percent in Canyon Creek and 5 percent in the SFCDR. Further, this reduction will only occur for a small stretch of river between the collection points in Osburn and Canyon Creek and Kellogg, where the same volume of clean treated water will be returned to the SFCDR. EPA has estimated this expected stream flow reduction using Basin-wide groundwater model historical stream flow monitoring data collected by the U.S. Geological Service (see the FFS Report [EPA, 2012] for documentation of these analyses). Before conducting any water treatment project, EPA will perform additional study and remedial design to ensure that stream flows are not reduced to a point that will have negative effects on water rights holders or aquatic life. During and after remedy implementation, stream flows and collected flow rates will be monitored. Water collected for treatment will include both contaminated groundwater and adit discharges. Surface water will not be collected directly from tributaries and the SFCDR.

Problems from stream flow reduction are not expected but, if any were to occur, collection rates could be modified to minimize or eliminate any problems. In addition, adit discharges currently planned for treatment at the CTP could be treated onsite using semi-passive[9] technologies. Following treatment at the CTP, the same volume of clean water will return to the SFCDR at Kellogg, albeit downstream from onsite treatment locations. Onsite treatment of the adit discharges involves smaller, semi-passive systems and returns the collected water back to the water body from which it came, resulting in no net reduction in stream flow. The flow rate of adit discharges to be collected is uncertain at this time. Adit discharge flow rates will be determined during design. Early activities will include the sampling of adit

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[8] In this evaluation, extreme low-flow conditions were based on the 7Q10 flow condition, which represents the lowest 7-day average flow that occurs on average only once every 10 years.

[9] Semi-passive treatment approaches that may be applied include *ex situ* chemical or biological treatment. *In situ* treatment approaches were considered in the FFS and may be evaluated further for application at specific sites.

discharge flows under both low- and high-flow conditions to inform planning for future water treatment actions and evaluation of projected stream flow reductions, including adit discharges.

Some comments received during the public comment period speculated that water treatment will eliminate or greatly reduce water flows. These comments were flawed in that they were based on impossible flow scenarios. For example, maximum groundwater and adit discharge flows, which only take place under high-flow conditions (conditions during peak runoff periods as occur in spring runoff or rain-on-snow events), were compared to the lowest flow conditions, which happen during dry periods like late summer and early fall. This logic was flawed. Peak flows do not occur during the dry season. Therefore, any assessment of stream flow reduction must consider both stream flows and projected groundwater and adit discharge collection under the same flow regime (i.e., comparison of high-flow to high-flow and low-flow to low-flow conditions).

3.7.4 Water Rights

Comment Summary: Comments were received stating that water in creeks and streams belongs to the State of Idaho and that the removal of water for groundwater treatment actions would need to be approved by the state.

EPA Summary Response: The State of Idaho has enacted laws concerning the use of water belonging to the state as described in Title 42 of the 2011 Idaho State Statute (the "Idaho state water law"). The Idaho state water law is an ARAR for the selected remedy. EPA will comply with the Idaho state water law as an ARAR and in accordance with CERCLA.

EPA Response: The State of Idaho has enacted laws concerning the use of water belonging to the state. The "Idaho state water law", described in Title 42 of the 2011 Idaho State Statute, is an ARAR for the selected remedy. EPA will comply with the Idaho state water law as an ARAR and in accordance with CERCLA. As part of the Selected Remedy, groundwater will be collected from the Woodland Park area of Canyon Creek and along the SFCDR near Osburn and in Kellogg (within the Bunker Hill Box). The groundwater collection in Kellogg will have no net impact on stream flows because the collected water will be treated and discharged at nearly the same location. Groundwater collected from Canyon Creek and Osburn will result in a minor reduction in stream flow in both the lower reaches of Canyon Creek and the SFCDR between Wallace and Kellogg. As discussed in Section 3.7.3, the estimated reduction from these actions under even extreme low-flow conditions is minimal. For this reason, EPA does not anticipate that the groundwater collection and treatment actions will impact existing water rights holders.

In Canyon Creek, the total volume of water that is associated with either water right licenses or statutory claims (surface water and groundwater) in the lower reach, where groundwater extraction would occur, is less than 2 cubic feet per second (cfs). During low-flow conditions, Canyon Creek flows at between 9 and 17 cfs. This means that between 80 and 90 percent of the stream flow remains unallocated (i.e., is not used to meet any water rights). In the case of Canyon Creek, "low-flow conditions" refer to the base flow that occurs in the fall dry season on the high end (17 cfs, as measured in 2006) and the 7Q10 flow on the low end (9 cfs), which represents the lowest 7-day average flow that occurs on average only once every 10 years. The estimated stream flow reduction in the lower reaches of Canyon Creek due to groundwater collection under 7Q10 conditions is 10 percent. Because of this, water rights holders in Canyon Creek likely will not be impacted by the collection of contaminated groundwater under low-flow conditions.

Similarly, in the SFCDR, 65 percent of the river flow is unallocated to water rights holders under 7Q10 conditions and 80 percent is unallocated under base-flow conditions. This, compared with the estimated reduction in river flow under low-flow conditions of 16 percent discussed above, indicates that water rights holders would not be impacted by the collection of contaminated groundwater and adit discharges under the Selected Remedy.

3.8 Remedy Protection

3.8.1 Protection of Remediated Properties from Stormwater Runoff

Comment Summary: Comments were received suggesting that EPA focus on stormwater runoff prevention to protect properties already cleaned up, rather than focusing on source control and water treatment actions.

EPA Summary Response: The Selected Remedy includes actions to protect remediated properties from SFCDR tributary flooding and stormwater runoff. Tributary flooding and stormwater runoff are concerns because the waters can carry and deposit contaminants as well as damage barriers put in place to protect people and the environment from contamination. The Selected Remedy will help protect areas that have been cleaned up—i.e., keep clean areas clean, which is a common-sense goal. Remedy protection includes actions such as local drainage controls to ensure that clean gravel or soil barriers are not washed away or recontaminated during heavy rain or snow events or by tributary flooding.

EPA Response: The Selected Remedy includes actions to protect remediated properties from SFCDR tributary flooding and stormwater runoff. Tributary flooding and stormwater runoff are concerns because the waters can carry and deposit contaminants as well as damage barriers put in place to protect people and the environment from contamination. The Selected Remedy will help protect areas that have been cleaned up—i.e., keep clean areas clean, which is a common-sense goal. Remedy protection includes actions such as local drainage controls to ensure that clean gravel or soil barriers are not washed away or recontaminated during heavy rain or snow events or by tributary flooding.

To date, EPA has addressed these types of issues on a site-by-site and as-needed basis. In some instances, recontaminated barriers have been replaced by new clean barriers. This approach may have been acceptable in the short term, but it is not proactive in addressing significant and recurring recontamination concerns. EPA recognizes that it is better to be more systematic about these types of recontamination problems. By being proactive, EPA intends to reduce the chance that clean barriers will be recontaminated. Based on hydraulic analyses, field experience over the last 15 years, and input from local public works and elected officials, EPA and IDEQ have identified areas most likely to be recontaminated by tributary flooding or heavy rain or snowfall and the Selected Remedy addresses these concerns. Basin-wide flooding issues (including SFCDR and Pine Creek flooding), however, are not addressed in this ROD Amendment, as discussed in Section 3.3.2.

EPA worked collaboratively with IDEQ to develop and evaluate remedy protection alternatives in the FFS Report (EPA, 2012). The Selected Remedy includes specific mitigation actions (referred to as remedy protection projects) within the primary Upper Basin communities (Pinehurst, Smelterville, Kellogg, Wardner, Osburn, Silverton, Wallace, and Mullan) to protect existing Selected Remedies focusing on human health that may be at risk from recontamination. The remedy protection projects include drainage controls such as replacing culverts, improving channel capacity, controlling erosion, and other actions to reduce the risks posed to the existing remedies. In addition to the eight primary communities, the Selected Remedy anticipates additional remedy protection work in the Upper Basin side gulches (defined as drainage areas with residential properties outside the primary communities). Remedy protection projects in the side gulches will be similar to work selected for the primary communities, and will be described in future decision documents as appropriate.

The remedy protection actions are included in the list of priority actions identified in the Selected Remedy.

3.9 Cost and Funding

3.9.1 Cost of Cleanup

Comment Summary: Comments were received stating that the total cleanup cost of $1.3 billion, as estimated for EPA's Preferred Alternative, is excessive.

EPA Summary Response: EPA agrees that $1.3 billion is a considerable amount of money, but this estimate represented all the actions that EPA felt were scientifically necessary to meet the human health and environmental protection goals outlined in the Proposed Plan. However, upon consideration of public comments and concerns, EPA decided to significantly reduce the scope of the Selected Remedy so that the total cost is decreased by about half. EPA's implementation planning process will also ensure that money is spent wisely to protect human health and the environment. However, as a result of the reduced scope, the Selected Remedy is now considered an interim rather than a final remedy.

EPA Response: EPA agrees that this is a considerable amount of money and has significantly reduced the scope of the Selected Remedy so that the total cost is decreased from $1.3 billion to about $635 million. EPA's implementation planning process will also ensure that money is spent wisely to protect human health and the environment. Under the Superfund law, EPA has a responsibility and the authority to take actions to ensure that the contamination in the Coeur d'Alene Basin is cleaned up to protect human health and the environment, and to communicate this cleanup to the public. The Preferred Alternative, as identified in the Proposed Plan, provided an overall vision of the required cleanup in the Upper Basin. Following consideration of public and stakeholder comments, and after further evaluation, EPA reduced the scope of the Selected Remedy documented in this ROD Amendment. As a result, the Selected Remedy is an interim remedy that identifies the highest-priority remedial actions that are expected to provide the greatest reduction of contamination in the SFCDR and its tributaries and protection of in-place human health barriers in local communities. The Selected Remedy is expected to make substantial progress toward meeting the overall remedial action objectives (RAOs) for the Upper Basin. EPA will ensure that settlement and other monies are spent wisely and will maximize the cleanup completed using these funds. This will be accomplished by rigorous implementation planning and pacing cleanup over time, allowing interest to accrue on the settlement monies.

EPA has listened and responded to comments received on the Proposed Plan to reduce the scope of the Selected Remedy. The total estimated 30-year NPV cost of the Selected Remedy, as presented in the ROD Amendment, is $635 million. This includes capital costs as well as long-term O&M costs. Furthermore, EPA has developed and documented an implementation approach to identify where the work starts, how it will proceed, how sites may be removed from the Selected Remedy should additional data indicate acceptable exposure risks, and how the community can be involved. The bottom line is that remedial actions will be planned and implemented to ensure that those providing the highest value in terms of effectiveness per dollar spent are conducted first, with consideration of a variety of other factors in consultation with the Basin Commission's Upper Basin PFT and other community members. EPA understands that $635 million is still a large sum of money, but cleaning up contamination from a hundred years of past mining practices in this large and complex area will require considerable time and resources. The actions included in the Selected Remedy will provide a significant step forward in cleanup of the Upper Basin, and EPA is committed to getting the job done as efficiently and effectively as possible.

3.9.2 State of Idaho Responsibilities

Comment Summary: Comments were received questioning how much funding the State of Idaho would be responsible for providing for the cleanup.

EPA Response: The State of Idaho is not required to provide funds for remedial actions funded by monies EPA recovered from settlements. Settlement funds can be used to reduce both federal and state costs associated with cleanup. EPA has received approximately $691 million from its settlements with ASARCO Inc. and the Hecla Mining Company, and is committed to careful use of these funds to protect human health and the environment over the long-term. However, the federal government may not pay directly for cleanup unless the state funds 10 percent of the construction costs and 100 percent of the O&M costs.

3.9.3 Taxpayer Responsibilities

Comment Summary: Comments were received expressing concern over the amount of money that taxpayers will be paying for the cleanup.

EPA Summary Response: EPA will pay for much of the proposed cleanup with funds from legal settlements between mining companies and the federal government. The cleanup will proceed as quickly as possible, recognizing the need to balance the speed of cleanup against the desire to increase the funds through interest accumulation. Taxpayer dollars, if any, used to fund the cleanup will augment settlement funds.

EPA Response: EPA will pay for much of the proposed cleanup with funds from legal settlements between mining companies and the federal government. The cleanup will proceed as quickly as possible, recognizing the need to balance the speed of cleanup against the desire to increase the funds through interest accumulation. Taxpayer dollars, if any, used to fund the cleanup will augment settlement funds. At this time, the largest amount of available settlement funds—more than $573 million—is from the ASARCO bankruptcy proceedings completed in 2009. Of this total, $494 million is apportioned for EPA response activities and the remainder will be used for mitigation of natural resource damage. Most of the ASARCO settlement funds can be used only for environmental cleanup in OU 3 (mining-related contamination in the Coeur d'Alene Basin outside the Bunker Hill Box).

Approximately $8 million are to be used for work in OU 2, the non-populated areas in the 21-square-mile Bunker Hill Box. An independent Work Trust has been established to manage the ASARCO settlement funds and conduct the EPA-approved cleanup. The money held by the Work Trust is invested, allowing this fund to continue to grow. Spending and investment under this Work Trust will be carefully managed by EPA to ensure the continued growth of the Work Trust while balancing the need to conduct cleanup in an efficient and a timely manner.

In 2011, a significant settlement was also reached with Hecla Mining Company. Under this settlement, Hecla will pay $263.4 million plus interest to the United States, the Coeur d'Alene Tribe, and the State of Idaho to resolve claims stemming from releases of wastes from its mining operations. Most (75 percent) of the recovery funds will be used for response actions at the Bunker Hill Superfund Site. The remaining amount will fund natural resource restoration projects.

3.9.4 Cost Estimating Assumptions

Comment Summary: Comments were received questioning the methods used to estimate the cost of cleanup and stating that EPA ignored inflation over time and the rising costs of construction.

EPA Response: The cost estimate was developed according to CERCLA guidance for the Feasibility Study (FS) process (EPA, 2000b). EPA guidance states that the accuracy of the cost estimates presented in an FS should be -30 percent to +50 percent, and that a discount rate of 7 percent should be used to estimate total project costs in today's dollars (EPA, 2000b). According to the guidance, this 7 percent discount rate accounts for inflation and the rising costs of construction over time. In this case, 2009 dollars are the basis for the NPV cost estimate, consistent with cost estimates presented in the FFS Report (EPA, 2012). The cost estimate includes the costs of both the remedial actions and O&M. Cost estimates for work to be performed will be further refined during the remedial design process.

3.10 Duration of Cleanup

3.10.1 Estimated Timeframe for Cleanup

Comment Summary: Comments were received stating that the cleanup duration of 50 to 90 years is too long.

EPA Summary Response: In response to public comments, EPA has reduced the scope of the Selected Remedy. Instead of a cleanup duration of 50 to 90 years, as envisioned in the Preferred Alternative in the Proposed Plan, the Selected Remedy is expected to take about 30 years to complete. The reduced scope of the ROD Amendment does result in the Selected Remedy being an interim remedy, meaning that it is not expected to meet all cleanup levels and all ARARs upon completion.

EPA Response: Due in part to extensive public concern about the duration of cleanup, EPA decided to significantly reduce the scope of the Selected Remedy by prioritizing the remedial actions that were identified in EPA's Preferred Alternative in the Proposed Plan. The Upper Basin Selected Remedy is an interim remedy which identifies the priority remedial actions that are expected to provide the greatest reduction of contamination in the SFCDR and its tributaries and protection of in-place human health barriers in local communities. EPA's goal is to address human health and environmental risks in the Upper Basin as quickly as possible and with minimum disruption. Implementation of the Selected Remedy is expected to take about 30 years, depending on spending rates.

How long it takes to implement the Selected Remedy will ultimately depend upon the annual funding rate, the ability to work in multiple areas simultaneously, the overall pace of cleanup, and how well the environmental system responds to cleanup actions. As the cleanup progresses, EPA will routinely look for opportunities to speed up the cleanup activities, while identifying locations where no further action is required. Using the adaptive management process, EPA will also evaluate the effectiveness of the cleanup actions as well as the need for additional actions. In addition, a key component of Five-Year Reviews, which EPA is required to complete under the NCP, is to look for ways to expedite cleanup.

3.10.2 Potential Effect of Superfund Designation

Comment Summary: Comments were received expressing concern that because the Upper Basin would continue to be a Superfund site for 50 to 90 years, the "Superfund stigma" would be damaging to the growth of the Silver Valley.

EPA Response: The Bunker Hill Superfund Site was listed on the National Priorities List (NPL) in 1983. Shortly after the listing, EPA began investigations and cleanup in the Bunker Hill Box (OUs 1 and 2), the area most impacted by mining-related contamination. An RI/FS for OU 3 (mining-related contamination in the Coeur d'Alene Basin outside the Box, including the Upper Basin) began in 1998. Since that time, development has continued in the Silver Valley, spurred on at least in part by millions of dollars of EPA response money spent on cleanup projects. Cleanup has provided opportunities for property to be transferred to the State of Idaho for development projects such as the Trail of the Coeur d'Alenes, Silver Mountain Resort, and Galena Ridge Golf Course, which have greatly benefited the Basin. In light of these examples, there is good reason to believe that cleanup of the Silver Valley will continue to enhance, not damage, economic growth.

3.10.3 Comprehensive versus Incremental ROD Amendments

Comment Summary: Comments were received suggesting that EPA should implement smaller, separate ROD Amendments in 10-year increments.

EPA Response: This Upper Basin ROD Amendment selects an interim remedy that includes priority cleanup actions. This Selected Remedy is expected to require about 30 years to implement, which is significantly shorter in duration than the expected implementation of the Preferred Alternative as identified in the Proposed Plan. EPA anticipates that through the adaptive management process and the development of additional decision documents as necessary, significant progress towards achieving environmental goals will be made over time. The processes used will be sufficiently flexible to allow modifications of cleanup approaches, as necessary. If these modifications require significant or fundamental changes to the Selected Remedy, EPA will prepare appropriate new decision document(s) and involve the public in that process.

3.10.4 Hecla's 10-Year Plan

Comment Summary: Comments were received expressing support for the 10-Year Plan that was developed by Hecla Mining Company (Hecla's 10-Year Plan) (Hecla, 2010). Some of these comments went further and recommended that EPA implement this plan.

EPA Summary Response: EPA does not believe that Hecla's 10-Year Plan is comprehensive enough to protect human health and the environment throughout the Upper Basin.

EPA Response: EPA does not believe that Hecla's 10-Year Plan is comprehensive enough to protect human health and the environment throughout the Upper Basin. Most of the sites identified in Hecla's 10-Year Plan are also priority sites that are selected in this ROD Amendment. However, the actions included in Hecla's 10-Year Plan only address a fraction of the contamination that needs to be and is addressed under EPA's Selected Remedy. Hecla's 10-Year Plan also relies heavily on less protective remedial actions, such as "toe pull-back" (moving the base of waste piles away from creeks and the SFCDR), regrading, soil capping, and revegetation. Furthermore, elements of Hecla's 10-Year Plan may not be technically feasible. For example, the plan calls for contaminated adit and seep discharges to be collected and treated at lagoon-type systems which, as proposed, have serious technical flaws and are likely not possible to implement.

In contrast to Hecla's 10-Year Plan, EPA's Selected Remedy identifies effective and proven actions. For example, the remedy includes methods such as excavation of highly contaminated floodplain sediments and tailings, and groundwater collection and treatment, to address contamination that is inaccessible for removal (such as materials located beneath roads and communities). EPA believes these actions will be more effective in reducing metals loading to the SFCDR and its tributaries, and will more comprehensively protect human health and the environment.

3.11 Implementation

3.11.1 Adaptive Management

Comment Summary: Comments were received expressing concern that the use of adaptive management during implementation of the cleanup will allow EPA to change the Selected Remedy without meaningful public participation and/or support. Other comments expressed concern that the term "adaptive management" is too vague.

EPA Summary Response: EPA will use adaptive management to monitor the performance of cleanup actions and will make adjustments to future actions to benefit from the information gained. Adaptive management does not mean that EPA can change the Selected Remedy without meaningful public participation. In fact, if EPA decides in the future that significant or fundamental changes to the remedy are needed, EPA is legally required to document changes to the Selected Remedy in an Explanation of Significant Differences, another ROD Amendment, or another appropriate decision document.

EPA Response: Adaptive management does not mean that EPA can change the Selected Remedy without meaningful public participation. In fact, if EPA determines in the future that significant or fundamental changes to the remedy are necessary, EPA is legally obligated by CERCLA to address these changes through an Explanation of Significant Differences, another ROD Amendment, or another appropriate decision document. Within the context of the Selected Remedy, adaptive management simply means that EPA will implement specific cleanup actions included in the remedy, monitor the effectiveness of those actions to determine whether cleanup levels are being achieved, and make adjustments to future cleanup actions to benefit from the information gained through the effectiveness monitoring. These adjustments may range from changes in design, changes in priority of certain actions, or potentially more significant or fundamental changes. If these adjustments require significant or fundamental changes to the Selected Remedy, EPA must prepare an appropriate new decision document. In such circumstances, consistent with the requirements of Section 113(k) of CERCLA and 40 CFR Section 300.435(c), EPA will provide opportunities for public participation. Depending on the significance of the changes in cleanup approach, there may be additional opportunities for public input.

Adaptive management is a critical component of the Selected Remedy because it is not possible for physical and chemical conditions to be fully defined and known for this large and complex area. Uncertainty is unavoidable, and the Selected Remedy must be managed and put into action taking this uncertainty into account. An adaptive management framework provides a methodology to carry out the Selected Remedy in a structured, iterative way. Adaptive management considers uncertainty, monitors and evaluates the effectiveness of the remedial actions and cleanup technologies, and then incorporates the "lessons learned" such that uncertainty is reduced for future actions as work progresses towards achievement of the overall cleanup goals. The adaptive management process will provide valuable information to adjust design approaches or prioritize cleanup actions so the greatest amount of effective cleanup is achieved for the lowest cost. EPA previously identified the need to adaptively manage cleanup activities in the Coeur d'Alene Basin in the ROD for OU 3 (EPA, 2002) and through the phased approach used to implement the remedy for non-populated areas of the Bunker Hill Box (OU 2) following bankruptcy of the potentially responsible party. In addition, the NAS agreed with EPA's decision documented in the 2002 ROD to perform the cleanup through the "establishment of a rigorous adaptive management process" for the planning, implementation, and management of environmental cleanup activities at the Bunker Hill Superfund Site (NAS, 2005). EPA is committed to using an adaptive management framework to manage and carry out the Selected Remedy for the Upper Basin, in accordance with its previous decision documents and the recommendations of the NAS.

The replanting of the OU 2 hillsides that surround the historical Lead Smelter and Zinc Plant is a highly visible and successful example of adaptive management at the Site. Several earlier attempts to revegetate the hillsides failed because the high degree of associated uncertainty was neither understood nor addressed. Uncertainty existed with respect to the causes of prior failures, the levels of contamination, and the planting conditions and species that would have the greatest chance of survival and natural regeneration. To develop a successful planting program, EPA conducted studies of several small-scale test plots on the hillsides. These studies evaluated specific areas of uncertainty such as hillside slopes; contaminant levels; varying fertilizers and seed-tackifiers; and different grass, shrub, and tree species. The test plots were monitored over two growth seasons, and the lessons learned enabled EPA to develop a variety of "recipes" for revegetating the hillsides. The hillside replanting was ultimately a great success, as rocky, bare slopes were transformed into a healthy, green, sustainable ecosystem.

3.11.2 Process to Determine Site-Specific Designs Versus Typical Conceptual Designs Presented in the FFS Report and the Proposed Plan

Comment Summary: Comments were received questioning the conceptual design approach using typical conceptual designs (TCDs). Commenters were concerned that this approach leaves significant decisions to be made after the ROD Amendment is issued.

EPA Summary Response: The use of an iterative process to address uncertainty is common in EPA response actions. In fact, at the ROD stage of any cleanup, only conceptual designs used to evaluate alternatives and compare costs are prepared. Following selection of a remedy, a detailed, rigorous engineering design process is followed to come up with the final designs that implement the remedy. If, through this standard design process and the application of adaptive management techniques, EPA determines that a significant change is necessary, a separate decision process, such as another ROD Amendment or an Explanation of Significant Differences, will be initiated. In any event, the public will have the opportunity to review implementation plans, site-specific remedial design documents, and any future decision documents.

EPA Response: As discussed in Section 3.10.3, sufficient information exists to support the Selected Remedy. However, insufficient information exists to characterize all the specific sources of metals contamination that affect the SFCDR, streams, and floodplains in some areas of the Upper Basin. Before cleanup takes place, many pre-design activities will be conducted at specific sites. Depending on the site, pre-design may include some or all of the following activities:

- Compilation and evaluation of existing site data
- Site investigations, including determination of the nature and extent of contamination and waste characterization
- Surveying and mapping of the site
- Evaluation of waste consolidation and material reuse opportunities
- Assessment of stormwater, surface water, and groundwater flows
- Assessment of site ownership
- Identification of easement and access requirements
- Assessment of historic features and cultural resources, as appropriate
- Review of the ESA for potential site restrictions
- Determination of site access needs (e.g., road improvements)

Following pre-design work, enough information will be available to begin early, site-specific remedial design. The use of this iterative process to address uncertainty is common in EPA response actions. In most cases, EPA anticipates that changes from the TCDs specified in the ROD Amendment to the site-specific remedial designs will be small and largely related to quantities (e.g., the volume of soil requiring excavation) rather than to remedial technologies. However, it is possible that some significant decisions will need to be made after the ROD Amendment is issued. EPA will determine whether these warrant separate decision processes, such as another ROD Amendment or an Explanation of Significant Differences. In any event, the public will have the opportunity to review implementation plans, site-specific remedial design documents, and any future decision documents.

For example, pre-design investigation work was conducted in the Ninemile Creek drainage in the summer of 2011. The investigation identified areas within the Ninemile Creek drainage that could serve as local waste consolidation areas, thereby reducing the volume of contaminated material that would need to be trucked to a regional repository. Survey data collected during the investigation also provided updated, more accurate estimates of contaminated waste volumes at specific sites. These additional pre-design data allow EPA to optimize the cost effectiveness of actions taken in the Ninemile Creek drainage. This pre-design strategy will be used throughout the Upper Basin.

As discussed in Section 3.11.1, adaptive management is critical to the remedial strategy for the Upper Basin. This was also recognized by the NAS during its review, and was a recurring theme of its conclusions and recommendations (NAS, 2005, Overview of Conclusions and Recommendations, Summary Page 3). The TCD approach taken with the Selected Remedy complements the adaptive management approach—as EPA learns more about remedial effectiveness and the site-specific extent of contamination, detailed remedial designs will be prepared.

3.11.3 Selection of and Approach to Stream and Riparian Cleanup Actions, and Coordination with Other Entities

Comment Summary: Comments were received requesting clarification on how locations and TCDs were assigned to the stream and riparian cleanup actions included in the cleanup plan, how the actions will be modified during design for site-specific conditions, and how EPA will coordinate with local, state, and other federal entities.

EPA Summary Response: The Selected Remedy includes conceptual designs for stream and riparian actions to be completed wherever sediment removal actions are done (i.e., the banks of a stream or river). EPA will complete site-specific conceptual and final designs for stream and riparian actions, which will include consideration of flood management issues and coordination, prior to completing the sediment removal actions. EPA will involve the community and stakeholders in site-specific design through the established Basin Commission processes.

EPA Response: The Selected Remedy includes waste removal actions in and adjacent to contaminated areas of the SFCDR and some of its tributaries. Once the removal portion of a cleanup action has been completed, some contamination may remain adjacent to the stream and riparian area (i.e., the banks of the stream or river), depending on the site and the extent of the contaminated wastes. Following the removal of contamination, the banks will be stabilized to reduce erosion and prevent further contaminated sediment loading to the stream or river, in those cases where not all contamination could feasibly be removed.

The FFS Report (EPA, 2012) identifies general locations within specific reaches of the SFCDR and its tributaries where stream and riparian cleanup actions, as described above, will occur; however, these locations are general areas that are not directly correlated to specific contaminated source sites. The FFS Report also includes 44 TCDs that describe how stream banks can be stabilized depending on site-specific conditions. The general remedial action locations and the associated stream and riparian cleanup action TCDs and quantities were initially developed during preparation of the 2001 FS Report (EPA, 2001c); were carried forward with an expanded group of TCDs in the FFS Report (EPA, 2012); and were based on estimates of the extent of historical mining-related impairment to river and stream systems as determined from aerial photographs, maps, and experience gained during site visits. Therefore, the conceptual locations and TCDs are currently based on broad assumptions and best professional judgment instead of site-specific information, supporting hydrologic and geotechnical analyses, and other design-related considerations that will be evaluated in the subsequent design phase of a remedial action (see Section 3.11.2). Progressing from the FFS-level conceptual action to a site-specific design is likely to result in modifications to both the specific action locations and the TCD approaches. One benefit of the TCD approach is that, as the design progresses, a TCD can be modified, removed, and/or replaced with another TCD as a result of new data, stakeholder input, or other emergent considerations that would result in EPA taking such action.

Section 3.3.2 describes EPA's jurisdictional authority and commitment to work with local, state, and other federal entities on issues related to SFCDR and Pine Creek flooding. As stated in Section 3.3.2, EPA will coordinate with local communities and flood control authorities, the Basin Commission, USACE, and FEMA during the site characterization and design phases of remedial actions to ensure that cleanup actions do not exacerbate flooding concerns along the SFCDR and Pine Creek. As further stated, where planning and logistical work sequencing allow, EPA will work collaboratively with other entities performing flood control projects to coordinate the implementation of cleanup projects in a manner that provides joint benefits.

The Upper Basin ROD Amendment clarifies the circumstances under which EPA can and will conduct stream and riparian stabilization actions. Per CERCLA, EPA can only address contamination-related issues. In the case of stream and riparian stabilization actions, CERCLA actions can address situations where contamination is actively eroding into a river system by removing the contamination to the extent feasible and then stabilizing the bank to an acceptable design-flood criterion. Mitigating flooding issues in the absence of contamination is not within EPA's CERCLA authority. However, as stated above, EPA is committed to coordinating and collaborating with other entities that have jurisdictional authority to address flooding issues. As an example, if a river reach is not a current source of contamination to the river system and modifications to the reach are planned by others for flood control purposes, if contamination is encountered or generated as part of the flood improvement project, then EPA will assist in locating an appropriate disposal location for the contaminated portion of the wastes generated by the project.

3.11.4 Modifications to Stream and Riparian Cleanup Actions from Those Presented in the Draft Final FFS Report and the Proposed Plan

Comment Summary: Comments were received questioning specific locations along the SFCDR where stream and riparian cleanup actions were identified, and the specific TCDs assigned for some actions.

EPA Summary Response: Following consideration of public and stakeholder comments received on the Proposed Plan, and as part of its effort to reduce the scope of the Preferred Alternative, EPA further evaluated stream and riparian reaches of the SFCDR and tributaries. As a result of these evaluations, EPA made changes to its plans for stream and riparian cleanup actions.

EPA Response: Following consideration of public and stakeholder comments received on the Proposed Plan, and as part of its effort to reduce the scope of the Preferred Alternative, EPA further evaluated reaches of the SFCDR designated for stream and riparian cleanup actions. The goal of the evaluation was to identify stream and riparian actions that were co-located with remedial actions, particularly sediment removal actions, included in the Selected Remedy. These sediment removal actions are primarily designated for riparian areas (along rivers and creeks). Stream and riparian actions will be conducted following remedial actions to stabilize rivers and creeks in the remediated locations. Therefore, the Selected Remedy refers to these actions as stream and riparian "stabilization" actions in the Selected Remedy. Changes to the stream and riparian actions as identified in the Proposed Plan are summarized below:

- **No stream and riparian actions in the Upper SFCDR Watershed (the SFCDR upstream of Wallace)**. EPA determined that stream and riparian stabilization actions are not needed in the Upper SFCDR at this time because the Selected Remedy includes only one sediment removal site (WAL038, located between Wallace and Mullan) and relatively few sediment removal actions in this watershed. In addition, most of the Upper SFCDR currently has abundant rock, riprap, and riparian vegetation, indicating that minimal erosion is likely occurring in this stretch of the river compared with other reaches of the SFCDR. Therefore, no stream and riparian stabilization actions are included for this watershed in the Selected Remedy.
- **Removal of stream and riparian actions in the Ninemile Creek Watershed.** The Selected Remedy does not include any remedial actions in the East Fork of Ninemile Creek; therefore, no stream and riparian stabilization actions will be needed for this reach. Stream and riparian stabilization actions will be conducted at the remaining reaches in the Ninemile Creek Watershed.
- **Stream reaches removed from Big Creek and Moon Creek.** Based on the reduced scope of the remedial actions included in the Selected Remedy, stream segments previously identified for stream and riparian actions along Big Creek and Moon Creek were not included in the Selected Remedy.
- **No stream and riparian actions in SFCDR reaches through Wallace.** The Selected Remedy does not include stream and riparian stabilization actions through Wallace. It is not expected that any sediment removal actions will be conducted through this area due to existing infrastructure (a county bridge, culverts, Interstate 90 support columns, and a concrete channel). Therefore, stream and riparian stabilization actions will not be conducted.
- **No stream and riparian actions in the Pine Creek Watershed.** The Selected Remedy does not include any stream and riparian stabilization actions for Pine Creek. With EPA's reduction in scope of the remedial actions included in the Selected Remedy, relatively few sediment removal actions are identified in the Pine Creek Watershed.
- **No stream and riparian actions west of Pinehurst in the Mainstem SFCDR Watershed (the SFCDR downstream of Wallace)**. The Preferred Alternative proposed stream and

riparian cleanup actions in three reaches to the west of Pinehurst. The Selected Remedy does not include any remedial actions in this area; therefore, stream and riparian stabilization actions west of Pinehurst are not included in the Selected Remedy. Stream and riparian stabilization actions will be conducted at the remaining reaches in the Mainstem SFCDR Watershed east of Kellogg.

Section 14.3 of the Decision Summary in Part 2 of this ROD Amendment provides additional details, including figure references, for the stream and riparian stabilization actions. The FFS Report (EPA, 2012) also documents the detailed changes and associated rationale for reducing the scope of stream and riparian actions included in the Selected Remedy.

3.11.5 Prioritizing Cleanup Actions

Comment Summary: Comments were received suggesting that EPA define or list the high-priority, near-term remedial actions included in the cleanup plan.

EPA Response: The Proposed Plan described how remedial actions included in the cleanup plan would be prioritized and carried out. This ROD Amendment clarifies and provides more details of the implementation approach for the Selected Remedy (see Section 12.3 of the Decision Summary in Part 2 of this ROD Amendment). With help from stakeholders and community members involved in the Basin Commission's Upper Basin PFT, EPA has developed a logical and transparent prioritization process over the past two years.

EPA has used the prioritization process to reduce the scope of the Selected Remedy as compared to the Preferred Alternative in the Proposed Plan. A site-by-site review was conducted to identify the highest-priority sites for remedial action and, thus, those that are included in the Selected Remedy. The Upper Basin PFT provided input to assist EPA in prioritizing actions to include in the Selected Remedy. This site-by-site review is described in detail in the FFS Report (EPA, 2012). Key considerations for this review included: (1) prior remedial actions and effectiveness of those actions; (2) active land uses; (3) potential human health risks; (4) downstream water quality; (5) site-specific data such as location, contaminant concentrations,[10] riparian acreage, and erosion potential; and (6) access road requirements.

3.11.6 Public Input During Implementation

Comment Summary: Comments were received expressing concern that EPA's general plan for implementing cleanup actions will not allow frequent and meaningful opportunities for public input.

EPA Summary Response: The public will have many meaningful opportunities to provide continuing input on the cleanup. We encourage your participation.

EPA Response: As described in Section 3.1.1, EPA has provided considerable opportunities for public input over time. A long-term Selected Remedy does not mean an end to public involvement; the public will have continuing opportunities to provide input on how the cleanup is being implemented. EPA has committed to implement remedial actions in the

[10] The review of site-specific contaminant concentrations included data collected following the publication of the Proposed Plan in the summer of 2011 at selected source sites in the Upper Basin. The results of this focused sampling effort are documented in the FFS Report (EPA, 2012).

Upper Basin through the Basin Commission process. Each year since the establishment of the Basin Commission and issuance of the ROD for OU 3 in 2002, EPA has provided a summary of CERCLA-related activities for the one- and five-year work plans prepared by the Commission that summarize planned Basin-related activities. The one-year work plans establish and maintain the sequencing of activities that will be needed to complete the goals and objectives of the five-year plan. The Basin Commission work plans focus on general areas of work and do not go into project-specific detail. Per Basin Commission protocol, the work plans are reviewed by the Commission's Technical Leadership Group (TLG) and the Citizens' Coordinating Council (CCC), the Executive Director, and any other citizens who may wish to review and comment.

With the issuance of this Upper Basin ROD Amendment, EPA's input into the Basin Commission's one- and five-year work plans will be expanded to include the actions in the Selected Remedy for the Upper Basin.

In addition to the more general Basin Commission Work Plans, EPA will prepare an Implementation Plan in collaboration with the Upper Basin PFT and other stakeholders. This plan will present the results of the prioritization process and will also summarize planned CERCLA activities on a project- and site-specific basis. EPA will work with the Basin Commission to develop the Implementation Plan for specific remedial actions associated with the Selected Remedy, and the public will have opportunities to provide input. In addition, EPA will continue to conduct Five-Year Reviews, as required by CERCLA, and the public will be invited to comment on drafts of Five-Year Review Reports.

3.12 Repositories and Waste Consolidation Areas

3.12.1 Waste Management Strategy, and Facility Siting and Design

Comment Summary: Comments were received expressing concern that the cleanup plan calls for additional repositories and that there are potential hazards associated with new repositories. Some of these comments also stated that new repositories would take away land that would otherwise have potential for development.

EPA Summary Response: More repositories will be required to safely secure contaminated materials removed during the cleanup. Repositories are carefully engineered to contain wastes onsite, preventing contaminants from being released. The use of centralized repositories reduces the footprint required for waste disposal, allowing for development in areas where wastes have been removed.

EPA Response: The Selected Remedy does call for significant excavation and consolidation of contaminated materials in either engineered repositories or "waste consolidation areas." For the purposes of the Selected Remedy, repositories are considered to be large, centrally located areas within the Upper Basin where contaminated soil excavated during cleanup actions is transported to, managed, and secured. EPA's preference will be to locate repositories in areas that are already contaminated, such as on top of historical mine tailings piles. The Big Creek Repository, Page Repository, Osburn Tailings Impoundment, and Hecla-Star Tailings Impoundment are examples of former tailings impoundments that either have been or could be turned into cleanup repositories. Repositories help protect people and the environment by dramatically decreasing the chance that people and wildlife will be exposed to metals-contaminated soil, sediments, and debris. Without repositories, cleanup cannot proceed and the public will continue to be exposed to high metals levels. The use of centralized repositories also reduces the footprint required for waste disposal, allowing for development in areas where wastes have been removed. Repositories constructed under the Selected Remedy will be engineered to securely contain waste materials, which will prevent contaminants from being released to surface water, groundwater, or air at concentrations above state and/or federal standards.

Waste consolidation areas will differ from the centrally located repositories. Waste consolidation areas will be established within tributary watersheds (e.g., the Ninemile and Canyon Creek Watersheds) where significant volumes of waste are already present from historical mine and mill site operations, and sufficient space is available for performing consolidation. Rather than haul these wastes out of the watershed to a regional repository, EPA's first step will be to look for locations to safely consolidate and cap wastes at the particular mine and mill site being cleaned up or in another area of the watershed where the consolidated wastes can be better protected from surface water runoff and erosion. This approach will significantly reduce the number of haul trucks driving through communities such as Woodland Park, Wallace, and Mullan. The approach has already been used successfully in the Upper Basin and, as a result, the volume of soil hauled to repositories has been minimized. Good examples of the successful use of waste consolidation areas include the Moon Creek Watershed and the Golconda Mine near Wallace. Pre-design investigation work has also led to the identification of locations for waste consolidation areas in the Ninemile Creek drainage. Based on this new information, selected TCDs for sites in the Ninemile drainage have been modified to optimize the use of these local waste consolidation areas and minimize the need for regional repository space.

EPA, IDEQ, and the Basin Commission are working together to identify locations for new repositories in the Upper Basin. There are many opportunities for community involvement in repository siting. To learn more, please contact Don Carpenter, IDEQ, at 208-373-0550 or Ed Moreen, EPA, at 208-664-4588, or visit: http://basincommission.com/TLG_PFT_Repository.asp.

4.0 Responses to Individual Comments

This section presents EPA's responses to individual comments received on the Proposed Plan. EPA received comments in various forms including letters, emails, and oral testimony at community meetings. The comments and EPA's responses are organized into the following attachments (the attachments are provided in electronic format):

- **Attachment A**: Index of Commenters and Responses
- **Attachment B**: Master Comment List
- **Attachment C**: Responses to Federal Agency Comments
- **Attachment D**: Responses to State Agency Comments
- **Attachment E**: Responses to Native American Tribe Comments
- **Attachment F**: Responses to Local Jurisdiction Comments

- **Attachment G**: Responses to Local Community/Special Interest Organization Comments
- **Attachment H**: Responses to Business Comments
- **Attachment I**: Responses to Individual Comments

Attachment A presents an Index of all comments sorted using two methods. First, all commenters are listed alphabetically by the last name of the person or the organization providing the comments. This list provides the locations (by attachment and page number) of the comments and EPA's responses. Second, all comments are listed alphabetically/numerically by the comment number, along with the locations of the comments and EPA's responses.

Many comments address similar issues. In these cases, the response for a given issue is provided once. Responses to later comments on the same issue refer to the master comment list where this response is provided. These responses are referred to as "master comment responses" and are found in Attachment B. When using Attachment B, the commenter may find that the referenced response addresses more issues than he or she raised. In these cases, it is expected that the commenter will be able to identify those parts of the referenced response that apply. In other cases, a comment may raise multiple issues. In such cases, the commenter may be referred to several master comment responses for a complete response to all issues raised. An overview of the issues raised and EPA's responses is provided in Part 3, Section 3.0, Responsiveness Summary.

In Attachments C through I, the comments and responses are sorted alphabetically by the last name of the commenter. Each comment letter, email, and oral testimony comment was assigned a unique identification number (e.g., 1365213). Each comment was assigned a unique comment number (e.g., LJ36-1). Many commenters submitted more than one comment letter. In these cases, a separate identification number and comment number were assigned for each set of comments. This approach helped EPA ensure that all comments were addressed.

In Attachments C through I, an image of the original comment is shown on the left side of the page and includes EPA's delineation. The right side of the page presents EPA's response to that comment.

A number of commenters' names were illegible, and these commenters are listed as "Unknown." EPA has included their comments in Attachment I and has responded to the comments where possible.

As provided in the CERCLA statute, Section 117(b), EPA is only responsible for providing responses to each of the "significant" comments, criticisms, and new data. Comments not meeting this statutory criterion have nonetheless been recorded in this section, and responses have been provided to the extent possible.