Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

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1.0 Purpose and Objectives

The purpose of this Technical Memorandum (TM) is to document changes and clarify information related to the stream and riparian cleanup actions included in the Draft Final Focused Feasibility Study [FFS] Report for the Upper Basin of the Coeur d'Alene River (CH2M HILL, 2010) and the Upper Basin Proposed Plan (EPA, 2010a). This TM has been prepared, in part, to respond to public and stakeholder comments received on EPA's Preferred Alternative described in the Upper Basin Proposed Plan. After consideration of those comments, EPA decided to evaluate portions of the South Fork of the Coeur d'Alene River (SFCDR) and its primary tributaries designated for stream and riparian cleanup actions. Part of this evaluation included a field visit on June 13, 2011, which was attended by representatives from EPA, the Basin Environmental Improvement Project Commission (BEIPC), Shoshone County, and CH2M HILL.

The specific objectives of this TM are as follows:

- Summarize the methods used to select streambank stabilization approaches and typical conceptual designs (TCDs) for individual stream and riparian reaches during preparation of the 2001 Feasibility Study (FS) Report for the Coeur d'Alene Basin (EPA, 2001), as carried forward in the 2010 Draft Final FFS Report.
- Document changes to streambank stabilization approaches since the 2010 Draft Final FFS Report and the Upper Basin Proposed Plan, in conjunction with the reduction of the scope of remedial actions from those included in the Preferred Alternative in the Proposed Plan to those in the Selected Remedy to be documented in the forthcoming Upper Basin Record of Decision (ROD) Amendment (EPA, in preparation).

- Clarify the remedial design process that will occur as planned stream and riparian cleanup actions progress from the conceptual feasibility level of design to final design and implementation.

Together, these TM objectives are intended to address public and stakeholder concerns, document the changes made since the Draft Final FFS Report and Proposed Plan, and inform the decision-making process for future detailed design and cost estimating related to streambank stabilization.

2.0 Background

The 2001 FS Report defined seven watersheds in the Upper Basin of the Coeur d'Alene River. These watersheds were subdivided into 21 segments that were further subdivided into 119 stream and riparian reaches along the SFCDR and its primary tributaries. The 2001 FS Report used a high-level approach (discussed in more detail in Section 3.1) to assign TCDs for cleanup actions to the various stream and riparian reaches along the SFCDR and its tributaries. In addition, the 2001 FS Report established associated estimated quantities and unit costs for each TCD with which to prepare an FS-level cost estimate. A total of 22 Stream and Riparian Cleanup Action TCDs (then referred to as "Bioengineering TCDs") were included in the 2001 FS Report; these were grouped into six general categories to facilitate cost estimating, and they represent a range of possible methods of reducing bank erosion and associated releases of contaminants and, where possible and appropriate, improving aquatic and riparian habitat.

The corresponding portions of the 2010 Draft Final FFS Report focused primarily on escalating the TCD unit costs for stream and riparian cleanup actions that had been included in the 2001 FS Report to 2009 dollars. No new or revised Stream and Riparian Cleanup Action TCDs were included in the 2010 Draft Final FFS Report; as discussed in Section 3.4 below, one of the TCD categories in the 2001 FS Report (Current Deflectors) was subdivided into two categories.

The 2010 Upper Basin Proposed Plan included large-scale remedial actions in, and adjacent to, the SFCDR and some of its tributaries to remove contaminated wastes. These actions were primarily the same as those included in Ecological Alternative 3 in the 2001 FS Report. Once the removal component of a remedial action is completed, it is anticipated that some contamination may remain along the channel banks and riparian areas, depending on the site and the extent of the contaminated wastes. At those site-specific locations, the stream and riparian actions will serve to stabilize the banks to reduce erosion and contaminated sediment loading to the channel.

3.0 Previous Approaches Used to Assign TCDs

Section 3.1 presents the approaches used to develop and assign TCDs in the 2001 FS Report, which were carried forward into the 2010 Draft Final FFS Report as discussed in Section 3.2. Section 3.3 describes general watershed and reach characteristics, and Section 3.4 discusses the 2001 and 2010 Stream and Riparian Cleanup Action TCDs by watershed.

3.1 2001 Feasibility Study Approach

The 2001 FS Report described the purpose of the Stream and Riparian Cleanup Action TCDs (then referred to as "Bioengineering TCDs" as noted above). As quoted below, the 2001 FS Report used a high-level approach. Bioengineering TCDs were

> "…developed without the benefit of supporting hydrologic and geotechnical analyses necessary to support the design phase. They are based on available data, broad assumptions, and best professional judgment in the place of site-specific information and may change considerably as more detailed studies are conducted. The intent of this approach is not to provide a specific plan for the application of these techniques. Rather, it is to provide remedial engineers and decision makers with a general example of how they will be employed under typical conditions…for the purpose of TCD quantity estimation in the FS." (2001 FS Report, Part 3, Volume 1, page 4-14)

The approach by which specific TCD quantities (and associated costs) were assigned to the 119 reaches of the SFCDR and its primary tributaries also used a high-level approach:

> "The bioengineering process options and associated TCD quantities were based on estimates of the extent of physically impaired and/or directly impacted stream and riparian areas from aerial photographs, maps, and experience gained during site visits. The approach to developing these estimates was based on best professional judgment of the extent of measures required to accomplish the following:
>
> – Stabilize physical functions to the extent required to help control failure risks for bioengineering actions and floodplain contaminant containment and removal actions
>
> – Stabilize existing contaminant source areas that may be left in place
>
> – Rebuild and stabilize bank and floodplain areas following contaminant removal" (2001 FS Report, Part 3, Volume 1, page 4-12)

3.2 2010 Focused Feasibility Study Approach

The 2010 Draft Final FFS Report described new information and data available since 2001 that would affect planned cleanup actions for the Upper Basin. However, all the Bioengineering TCDs associated with Ecological Alternatives 3 and 4 in the 2001 FS Report were retained as Stream and Riparian Cleanup Action TCDs in the 2010 Draft Final FFS Report, and no new information related to stream and riparian cleanup actions was included. No changes were made to the Stream and Riparian Cleanup Action TCDs aside from the updated cost estimates.

3.3 Watershed and Reach Characteristics

To better understand the similarities and differences between watersheds and to help inform future reach-scale and site-specific designs, Table 1 was developed to summarize characteristics of the seven Upper Basin watersheds addressed in the 2010 Draft Final FFS Report and the Proposed Plan, and their primary subwatersheds.

As shown in Table 1, average gradients range from 1 percent in the Mainstem SFCDR Watershed to as much as 15 percent in the West Fork Big Creek subwatershed. This variability in slope, combined with local streambank conditions (i.e., vegetation, rock, and/or visible contamination), has a direct effect on the potential for bank erosion. As noted in Section 5.2, the information summarized here will continue to be refined (using more detailed data) in the subsequent design phases.

Figure 1 presents the longitudinal profiles for the watersheds and subwatersheds, and Table 2 includes the specific reach data used to generate Figure 1. These data indicate that the SFCDR and its tributaries significantly increase in gradient moving east (upstream) through the Upper Basin.

3.4 Stream and Riparian Cleanup Action TCDs by Watershed

The watershed and reach characteristics summarized above provide a context to understand the distribution and number of Bioengineering TCDs presented in the 2001 FS Report and Stream and Riparian Cleanup Action TCDs presented in the 2010 Draft Final FFS Report. As noted previously, a total of 22 separate TCDs were proposed in the 2001 FS Report, and these were grouped into six general categories. One of those categories (Current Deflectors) was subdivided into two categories to facilitate cost estimating, and summary descriptions of the resulting seven TCD categories are provided below.

- **Current Deflectors.** Current deflectors include several different types of structures constructed of wood, rock, or other materials attached to a streambank or in mid-channel, which redirect stream energy away from erodible areas. Sufficient numbers of current deflectors, properly spaced and oriented, can slow drainage rates and increase off-channel water storage, reducing flow energy in downstream areas, limiting flood damage, and preventing channel migration from outflanking shoreline stabilization structures. These structures also serve to stabilize sediment and bedload transport, and can be configured to trap migrating fine sediments.

- **Current Deflectors, Sediment Traps.** Sediment traps are added to the current deflectors described above to reduce migrating sediments in areas where sediments impinge on the ecosystem. The sediment traps may be pools that are excavated to allow sediments to gather in those areas.

- **Vegetative Bank Stabilization.** The purpose of these TCDs is to introduce a self-maintaining mechanism for improving streambank stability by planting native species adapted to riparian and streambank conditions. Banks are stabilized by root growth and above-ground vegetation that reduces stream energy. The materials used may include seeded ground cover, live cuttings, or rooted plant stock.

- **Bioengineered Revetments.** These TCDs are used to create a durable form of streambank protection that provides riparian and in-stream habitat features. Bioengineered revetments integrate a variety of bank stabilization materials including riprap, large woody debris, and live plantings. Properly designed bioengineered revetments can be used in higher-energy areas where protection of controlled source areas in the floodplain is desired.

- **Floodplain and Riparian Replanting.** Techniques for riparian zone rehabilitation generally include generally include replanting of riparian vegetation where possible, including a diversity of native grasses, shrubs, and trees, and additional structural elements (e.g., nurse logs, snags) to provide additional site stabilization. In some cases site preparation activities including soil removal and replacement, road retirement, and soil amendments may be required. These activities are expected to be conducted in conjunction with excavation and removal of contaminated materials from the floodplain, but will also be used to stabilize areas with high erosion potential as appropriate.
- **Off-Channel Hydrologic Features.** The development of off-channel hydrologic features such as side channels, ponds, and wetlands with hydraulic conductivity to the stream channel can help moderate and stabilize the hydrology of degraded stream systems. These TCDs can be appropriate where local depressions and broad floodplain or riparian areas are present. Off-channel hydrologic features provide a variety of physical functions relevant to remedial design including retention and storage of floodwater during high-flow periods, sediment capture, and reservoirs for maintaining baseflows.
- **Channel Realignment.** These TCDs involve the use of heavy machinery to redirect and reshape stream channels to more naturally stable conditions and to recreate in-channel hydrologic features, particularly increased pool densities and volumes, to the extent possible given existing constraints. Channel stability in this context refers to hydrologic and bedload transport conditions. Channel realignment can be used in areas where large amounts of potentially unstable bedload materials are present that, if not properly addressed, could increase risks to bioengineering structures and other stabilized areas.

As presented in Tables 3 and 4 and Figure 2, the distribution of these seven TCD categories varied across the seven watersheds in the 2001 FS Report and the 2010 Draft Final FFS Report. The following patterns can be observed in Figure 2:

- The distribution of the Current Deflectors and Current Deflectors, Sediment Traps TCDs was essentially the same across all seven watersheds.
- Vegetative Bank Stabilization and Bioengineered Revetments TCDs were proposed for more than 21 and 18 miles of streambank, respectively, and were most abundant in the three watersheds with the longest stream lengths (the Upper SFCDR, Ninemile Creek, and Mainstem SFCDR Watersheds).
- The Floodplain and Riparian Replanting TCD was more common along the lower-gradient Mainstem SFCDR (downstream of River Mile 200) than in the steeper-gradient tributaries (Big Creek, Moon Creek, and Pine Creek).
- Five of the seven TCD categories were proposed for all seven watersheds, but Off-Channel Hydrologic Features were the most abundant in the Mainstem SFCDR Watershed, and Channel Realignments were only included for the Canyon Creek, Ninemile Creek, and Mainstem SFCDR Watersheds.

In general, these patterns of the TCDs by watershed suggested that upper reaches of the Mainstem SFCDR and most of the tributaries would be areas where the existing channel alignment is unchanged by remediation, and the remaining streambanks may be stabilized using the Stream and Riparian Cleanup Action TCDs. The few locations where the valley is

wider, such as the Mainstem SFCDR around Osburn and the lower portions of Canyon and Ninemile Creeks, may be the only locations where the Off-Channel Hydrologic Features and Channel Realignment TCDs are appropriate.

4.0 Changes in Stream and Riparian Actions from the Preferred Alternative to the Forthcoming Selected Remedy

Section 4.1 discusses changes to stream and riparian actions from those presented in the Preferred Alternative in the Proposed Plan to those included in the Selected Remedy to be documented in the forthcoming Upper Basin ROD Amendment, resulting from a reduction in the scope of remedial actions included in the Selected Remedy. Section 4.2 discusses stakeholder comments that were made on the stream and riparian actions included for three specific watershed segments in the Preferred Alternative in the Proposed Plan, and how these comments have been addressed.

4.1 Changes to Stream and Riparian Actions Resulting from the Reduction in Scope of Remedial Actions in the Forthcoming Selected Remedy

Following consideration of public and stakeholder comments on the Preferred Alternative in the Proposed Plan and additional analysis and evaluation by EPA, EPA decided to reduce the scope of the remedial actions to be included in the forthcoming ROD Amendment and to select an interim remedy for the Upper Basin. The interim Selected Remedy will primarily focus on remedial actions at the most contaminated sites including those in the Canyon Creek and Ninemile Creek Watersheds and along the mainstem of the SFCDR, including the Bunker Hill Box (Operable Unit [OU] 2).

As part of EPA's evaluation of the Preferred Alternative in the Proposed Plan and the subsequent decision to reduce the scope of the forthcoming Selected Remedy, and in consideration of public and stakeholder comments regarding stream and riparian cleanup actions, those stream and riparian actions that are co-located with retained 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 actions will be conducted following remedial actions in order to stabilize rivers and creeks in the remediated locations. Therefore, the forthcoming Selected Remedy will refer to these actions as stream and riparian "stabilization" actions.

Figures 3 through 9 depict the planned remedial actions (highlighting both sediment and non-sediment removal actions) relative to stream and riparian reaches for each watershed in the Upper Basin. The exact locations of stream and riparian stabilization actions will be determined during remedial design and will be co-located with sediment removal actions.

Stream and riparian stabilization actions will primarily coincide with the areas of focus for remedial actions in the forthcoming Selected Remedy: Canyon Creek, Ninemile Creek, and the Mainstem SFCDR. If no remedial actions or only non-sediment removal actions are planned for a reach, stream and riparian stabilization actions will not be included in the Selected Remedy. Table 5 lists the stream and riparian reaches that were included in the Preferred Alternative in the Proposed Plan and indicates whether the reaches will be

retained in or excluded from the forthcoming Selected Remedy. The rationale for excluding individual reaches are also included in Table 5, and more details are provided in the summary of changes by watershed that is provided below.

- **No stream and riparian actions in the Upper SFCDR Watershed**. EPA has determined that stream and riparian stabilization actions are not needed in the Upper SFCDR Watershed because the forthcoming Selected Remedy will include only one sediment removal site (WAL038, located between Wallace and Mullan) and relatively few remedial actions in this watershed (see Figure 3). Because of the minimal actions planned and the stable streambanks, discussed in Section 4.2, no stream and riparian stabilization actions will be included for this watershed in the Selected Remedy.
- **All stream and riparian actions retained in the Canyon Creek Watershed.** No changes will be made to the stream and riparian actions in the Canyon Creek Watershed from the Preferred Alternative in the Proposed Plan to the forthcoming Selected Remedy (see Figure 4). Stream and riparian actions in this watershed are being retained because the Selected Remedy will include extensive sediment removal actions throughout Canyon Creek.
- **No stream and riparian actions in reach NM03-1 in the Ninemile Creek Watershed**. The forthcoming Selected Remedy will not identify any remedial actions in reach NM03-1; 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 (see Figure 5).
- **Stream and riparian reaches removed from the Big Creek and Moon Creek Watersheds**. Based on the reduction of scope in the remedial actions included in the forthcoming Selected Remedy, one reach in each of these watersheds (BIG04-2 and MC01-2, respectively) that was previously identified for stream and riparian actions will no longer be included in the Selected Remedy because no remedial actions will be identified for these reaches (see Figures 6 and 7).
- **No stream and riparian actions in the Pine Creek Watershed**. The forthcoming Selected Remedy will not include any stream and riparian stabilization actions for Pine Creek. With EPA's reduction of the scope of the remedial actions to be included in the Selected Remedy, relatively few sediment removal actions are identified in the Pine Creek Watershed (see Figure 8).
- **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). The forthcoming Selected Remedy will not include any remedial actions in this area; therefore, stream and riparian stabilization actions west of Pinehurst will not be included in the Selected Remedy (see Figure 9). Stream and riparian stabilization actions will be conducted at the remaining reaches in the Mainstem SFCDR Watershed east of Kellogg, as indicated in Figure 9.

The Preferred Alternative in the Proposed Plan identified 56 reaches for stream and riparian cleanup actions. Based on the changes described above, the forthcoming Selected Remedy will include 28 reaches for stream and riparian stabilization actions. This will reduce the

geographic scope of stream and riparian actions by approximately 21 river miles (see Table 5).

4.2 Stakeholder Input on Stream and Riparian Actions in Three Specific Watershed Segments Along the SFCDR

Of the 119 stream and riparian reaches along the SFCDR and its tributaries, comments provided by stakeholders on the Proposed Plan and during the June 13, 2011, field visit were specific to 12 reaches located within three watershed segments along the SFCDR: the Upper SFCDR Watershed between Mullan and Wallace, the Mainstem SFCDR Watershed through Wallace, and the Mainstem SFCDR Watershed through Kellogg. Stakeholder input and changes made by EPA to the stream and riparian stabilization actions in these areas are summarized in the following sections.

4.2.1 Upper SFCDR Watershed, Segment UpperSFCDRSeg01, Reaches UG01-13 through UG01-19

These seven reaches of the SFCDR between the communities of Mullan and Wallace (see Figure 3) are a total of approximately 5 miles long; moderately steep (0.7 to 3.6 percent); well vegetated along the river corridor; and confined by steep banks, Interstate 90 (I-90), and the Trail of the Coeur d'Alenes. The Draft Final FFS Report proposed six different types of TCDs distributed throughout these seven reaches that were intended to reduce bank erosion and associated releases of contaminants and, where possible and appropriate, to improve aquatic and riparian habitat. Stakeholders commented that because these reaches are more vegetated than many reaches along the SFCDR, they are less subject to bank erosion and may not require the stream and riparian cleanup actions described in the Draft Final FFS Report.

EPA's interpretation of existing conditions in the Upper SFCDR Watershed is consistent with that of the stakeholders: specifically, relatively minimal erosion is likely occurring in the reaches between Mullan and Wallace compared with other reaches of the SFCDR due to abundant rock, riprap, and riparian vegetation. In addition, as discussed in Section 4.1, the forthcoming Selected Remedy will include relatively few sites for remedial action in these reaches compared to the actions included in the Preferred Alternative in the Proposed Plan. Therefore, stream and riparian stabilization actions in the Upper SFCDR Watershed will not be included in the Selected Remedy based on existing site conditions, stakeholder input, and the lack of co-located remedial actions.

4.2.2 Mainstem SFCDR Watershed, Segment MidGradSeg01, Reaches MG01-1 through MG01-3

These three reaches of the SFCDR through the community of Wallace (see Figure 10) are a total of approximately 1.2 miles long; have moderate gradients (0.3 to 1.4 percent); have portions confined by a concrete flood conveyance channel, steep banks, I-90, and the Trail of the Coeur d'Alenes; and include the confluences with Canyon and Ninemile Creeks. The Draft Final FFS Report proposed five different types of TCDs distributed throughout these three reaches that were intended to reduce bank erosion and associated releases of contaminants and, where possible and appropriate, to improve aquatic and riparian habitat. During the June 13, 2011, field visit, stakeholders commented that the proposed TCDs

through this area may increase channel roughness and exacerbate flooding conditions. The stakeholders requested that the TCDs be revised and considered as part of a more holistic plan that also addresses flood management, urban development, fish passage, and existing infrastructure (a county bridge, culverts, I-90 support columns, and a concrete flood conveyance channel) associated with the SFCDR and the two tributaries in this area.

Stream and riparian stabilization actions in these reaches through Wallace will not be included in the forthcoming Selected Remedy because sediment removal actions are not planned through this area due to the presence of existing infrastructure. Coordination between EPA and other entities that may address flood management issues within these reaches in the future is described in Section 5.1.

4.2.3 Mainstem SFCDR Watershed, Segment MidGradSeg02, Reaches MG02-2 and MG02-3

These two reaches of the SFCDR through the community of Kellogg (see Figure 10) are located within the Bunker Hill Box (OU 2); are a total of approximately 2 miles long; have low gradients (less than 0.5 percent); are generally trapezoidal in shape with a wide main channel and small floodplain bench, some riprapped banks, and visible contamination in some banks; and include the confluences with Milo Creek and other smaller creeks. The Draft Final FFS Report did not propose any streambank stabilization TCDs for these reaches. During the June 13, 2011, field visit, stakeholders requested that additional OU 2 stream and riparian actions beyond those already conducted for the Phase 1 remedial actions in Smelterville Flats be added to EPA's Preferred Alternative described in the Proposed Plan. The stakeholders requested that these actions address not only contamination but also flood management, urban development, fish passage, and existing infrastructure (a county bridge and culverts) associated with the SFCDR and the tributaries in this area.

Stream and riparian stabilization actions through Kellogg will not be included in the forthcoming Selected Remedy because the EPA does not plan to conduct sediment removal actions in this area at this time. The Phase 1 source control remedial actions completed in OU 2 in 1997 and 1998 (EPA, 2010b) included streambank stabilization measures in the area known as Smelterville Flats (north of I-90 in the vicinity of reaches MG02-6 and MG02-7 in Figure 10). The 2010 Five-Year Review Report (EPA, 2010b), which was prepared in accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements, noted that the south banks of the SFCDR through the Smelterville Flats area are in excellent condition, are stable, and are performing adequately to minimize sediments entering the river. Erosion of contaminated sediments through Kellogg and located in the Bunker Hill Box has been partially addressed by actions already taken under the ROD for OU 2 (EPA, 1992), and these actions are inspected and monitored for effectiveness as part of EPA's Five-Year Review process. Under that process, EPA may identify the need for more erosion control actions within OU 2; however, none have been identified at this time. Coordination between EPA and other entities addressing flood management will be necessary prior to implementing further CERCLA remedial actions at these river reaches (see Section 5.1).

5.0 Clarification of Remedial Design Process

EPA received significant public and stakeholder comments on the Proposed Plan requesting clarification of the remedial design process, including the design of stream and riparian actions and how EPA coordinates with other entities on flood management projects. Section 5.1 discusses how EPA will coordinate with other entities for projects where flood management is an issue along the SFCDR and its tributaries. Section 5.2 clarifies the process of moving from an FS-level conceptual approach to final design for stream and riparian stabilization actions.

5.1 Coordination with Other Entities on Flood Management Projects

The forthcoming Upper Basin ROD Amendment will clarify the circumstances under which EPA can and will conduct stream and riparian stabilization actions. Under CERCLA, EPA can only address contamination issues that are associated with unacceptable risks. In the case of stream and riparian stabilization actions, CERCLA actions can address situations where EPA has determined that sources of substantial contaminated material are actively eroding a river system, through removal of this contaminated material to the extent feasible and then stabilization of the streambank to minimize further erosion.

Mitigating flooding issues in the absence of contamination is not within EPA's CERCLA authority. However, EPA is committed to coordinating and collaborating with other entities that have jurisdictional authority to address flooding issues. During implementation of the Selected Remedy, EPA will coordinate with local communities and flood control authorities, the BEIPC, the U.S Army Corps of Engineers (USACE), and the Federal Emergency Management Agency during the site characterization and design phases of the remedial actions identified in the forthcoming Upper Basin ROD Amendment to ensure that cleanup actions do not exacerbate flooding concerns along the SFCDR and its tributaries. 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. As an example, if a stream and riparian 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, and if contamination is encountered or generated as part of a flood improvement project, EPA will provide an Institutional Controls Program repository for contaminated materials.

5.2 From Conceptual TCDs to Final Design

As described above, the current stream and riparian reach locations and assigned TCDs (in the 2001 FS Report and the 2010 Draft Final FFS Report) were based on general assumptions and best professional judgment in place of site-specific information. Detailed field investigations; hydrologic, hydraulic, geomorphic, and geotechnical analyses; use of LiDAR collected in 2009; and other design-related issues will be considered in the subsequent design phase of a remedial action. Progressing from an FS-level conceptual action to a site-specific remedial design is expected to result in modifications to both the specific action location(s) and the TCD approach(es). One benefit of the overall 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.

In 2002, USACE and three agencies in the State of Washington (Departments of Fish and Wildlife, Transportation, and Ecology) published the first in a series of aquatic habitat guidelines titled the *Integrated Streambank Protection Guidelines* [ISPG] *2003* (Washington State Aquatic Habitat Guidelines Program, 2002). The ISPG were prepared by recognized stream restoration experts with input from many agencies, and include detailed recommendations for streambank stabilization and protection methods. The TCDs included in the Draft Final FFS Report and to be included in the forthcoming Selected Remedy are conceptual designs that will be optimized during site-specific design using the ISPG or local examples of successful streambank stabilization in the Coeur d'Alene Basin.[1]

As described in the Draft Final FFS Report, insufficient information exists with which to characterize the specific sources of metals contamination affecting the streams and floodplains in some areas of the Upper Basin. Prior to implementing remedial actions, numerous pre-design and design activities will take place at a site-specific level. Depending on the site, some or all of the following activities may be included in the design process:

- Compilation and evaluation of existing site data
- Site investigation(s), 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 and modeling of stormwater, surface water, and groundwater flows
- Assessment of site ownership
- Identification of easement and access requirements
- Assessment of cultural resources, as appropriate
- Review of the Endangered Species Act for potential site restrictions
- Determination of site access needs (e.g., road improvements)

Following pre-design work, sufficient information will be available to begin site-specific remedial design. In most cases, changes from the TCDs specified in the forthcoming Upper Basin ROD Amendment to the site-specific remedial designs are anticipated to be minimal and largely related to quantities (e.g., the volume of soil requiring excavation) rather than remedial technologies. However, some significant decisions may need to be made after the ROD Amendment is issued. EPA will determine whether these warrant separate decision documentation, such as another ROD Amendment or an Explanation of Significant Differences. As the overall process moves ahead, opportunities for public involvement will continue to be available via input on implementation plans, site-specific remedial design documents, and potential future decision documents.

[1] Many of the streambank stabilization and protection methods in the ISPG are applicable to conditions in Idaho as well as to those in Washington and, where appropriate, will be consulted during site-specific design because no corresponding guidelines are currently available for the state of Idaho.

6.0 References

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Tables

TABLE 1

Characteristics of Upper Basin Watersheds and Subwatersheds

Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Code	Drainage Area (square miles)	Length (miles)	Number of Reaches	Average Gradient (percent)
Upper SFCDR	UG	51	15.3	19	2%
Canyon Creek	CC	22	12.4	7	5%
Ninemile Creek	NM	12	4.9	5	4%
East Fork Ninemile Creek	NM	6	4.4	2	10%
Big Creek	BIG	30	10.2	10	5%
East Fork Big Creek	BIG	8	4.6	2	12%
West Fork Big Creek	BIG	6	3.3	2	15%
Moon Creek	MC	9	4.1	4	6%
West Fork Moon Creek	MC	4	3.2	2	10%
Pine Creek	PC	80	10.9	13	1%
West Fork Pine Creek	PC	40	5.5	4	8%
East Fork Pine Creek	PC	31	6.8	12	5%
Mainstem SFCDR	MG	59	19.8	37	1%

Note:

SFCDR = South Fork of the Coeur d'Alene River

TABLE 2

Characteristics of Stream and Riparian Reaches in Upper Basin Watersheds and Subwatersheds

Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Reach	Length		Average Gradient
		(feet)	(miles)	(percent)
Upper South Fork Coeur d'Alene River	UG01-1	13278	2.5	12.9%
	UG01-2	11957	2.3	3.1%
	UG01-3	2291	0.4	1.8%
	UG01-4	514	0.1	2.5%
	UG01-5	3116	0.6	2.2%
	UG01-6	3041	0.6	0.7%
	UG01-7	2613	0.5	2.9%
	UG01-8	815	0.2	0.3%
	UG01-9	3965	0.8	1.7%
	UG01-10	3076	0.6	1.7%
	UG01-11	935	0.2	0.3%
	UG01-12	8872	1.7	1.6%
	UG01-13	4868	0.9	1.2%
	UG01-14	943	0.2	2.7%
	UG01-15	3389	0.6	0.7%
	UG01-16	3002	0.6	1.9%
	UG01-17	7397	1.4	1.2%
	UG01-18	6182	1.2	1.3%
	UG01-19	719	0.1	3.6%
Canyon Creek	CC01-1	1088	0.2	1.1%
	CC01-2	6970	1.3	11.1%
	CC01-3	13610	2.6	7.8%
	CC02-1	6634	1.3	3.8%
	CC04-1	20053	3.8	3.3%
	CC05-1	2321	0.4	2.3%
	CC05-2	14553	2.8	2.3%
Ninemile Creek	NM03-1	9264	1.8	6.1%
	NM04-1	422	0.1	5.7%
	NM04-2	3715	0.7	3.2%
	NM04-3	1434	0.3	2.5%
	NM04-4	11102	2.1	2.4%
East Fork Ninemile Creek	NM01-1	8021	1.5	12.4%
	NM02-1	15106	2.9	7.1%
Big Creek	BIG02-1	5102	1.0	21.2%
	BIG02-2	3956	0.7	11.9%
	BIG02-3	3621	0.7	4.6%
	BIG02-4	3075	0.6	2.3%
	BIG02-5	713	0.1	0.8%
	BIG02-6	3985	0.8	2.8%
	BIG02-7	5943	1.1	3.6%
	BIG04-1	9988	1.9	2.8%

TABLE 2

Characteristics of Stream and Riparian Reaches in Upper Basin Watersheds and Subwatersheds

Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Reach	Length		Average Gradient
		(feet)	(miles)	(percent)
	BIG04-2	3816	0.7	1.9%
	BIG04-3	13419	2.5	1.7%
East Fork Big Creek	BIG01-1	8734	1.7	17.8%
	BIG01-2	15476	2.9	7.0%
West Fork Big Creek	BIG03-1	9390	1.8	22.6%
	BIG03-2	8279	1.6	7.9%
Moon Creek	MC02-1	6672	1.3	16.3%
	MC02-2	5587	1.1	3.1%
	MC02-3	2898	0.5	2.5%
	MC02-4	6384	1.2	1.8%
West Fork Moon Creek	MC01-1	7651	1.4	15.5%
	MC01-2	9395	1.8	4.6%
Pine Creek	PC02-5	1528	0.3	2.4%
	PC02-6	11845	2.2	1.8%
	PC02-7	2221	0.4	2.0%
	PC02-8	3229	0.6	1.4%
	PC02-9	3463	0.7	0.9%
	PC02-10	1273	0.2	2.5%
	PC02-11A	2357	0.4	1.3%
	PC02-11B	1726	0.3	0.2%
	PC02-12	4518	0.9	1.0%
	PC03-1	4064	0.8	1.0%
	PC03-2	2199	0.4	0.1%
	PC03-3	19688	3.7	0.8%
	PC03-4	2048	0.4	0.2%
West Fork Pine Creek	PC02-1	7769	1.5	16.5%
	PC02-2	12676	2.4	5.3%
	PC02-3	1346	0.3	5.8%
	PC02-4	7457	1.4	3.5%
East Fork Pine Creek	PC01-1	5327	1.0	15.0%
	PC01-2	2630	0.5	11.7%
	PC01-3	2738	0.5	6.4%
	PC01-4	4055	0.8	3.9%
	PC01-5	2491	0.5	2.4%
	PC01-6	941	0.2	3.3%
	PC01-7	2558	0.5	1.5%
	PC01-8	3315	0.6	2.3%
	PC01-9	3291	0.6	1.2%
	PC01-10	759	0.1	1.3%
	PC01-11	974	0.2	3.8%
	PC01-12	6846	1.3	1.4%
Mainstem South Fork Coeur d'Alene River	MG01-1	3015	0.6	1.4%

TABLE 2

Characteristics of Stream and Riparian Reaches in Upper Basin Watersheds and Subwatersheds

Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Reach	Length		Average Gradient
		(feet)	(miles)	(percent)
	MG01-2	1635	0.3	0.3%
	MG01-3	1935	0.4	0.6%
	MG01-4	5778	1.1	0.9%
	MG01-5	1311	0.2	0.8%
	MG01-6	7595	1.4	0.8%
	MG01-7	2099	0.4	2.2%
	MG01-8	4694	0.9	0.6%
	MG01-9	1115	0.2	1.0%
	MG01-10	1026	0.2	0.3%
	MG01-11	1610	0.3	1.1%
	MG01-12	3042	0.6	0.5%
	MG01-13	4529	0.9	0.8%
	MG01-14	1515	0.3	0.3%
	MG01-15	3864	0.7	0.8%
	MG01-16	2143	0.4	1.0%
	MG01-17	5480	1.0	0.4%
	MG01-18	2731	0.5	0.6%
	MG02-1	4455	0.8	0.5%
	MG02-2	7747	1.5	0.5%
	MG02-3	2990	0.6	0.0%
	MG02-3A	645	0.1	0.2%
	MG02-3B	2463	0.5	0.1%
	MG02-3C	1629	0.3	0.0%
	MG02-3D	1727	0.3	0.2%
	MG02-3E	1847	0.3	0.3%
	MG02-4	187	0.0	5.9%
	MG02-5	3180	0.6	0.9%
	MG02-6	1346	0.3	0.7%
	MG02-7	12605	2.4	0.4%
	MG02-8A	826	0.2	0.5%
	MG02-8B	471	0.1	0.0%
	MG02-8C	267	0.1	1.5%
	MG02-9	9267	1.8	0.2%
	MG02-10	1235	0.2	0.2%
	MG02-11	1092	0.2	0.1%
	MG02-12	154	0.0	0.0%

TABLE 3

Watershed Reaches Affected by Stream and Riparian Cleanup Action TCDs

Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

		Number of Watershed Reaches Affected[2]							
TCD ID	**TCD Category[1]**	**UG**	**CC**	**NM**	**BIG**	**MC**	**PC**	**MG**	**Upper Basin Total[2]**
CD-AVG	Current Deflectors	15	4	6	2	4	3	21	55
CD-SED	Current Deflectors, Sediment Traps	15	4	6	2	4	3	20	54
VBS-AVG	Vegetative Bank Stabilization	16	4	6	2	4	3	19	54
BSBR-AVG	Bioengineered Revetments	16	4	5	2	4	3	21	55
FP/RP-AVG	Floodplain and Riparian Replanting	13	4	6	1	4	3	19	50
OFFCH-AVG	Off-Channel Hydrologic Features	3		3	1		2	10	19
CH REAL-1	Channel Realignment		1	3				6	10

Notes:

[1] The TCD categories below are those used in the 2001 Feasibility Study (FS) Report (U.S. Environmental Protection Agency, 2001) and the 2010 Draft Final Focused Feasibility Study (FFS) Report (CH2M HILL, 2010).

[2] Watershed reaches affected are based on the 2001 FS Report and the 2010 Draft Final FFS Report.

BIG = Big Creek Watershed

CC = Canyon Creek Watershed

MC – Moon Creek Watershed

MG = (Mid-Grade Segment) Mainstem SFCDR Watershed

NM = Ninemile Creek Watershed

PC = Pine Creek Watershed

TCD = typical conceptual design

UG = (Upper-Grade Segment) Upper SFCDR Watershed

SFCDR = South Fork of the Coeur d'Alene River

TABLE 4

Estimated Quantities Affected by Stream and Riparian Cleanup Action TCDs, by Watershed

Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

			Watershed Quantities[2]							
TCD ID	**TCD Category[1]**	**UOM**	**UG**	**CC**	**NM**	**BIG**	**MC**	**PC**	**MG**	**Upper Basin Total[2]**
CD-AVG	Current Deflectors	EA	477	310	272	137	145	65	281	1,687
CD-SED	Current Deflectors, Sediment Traps	EA	53	35	30	16	17	8	35	194
VBS-AVG	Vegetative Bank Stabilization	LF	29,600	21,100	23,220	5,800	4,770	4,600	24,858	113,948
BSBR-AVG	Bioengineered Revetments	LF	24,231	12,670	20,020	5,800	4,480	4,600	26,452	98,253
FP/RP-AVG	Floodplain and Riparian Replanting	AC	67	71	46	7	17	16	102	326
OFFCH-AVG	Off-Channel Hydrologic Features	AC	4		1	4		8	76	93
CH REAL-1	Channel Realignment	AC		19	23				28	70

Notes:

[1] The TCD categories below are those used in the 2001 Feasibility Study (FS) Report (U.S. Environmental Protection Agency, 2001) and the 2010 Draft Final Focused Feasibility Study (FFS) Report (CH2M HILL, 2010).

[2] Watershed quantities are based on the 2001 FS Report and the 2010 Draft Final FFS Report.

BIG = Big Creek Watershed

CC = Canyon Creek Watershed

MC = Moon Creek Watershed

MG = (Mid-Grade Segment) Mainstem SFCDR Watershed

NM = Ninemile Creek Watershed

PC = Pine Creek Watershed

UG = (Upper-Grade Segment) Upper SFCDR Watershed

AC = acres

EA = each

LF = lineal feet

TCD = typical conceptual design

UOM = units of measure

TABLE 5

Summary of Differences in Stream and Riparian Actions Between the Preferred Alternative in the Proposed Plan and the Forthcoming Selected Remedy

Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Segment ID	Stream and Riparian Reach Included in Preferred Alternative	Reach Length (feet)	Reach Length (miles)	Notes
Included in Forthcoming Selected Remedy (a)					
Big Creek	BigCrkSeg04	BIG04-3	13,419	2.5	No change from Proposed Plan.
Canyon Creek	CCSeg02	CC02-1	6,634	1.3	No change from Proposed Plan.
	CCSeg04	CC04-1	20,053	3.8	No change from Proposed Plan.
	CCSeg05	CC05-1	2,321	0.4	No change from Proposed Plan.
		CC05-2	14,553	2.8	
Moon Creek	MoonCrkSeg02	MC02-2	5,587	1.1	No change from Proposed Plan.
		MC02-3	2,898	0.5	
		MC02-4	6,384	1.2	
Mainstem SFCDR	MIDGradSeg01	MG01-4	5,778	1.1	No change from Proposed Plan.
		MG01-5	1,311	0.2	
		MG01-6	7,595	1.4	
		MG01-7	2,099	0.4	
		MG01-8	4,694	0.9	
		MG01-9	1,115	0.2	
		MG01-10	1,026	0.2	
		MG01-11	1,610	0.3	
		MG01-12	3,042	0.6	
		MG01-13	4,529	0.9	
		MG01-14	1,515	0.3	
		MG01-15	3,864	0.7	
		MG01-16	2,143	0.4	
		MG01-17	5,480	1.0	
		MG01-18	2,731	0.5	
Ninemile Creek	NMSeg01	NM01-1	8,021	1.5	No change from Proposed Plan.
	NMSeg02	NM02-1	15,106	2.9	No change from Proposed Plan.
	NMSeg04	NM04-1	422	0.1	No change from Proposed Plan.
		NM04-2	3,715	0.7	
		NM04-3	1,434	0.3	
		Total Length	**149,079**	**28.2**	
Excluded from Forthcoming Selected Remedy					
Big Creek	BigCrkSeg04	BIG04-2	3,816	0.7	No remedial actions to be included in forthcoming Selected Remedy.
Moon Creek	MoonCrkSeg01	MC01-2	9,395	1.8	No remedial actions to be included in forthcoming Selected Remedy.
Mainstem SFCDR	MIDGradSeg01	MG01-1	3,015	0.6	No sediment removal actions will occur in these reaches because of existing infrastructure.
	MIDGradSeg01	MG01-2	1,635	0.3	
	MIDGradSeg01	MG01-3	1,935	0.4	
	MIDGradSeg02	MG02-10	1,235	0.2	No remedial actions to be included in forthcoming Selected Remedy.
	MIDGradSeg02	MG02-11	1,092	0.2	
	MIDGradSeg02	MG02-12	154	0.0	
Ninemile Creek	NMSeg03	NM03-1	9,264	1.8	No remedial actions to be included in forthcoming Selected Remedy.
Pine Creek	PineCrkSeg03	PC03-1	4,064	0.8	No sediment removal actions to be included in forthcoming Selected Remedy.
	PineCrkSeg03	PC03-2	2,199	0.4	
	PineCrkSeg03	PC03-3	19,688	3.7	

TABLE 5

Summary of Differences in Stream and Riparian Actions Between the Preferred Alternative in the Proposed Plan and the Forthcoming Selected Remedy

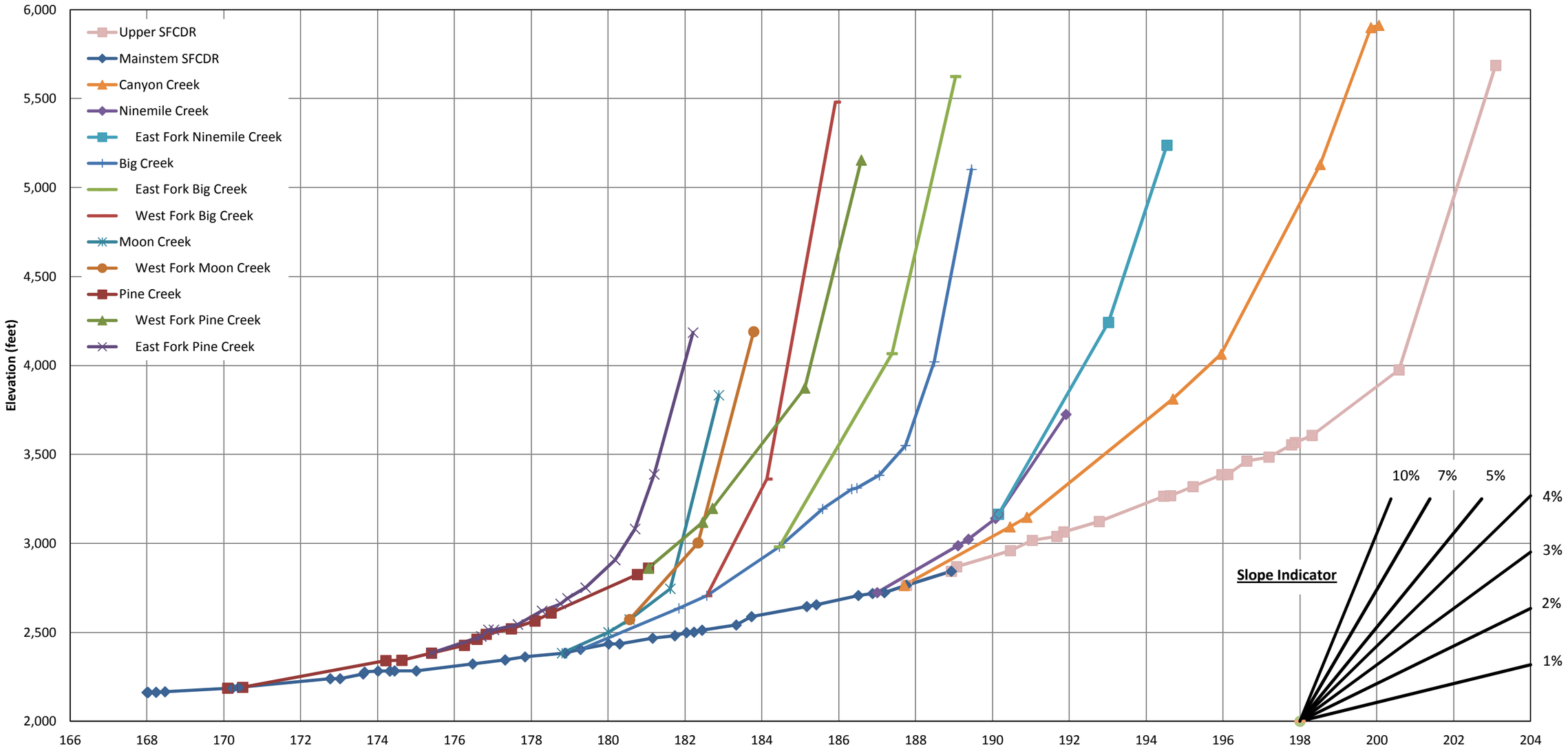
Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

Watershed	Segment ID	Stream and Riparian Reach Included in Preferred Alternative	Reach Length (feet)	Reach Length (miles)	Notes
Upper SFCDR	UpperSFCDRSeg01	UG01-4	514	0.1	No remedial actions to be included in forthcoming Selected Remedy.
		UG01-5	3,116	0.6	
		UG01-6	3,041	0.6	
		UG01-7	2,613	0.5	
		UG01-8	815	0.2	
		UG01-9	3,965	0.8	Limited remedial actions and sediment removal actions to be included in forthcoming Selected Remedy.
		UG01-10	3,076	0.6	No remedial actions to be included in forthcoming Selected Remedy.
		UG01-11	935	0.2	
		UG01-12	8,872	1.7	Limited remedial actions and sediment removal actions to be included in forthcoming Selected Remedy.
		UG01-13	4,868	0.9	
		UG01-14	943	0.2	
		UG01-15	3,389	0.6	
		UG01-16	3,002	0.6	
		UG01-17	7,397	1.4	
		UG01-18	6,182	1.2	
		UG01-19	719	0.1	
		Total Length	**110,939**	**21.0**	

Note:

(a) Stream and riparian stabilization actions will occur in isolated locations within the reaches identified.

Figures

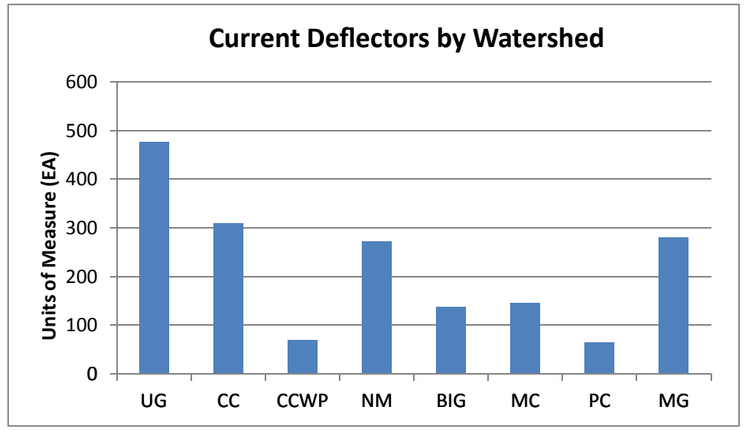


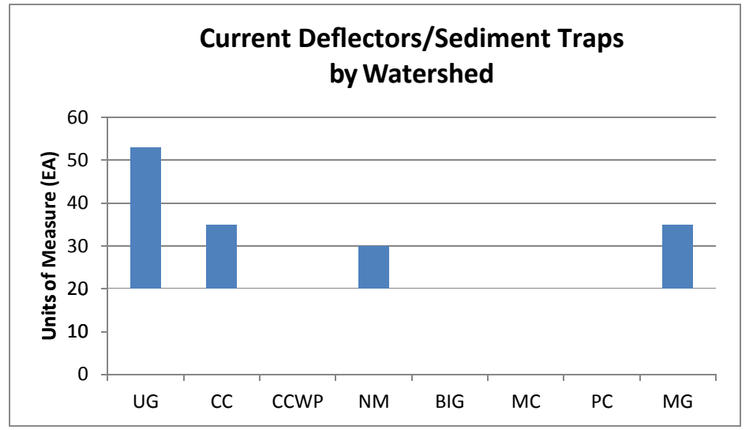
SOURCES:
Elevations:USGS 10-meter digital elevation model (DEM) obtained via download September 1, 2010); reach segments: EPA, 2001.

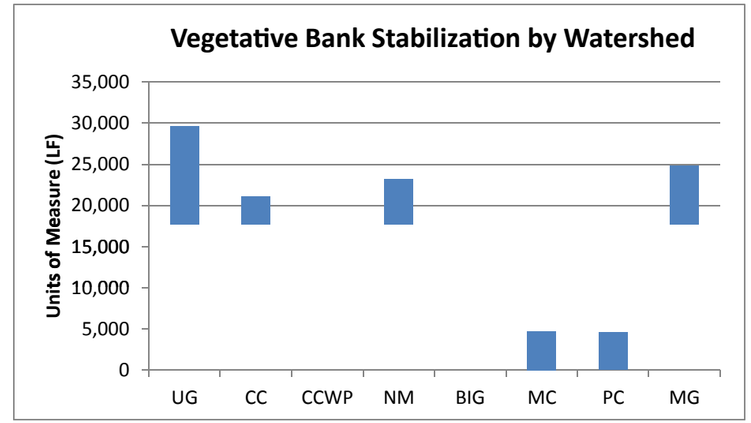
EPA = U.S. Environmental Protection Agency
SFCDR = South Fork of the Coeur d'Alene River
USGS = U.S. Geological Survey

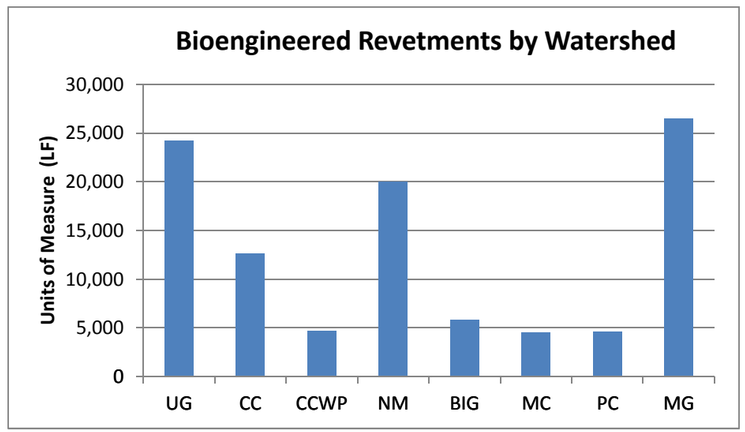
Figure 1
Longitudinal Profiles of Stream and Riparian Reaches, Upper Basin Watersheds and Subwatersheds
Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

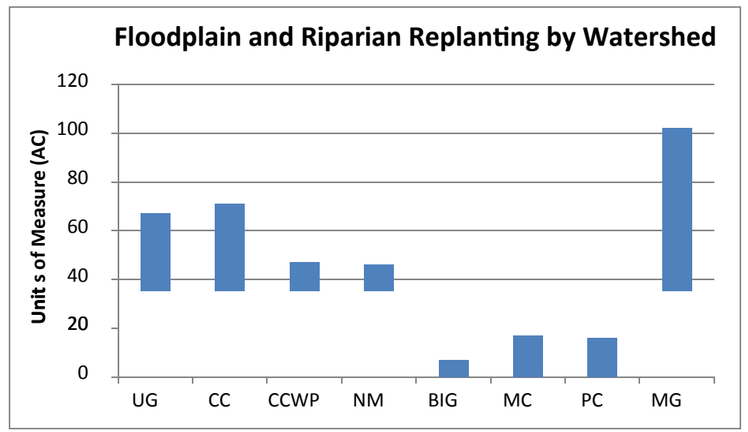
EPA

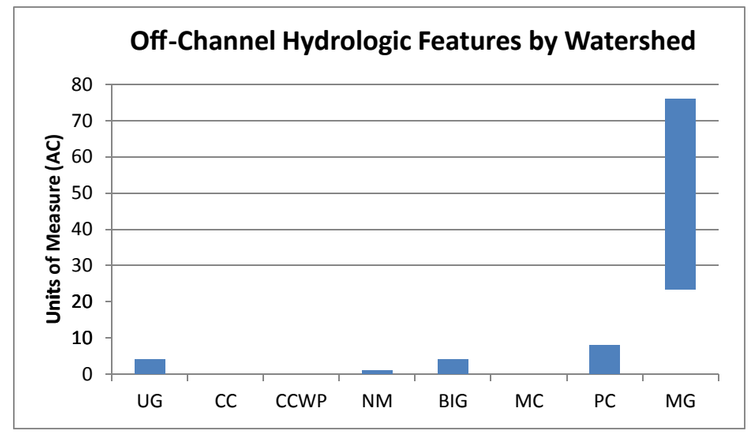


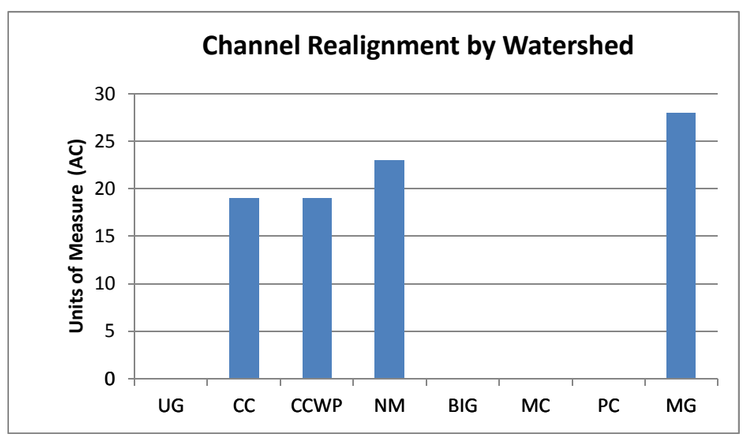








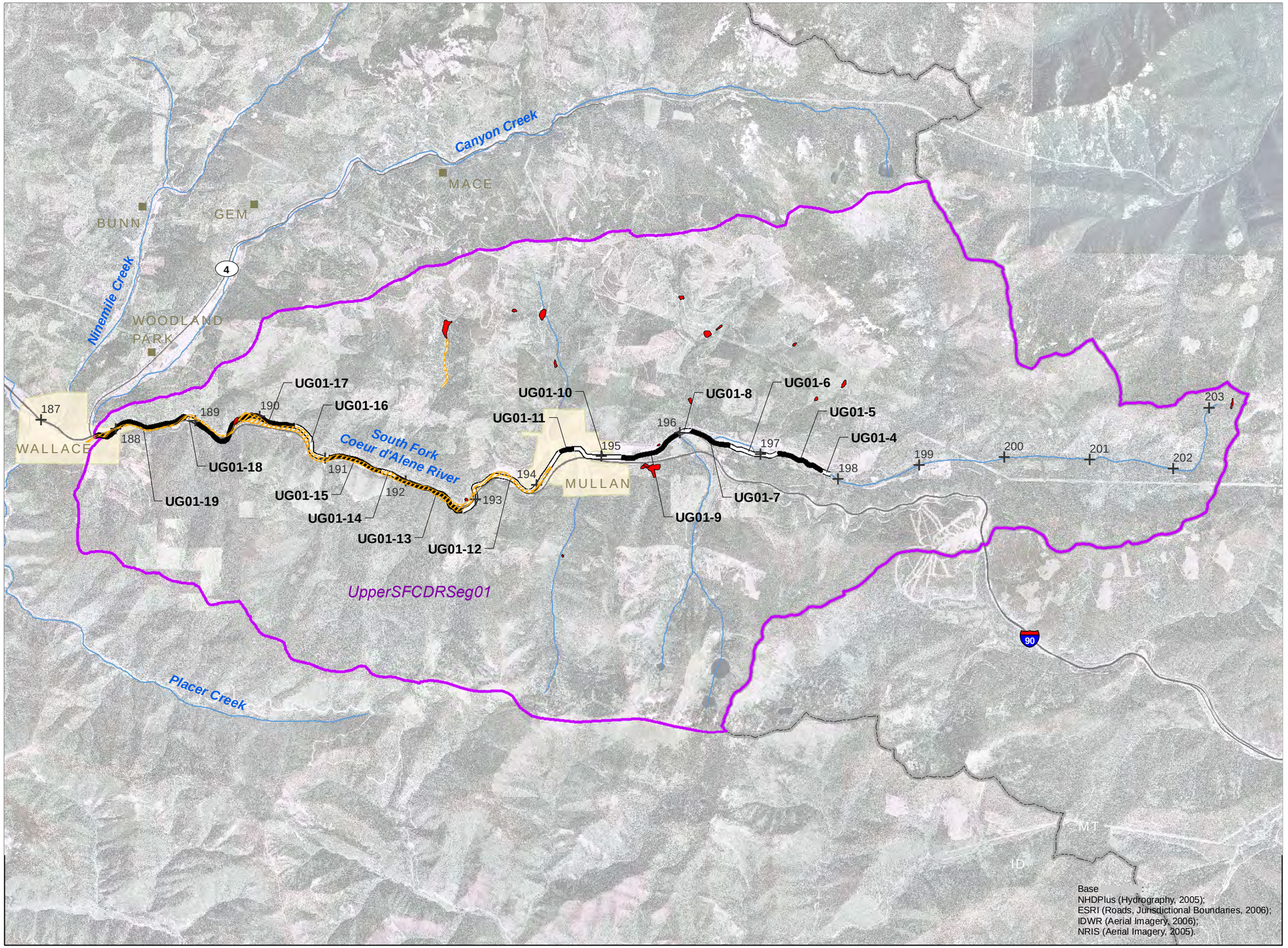


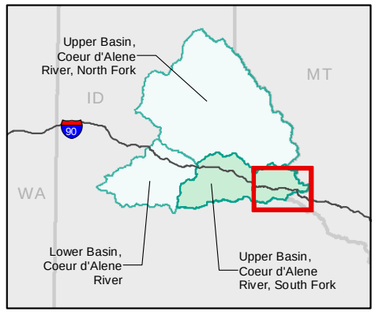


BIG = Big Creek Watershed
CC = Canyon Creek Watershed
CCWP = Canyon Creek Woodland Park
MC – Moon Creek Watershed
MG = (Mid-Grade Segment) Mainstem SFCDR Watershed
NM = Ninemile Creek Watershed
PC = Pine Creek Watershed
UG = (Upper-Grade Segment) Upper SFCDR Watershed

AC = acres
EA = each
LF = lineal feet
SFCDR = South Fork of the Coeur d'Alene River

Figure 2
Allocation of TCD Categories by Watershed, Generally Upstream to Downstream
Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site





Site with Remedial Action (non-sediment removal) Included in Forthcoming Selected Remedy

Site with **Sediment Removal** Remedial Action Included in Forthcoming Selected Remedy[1]

203 River Mile

River/Creek

UG01-4 Stream and Riparian Reach Included in Alternative 3+

Watershed Segment

City Limit

State Boundary

N

0 0.5 1 2 Miles

Notes:

No stream and riparian stabilization actions for the Upper SFCDR Watershed will be included in the Forthcoming Selected Remedy.

[1] Sediment removal actions will occur in isolated locations within the site identified.

Figure 3
Stream and Riparian Stabilization Actions, Upper SFCDR Watershed
Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

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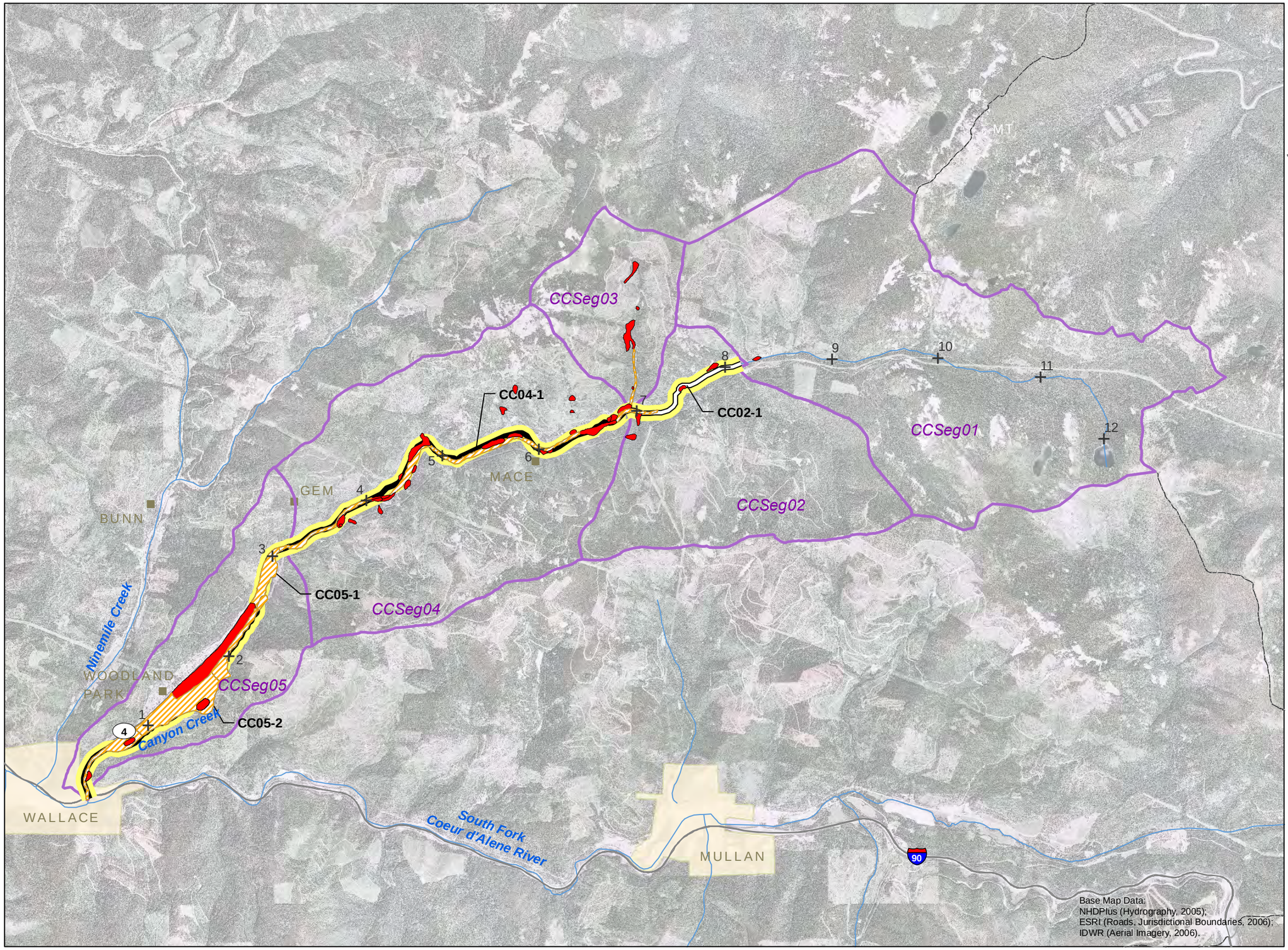
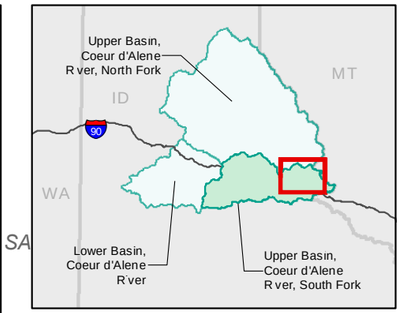




Site with Remedial Action (non-sediment removal) Included in Forthcoming Selected Remedy

Site with **Sediment Removal** Remedial Action Included in Forthcoming Selected Remedy[1]

4 River Mile

River/Creek

CC05-2 Stream and Riparian Reach Included in Alternative 3+ and Forthcoming Selected Remedy

City Limit

Watershed Segment

State Boundary

N

0 0.25 0.5 1 Miles

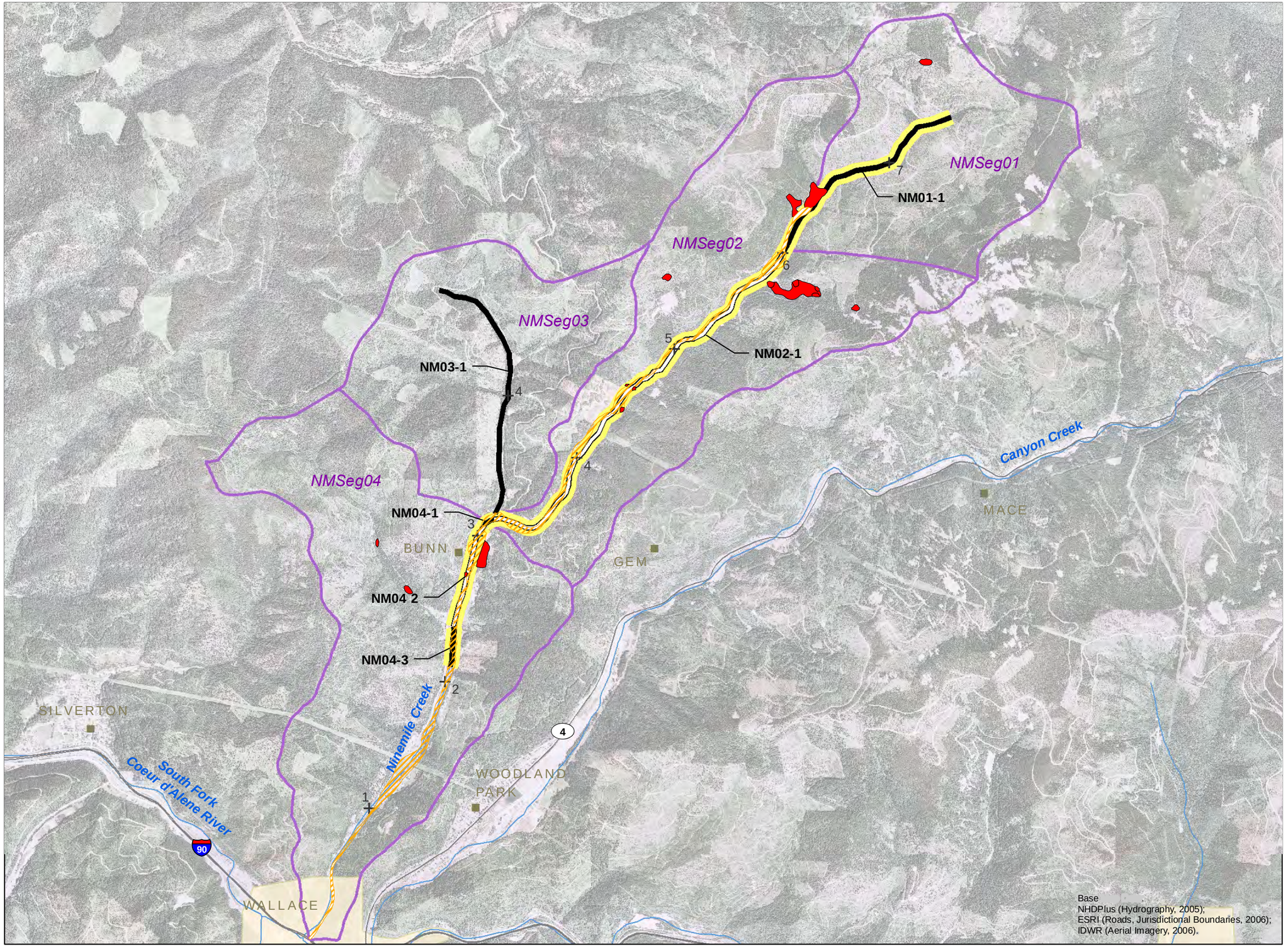
Note:

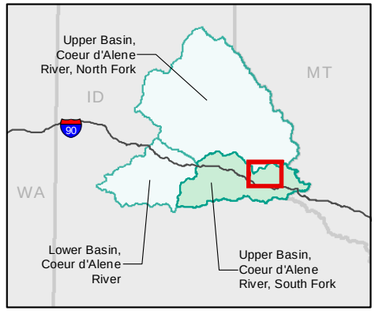
[1] Sediment removal actions and associated stream and riparian stabilization actions will occur in isolated locations within the site identified.

Figure 4
Stream and Riparian Stabilization Actions, Canyon Creek Watershed
Updates to Stream and Riparian Actions, 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).

EPA





Site with Remedial Action (non-sediment removal) Included in Forthcoming Selected Remedy

Site with **Sediment Removal** Remedial Action Included in Forthcoming Selected Remedy[1]

River Mile

River/Creek

NM03-1 Stream and Riparian Reach Included in Alternative 3+

NM04-2 Stream and Riparian Reach Included in Forthcoming Selected Remedy

Watershed Segment

City Limit

N

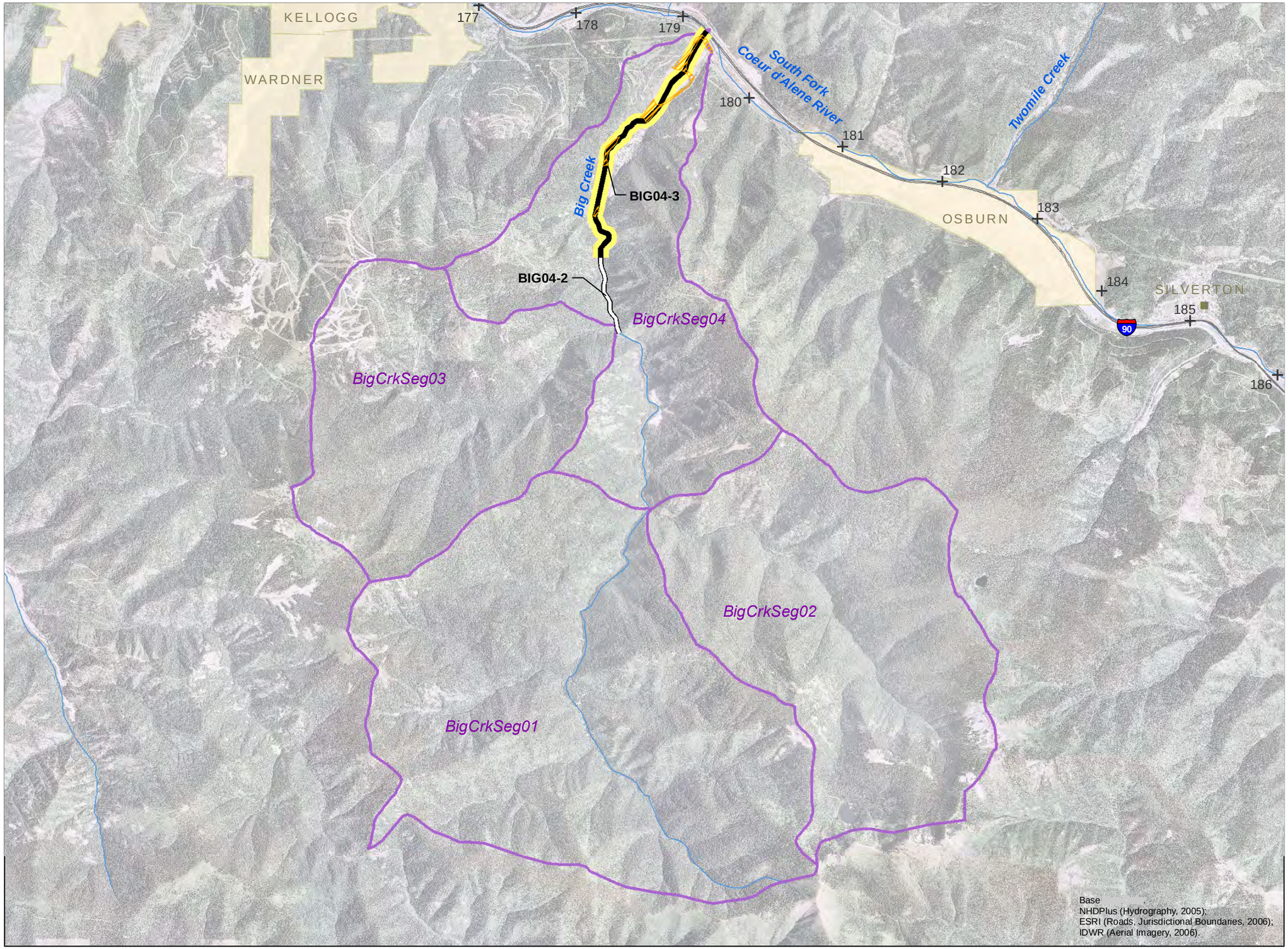
0 0.25 0.5 1 Miles

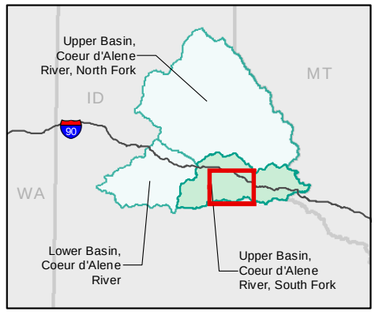
Base
NHDPlus (Hydrography, 2005);
ESRI (Roads, Jurisdictional Boundaries, 2006);
IDWR (Aerial Imagery, 2006).

Note:

[1] Sediment removal actions and associated stream and riparian stabilization actions will occur in isolated locations within the site identified.

Figure 5
Stream and Riparian Stabilization Actions, Ninemile Creek Watershed
Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site





Site with Remedial Action (non-sediment removal) Included in Forthcoming Selected Remedy

Site with **Sediment Removal** Remedial Action Included in Forthcoming Selected Remedy[1]

180 River Mile

River/Creek

BIG04-2 Stream and Riparian Reach Included in Alternative 3+

BIG04-3 Stream and Riparian Reach Included in Forthcoming Selected Remedy

Watershed Segment

City Limit

N

0 0.25 0.5 1 Miles

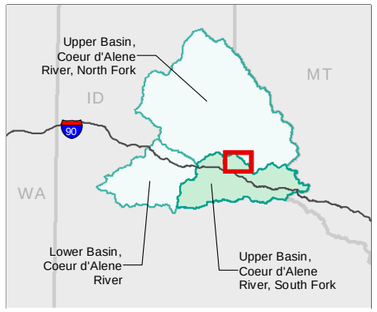
Base .
NHDPlus (Hydrography, 2005);
ESRI (Roads, Jurisdictional Boundaries, 2006);
IDWR (Aerial Imagery, 2006).

Note:

[1] Sediment removal actions and associated stream and riparian stabilization actions will occur in isolated locations within the site identified.

Figure 6
Stream and Riparian Stabilization Actions, Big Creek Watershed
Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

EPA



Site with Remedial Action (non-sediment removal) Included in Forthcoming Selected Remedy

Site with **Sediment Removal** Remedial Action Included in Forthcoming Selected Remedy[1]

179 River Mile

River/Creek

MC01-2 Stream and Riparian Reach Included in Alternative 3+

MC02-4 Stream and Riparian Reach Included in Forthcoming Selected Remedy

Watershed Segment

N

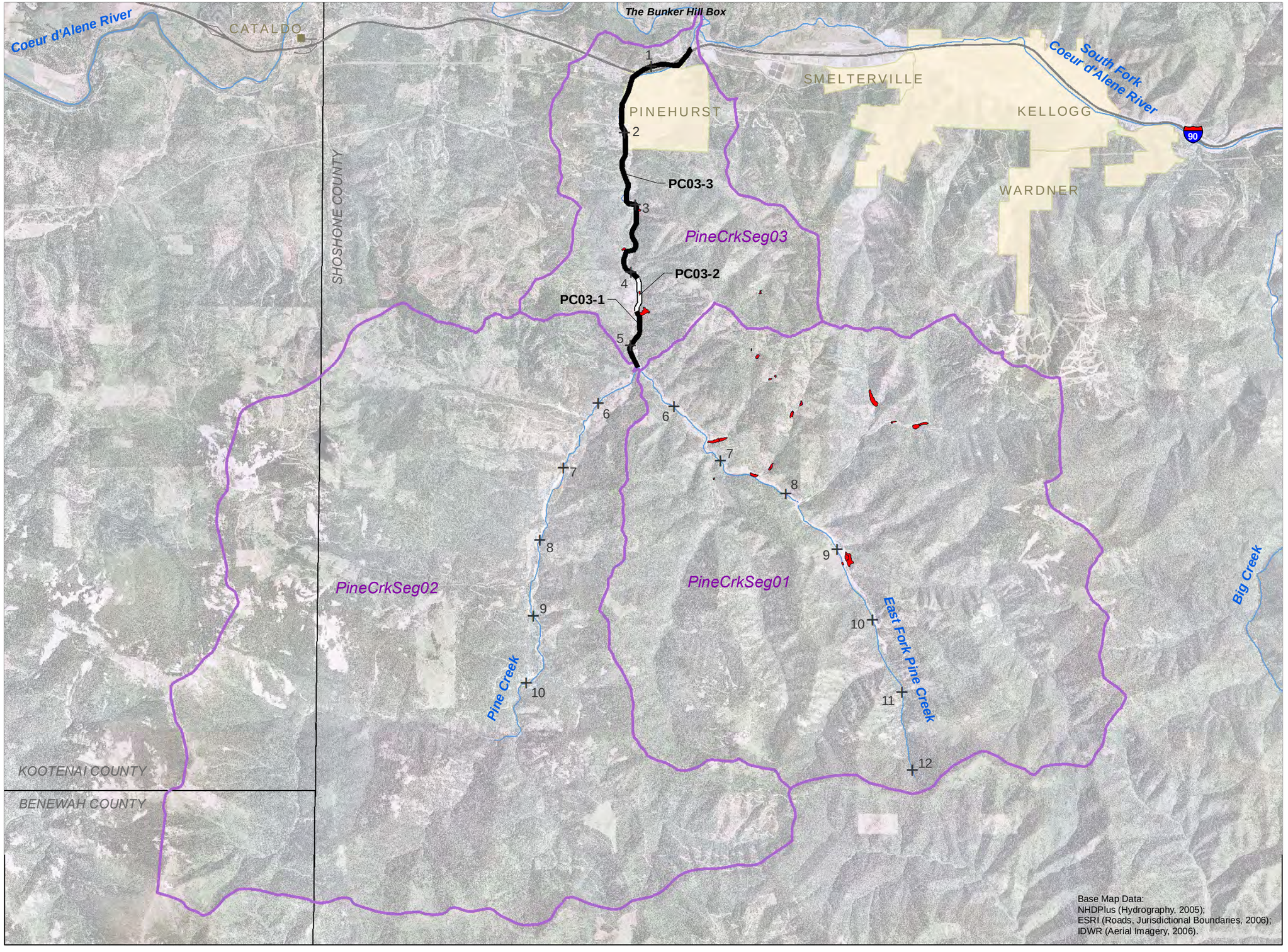
0 0.25 0.5 1 Miles

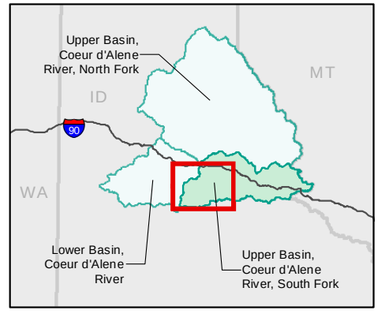
Base Map Data:
NHDPlus (Hydrography, 2005);
ESRI (Roads, Jurisdictional Boundaries, 2006);
IDWR (Aerial Imagery, 2006).

Note:

[1] Sediment removal actions and associated stream and riparian stabilization actions will occur in isolated locations within the site identified.

Figure 7
Stream and Riparian Stabilization Actions, Moon Creek Watershed
Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site





Site with Remedial Action (non-sediment removal) Included in Forthcoming Selected Remedy

Site with **Sediment Removal** Remedial Action Included in Forthcoming Selected Remedy[1]

4 River Mile

River/Creek

PC03-1 Stream and Riparian Reach Included in Alternative 3+

Watershed Segment

City Limit

N

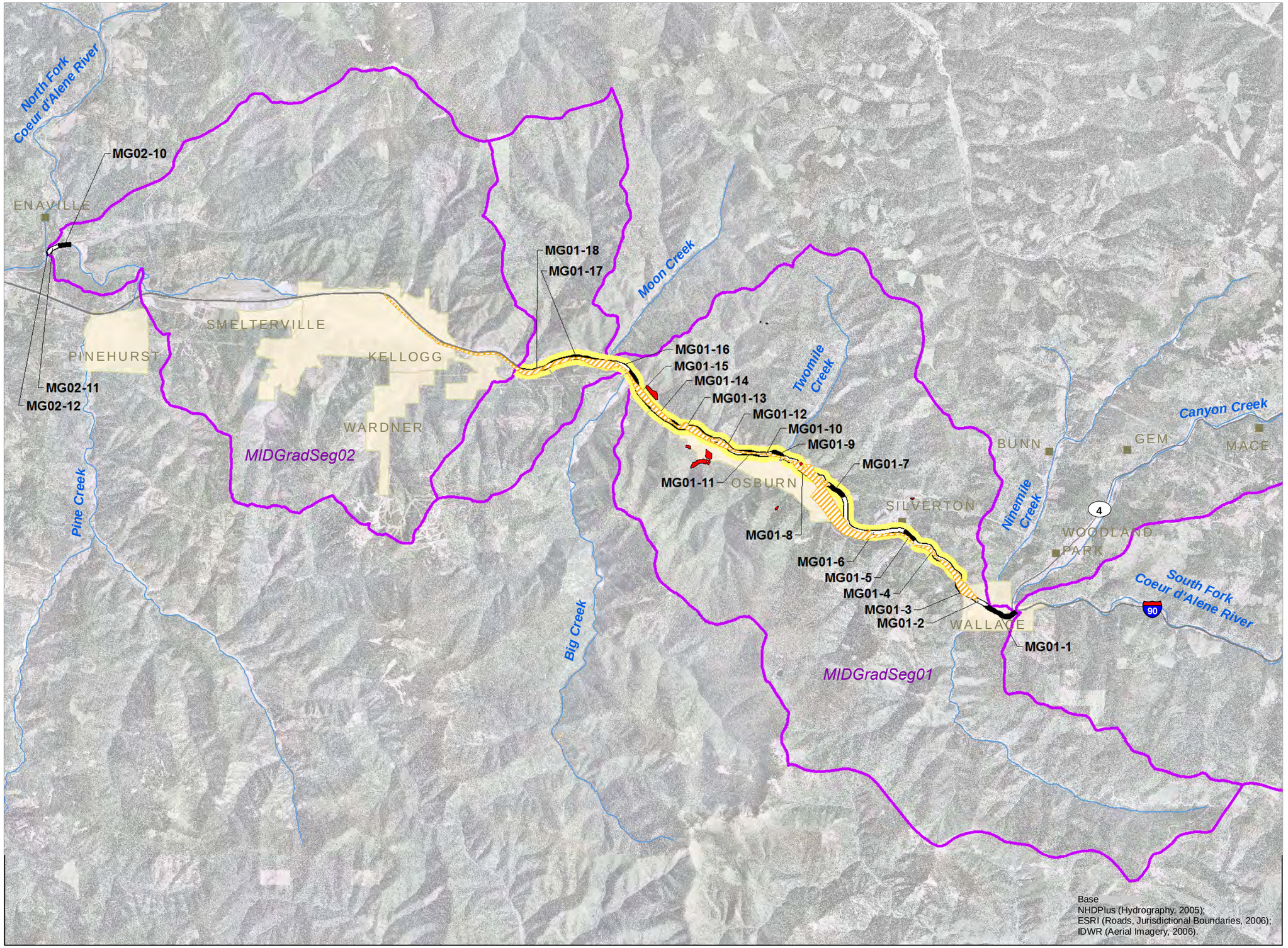
0 0.5 1 2 Miles

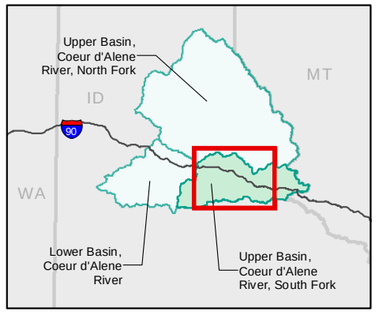
Notes:

No stream and riparian stabilization actions for the Pine Creek Watershed will be included in the Forthcoming Selected Remedy.

[1] Sediment removal actions will occur in isolated locations within the site identified.

Figure 8
Stream and Riparian Stabilization Actions, Pine Creek Watershed
Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site





Site with Remedial Action (non-sediment removal) Included in Forthcoming Selected Remedy

Site with **Sediment Removal** Remedial Action Included in Forthcoming Selected Remedy[1]

187 River Mile

River/Creek

MG02-10 Stream and Riparian Reach Included in Alternative 3+

MG01-16 Stream and Riparian Reach Included in Forthcoming Selected Remedy

Watershed Segment

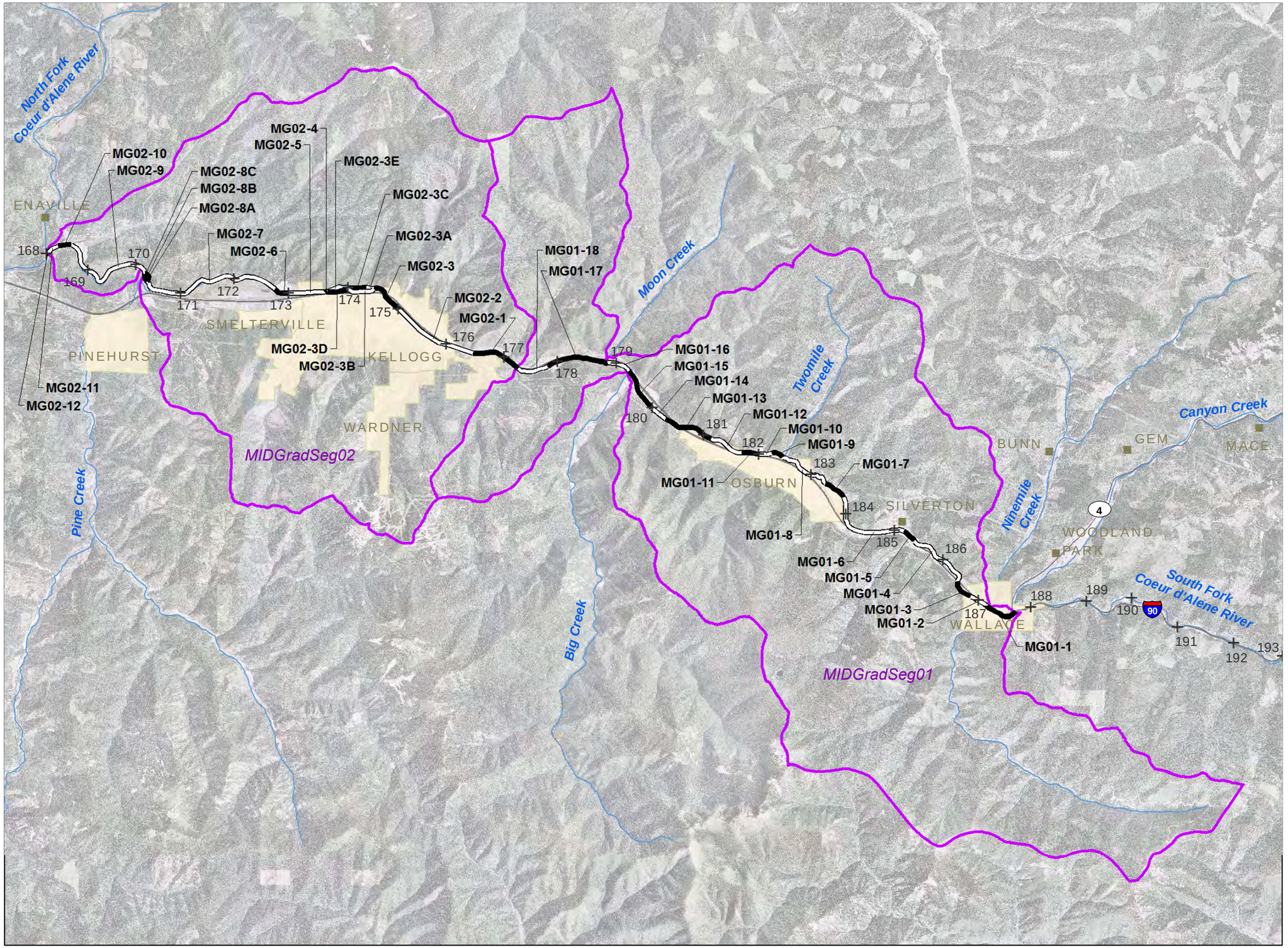
City Limit

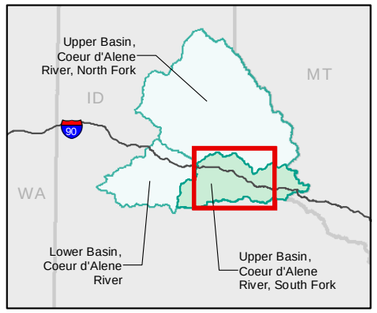
N 0 0.5 1 2 Miles

Note:

[1] Sediment removal actions and associated stream and riparian stabilization actions will occur in isolated locations within the site identified.

Figure 9
Stream and Riparian Stabilization Actions, Mainstem SFCDR Watershed
Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site





187 River Mile

River/Creek

Stream and Riparian Reach

MG01-1 (Stream and Riparian Reach ID)

Watershed Segment

City Limit

N

0 0.5 1 2 Miles

Base Map Data:
NHDPlus (Hydrography, 2005);
ESRI (Roads, Jurisdictional Boundaries, 2006);
IDWR (Aerial Imagery, 2006).

Figure 10
Stream and Riparian Reaches, Mainstem SFCDR Watershed
Updates to Stream and Riparian Actions, Upper Basin of the Coeur d'Alene River, Bunker Hill Superfund Site

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