B O N N E V I L L E   P O W E R   A D M I N I S T R A T I O N

Lemhi Valley River and Floodplain Restoration Projects

Draft

Environmental Assessment

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Table of Contents

List of Figures

List of Tables

1 Purpose and Need for Action

1.1 Introduction

The Bonneville Power Administration (BPA) proposes to provide funding for river and floodplain habitat restoration actions in the mainstem and tributaries of the Lemhi River in eastern Idaho. These actions include six mainstem and tributary river/stream restoration actions; four irrigation diversion modifications; one culvert replacement; and planting, riparian-protection fencing, invasive weed treatments, and hydroseeding[1] at various locations within the Lemhi River Valley (hereafter, the Valley). These actions would be sponsored and managed by a number of entities, including the Idaho Department of Fish and Game (IDFG), Lemhi Regional Land Trust (LRLT), Trout Unlimited (TU), Lemhi Soil and Water Conservation District (LSWCD), and the Upper Salmon Basin Watershed Program of the State of Idaho's Office of Species Conservation.

BPA is preparing this Environmental Assessment (EA) pursuant to the National Environmental Policy Act of 1969 (NEPA) (42 US Code [USC] §§ 4321 et seq.) and its implementing regulations, which require federal agencies to assess the impacts their actions may have on the environment and make that impact analysis available to the public. This EA was prepared to determine if the Proposed Action would be likely to significantly affect the environment, warranting preparation of an environmental impact statement (EIS), or whether it is appropriate to prepare a Finding of No Significant Impact (FONSI).

1.2 Need

BPA needs to determine whether to provide funding to the sponsoring entities, IDFG, LRLT, TU, LSWCD, and the Upper Salmon Basin Watershed Program of the State of Idaho's Office of Species Conservation, for the eleven distinct aquatic habitat restoration projects in the Lemhi River Valley.

1.3 Purposes

In meeting the need for action, BPA seeks to achieve the following purposes:

- Support efforts to mitigate for effects of development and operation of the Federal Columbia River Power System on fish and wildlife in the mainstem Columbia River and its tributaries pursuant to the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Northwest Power Act; 16 USC §§ 839 *et seq.*) in a manner consistent with the Northwest Power and Conservation Council's Columbia River Basin Fish and Wildlife Program and the purposes of the Northwest Power Act.
- Help BPA meet its obligations under the Endangered Species Act (ESA) by fulfilling commitments begun under the 2008 National Oceanic Atmospheric and Administration Fisheries (NOAA Fisheries) Federal Columbia River Power System Biological Opinion (as supplemented in 2010 and 2014) (2008 BiOp) and ongoing commitments under the 2019 NOAA Fisheries Columbia River System BiOp (2019 CRS BiOp). The 2008 BiOp called for identifying tributary habitat restoration projects and the 2019 CRS BiOp largely continues the tributary habitat restoration program.
- Fulfill Bonneville's commitments under the 2018 Columbia River Fish Accord Extension agreement.

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[1] Hydroseeding is a planting process that uses a slurry of seed and mulch. It is often used as an erosion control technique on construction sites, as an alternative to the traditional process of broadcasting or sowing dry seed.

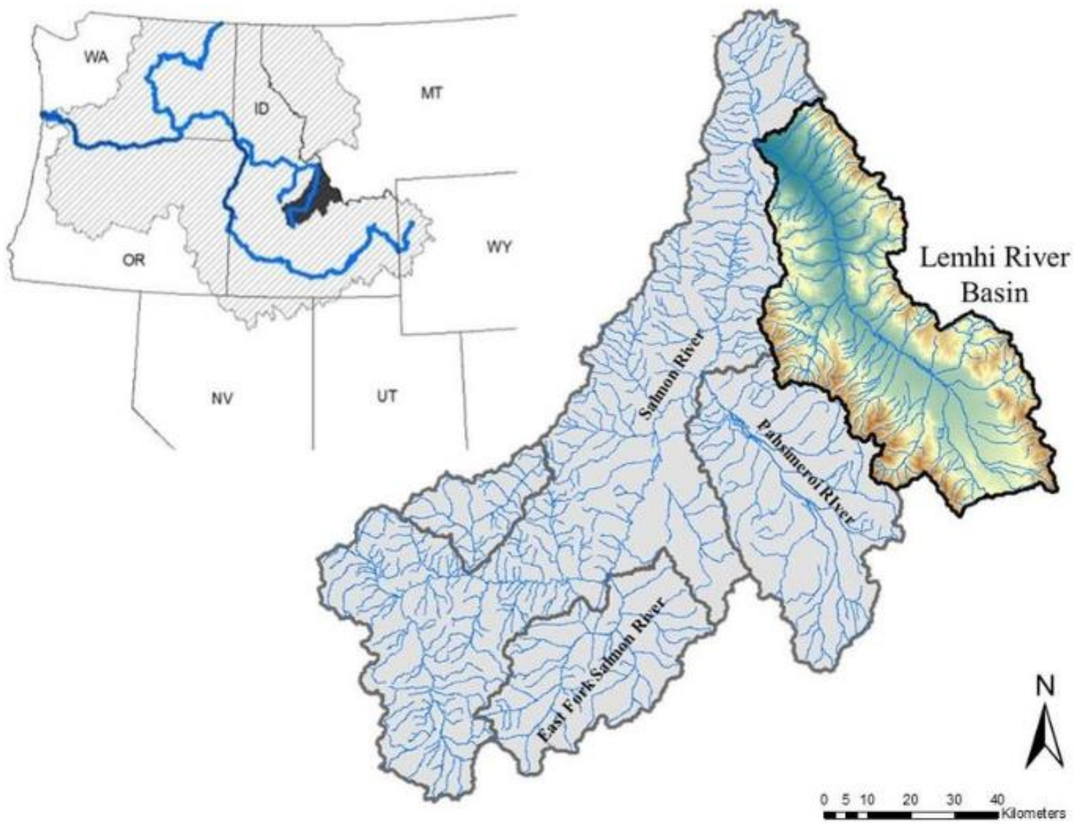
- Minimize adverse effects to the human environment, avoid jeopardizing the continued existence of ESA-listed species, and avoid adverse modification or destruction of designated critical habitat.

1.4 Background

1.4.1 The Lemhi River Valley

The Lemhi River is a 60-mile-long river in Idaho. It is a tributary of the Salmon River, which in turn is tributary to the Snake River and Columbia River (see Figure 1).

Figure 1 The Lemhi River Basin



The Lemhi River begins at the confluence of Eighteenmile Creek and Texas Creek near Leadore, Idaho and flows generally northwest, through the valley formed by the Lemhi Range to the west, and the Bitterroot Range and Beaverhead Mountains to the east. The Lemhi River flows into the Salmon River at the city of Salmon, Idaho (Figure 2).

Figure 2 Lemhi River Valley

The Lemhi River and its tributaries historically provided significant spawning, rearing, and over-wintering habitat for anadromous Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*). Beginning in the mid-1800s, however, homesteading in the Valley began impacting fish populations and fish habitat. Beaver were removed, grazing and farming was widespread, and human development altered aquatic habitats by cattle grazing, agriculture, water withdrawals, stream channelization, stream dewatering, road construction, logging, and mining. Both of these species are now listed as "threatened" under the ESA.

These land-use actions altered the hydrology of the Lemhi River and its tributaries. They blocked fish passage, reduced stream flows, removed cover, and elevated water temperatures in many areas to levels prohibiting the access to, or use by, ESA-listed fish for spawning, rearing or overwintering. Still, today, summer streamflow reductions (from irrigation diversions July through September) directly affect the quantity and quality of fish habitat, and affect migration and access to suitable spawning and rearing habitat for these fish (Munther, 1974; Scott *et al*., 1981). Reduced summer stream flows decrease juvenile rearing space, resulting in poor growth and survival (Quinn, 2005).

In the late 1980's and early 1990's, Valley ranchers sought assistance from state and federal officials to help develop a plan for conserving their declining salmon and steelhead, and the Northwest Power and Conservation Council (see Section 1.4.2, "*Bonneville Power Administration, the Northwest Power Act and the Council's Fish and Wildlife Program*", below) developed a "Strategy for Salmon" (NPCC 1992) which, among other things, called for cooperative efforts between private landowners, government, and other stakeholders to develop plans for salmon recovery. Early cooperative action in the Lemhi Valley led to three positive actions: an irrigator's plan to improve fish passage (LID and WD74 1992); a "Model Watershed Plan" (ISCC 1995) which identified a range of fish conservation actions; and the establishment of the "Model Watershed Project" which has since expanded to become the Upper Salmon Basin Watershed Project (USBWP). Since then, numerous projects to improve fish passage, improve riparian and aquatic habitat, increase and protect instream flow, and monitor results have been implemented. BPA has played a major role (along with NOAA Fisheries and the Bureau of Reclamation) in funding many of these improvements.

BPA's investments in the Lemhi Valley began in the early 1990's. It has funded the USBWP since 1992, and purchased thousands of acres of conservation easements for long-term protection of fish habitat on working farms and ranches. It has cooperatively funded numerous on-the-ground projects to improve irrigation systems and diversions; improve instream and riparian habitats; and reconstruct or install new fish screens (to prevent fish from entering irrigation ditches). Today, the Lemhi River is critical to recovery of spring Chinook and steelhead populations in the Columbia Basin. NOAA Fisheries identified the Lemhi River population of steelhead as one of the top few populations in the Columbia River basin that must achieve and maintain population viability for the ultimate recovery of this species (NMFS 2019). The Lemhi River was also identified as one of the highest two spring Chinook populations as having the highest potential to benefit population recovery in the near term (NMFS 2019).

The actions evaluated in this EA for funding by BPA are a continuation of these cooperative efforts and have been proposed to restore some of what was lost by the development actions over the past 150 years. Their goal is to help reestablish historical stream flows, restore stream conditions capable of producing and supporting diverse and numerous aquatic species, reconnect stream courses with their floodplain, and develop vegetative cover (instream and streamside). BPA's proposed funding actions would restore fish passage, lower stream temperatures, reduce unnatural erosion and turbidity, improve sediment capture, and develop fish and wildlife habitat structure in streams and uplands. These actions are all intended to help protect and restore aquatic and upland habitats sufficient to support the life history needs of ESA-listed fish and wildlife.

These projects are all considered in one EA because they are all located in the same geographic area; they all seek the same objective (to improve conditions for ESA-listed fish), they share similar actions with similar impacts and mitigations; and would all be implemented in the same two-year timeframe.

1.4.2 Bonneville Power Administration, the Northwest Power Act and the Council's Fish and Wildlife Program

BPA is a federal power marketing agency within the U.S. Department of Energy with responsibility for marketing and selling power generated by the Federal Columbia River Power System. BPA's operations are governed by several statutes, including the Northwest Power Act. The Northwest Power Act directs BPA to protect, mitigate, and enhance fish and wildlife affected by development and operation of federal hydroelectric facilities on the Columbia River and its tributaries in a manner consistent with the Northwest Power and Conservation Council's (the Council) Columbia River Basin Fish and Wildlife Program (Program). The Council is an interstate agency established under the authority of the Northwest Power Act to develop and maintain a regional power plan and a fish and wildlife program to balance the Northwest's environment and energy needs. The Northwest Power Act directs the Council to develop a program to "protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries... affected by the development, operation, and management of hydroelectric projects while assuring the Pacific Northwest an adequate, efficient, economical, and reliable power supply." (NPCC 2014). The Council recommends fish and wildlife mitigation for BPA funding and the Council's Independent Scientific Review Panel periodically reviews most BPA-funded fish and wildlife mitigation projects for consistency with the Program.

1.4.3 Columbia Basin Fish Accords and Extension

On May 2, 2008, BPA signed the 2008 Columbia Basin Fish Accords with the State of Idaho and extended this agreement in 2018. The 2018 Fish Accord Extension includes funding commitments for all of the Lemhi Valley Restoration Projects, subject to compliance with applicable law, including environmental review under NEPA.

1.5 Public Involvement

1.5.1 Scoping

To help determine issues to be addressed in the EA, BPA conducted public scoping outreach. BPA mailed letters on January 21, 2020 to landowners, tribes, government agencies, and other potentially affected or concerned citizens and interest groups. The public letter provided information about the Proposed Action and the EA scoping period, requested comments on issues to be addressed in the EA, and described how to comment (mail, fax, telephone, the BPA website, and at scoping meetings). The public letter was posted on a project website established by BPA to provide information about the program and the EA process. The public comment period began on January 21, 2020, and BPA accepted comments on the project from the public until February 21, 2020. All project documents and comments received are available for public review on BPA's website at www.bpa.gov/goto/LemhiRestoration.

1.5.2 Public Comments

Three individuals responded to the request for comment, but none spoke substantively to the projects proposed. One stated that they were already engaged with these projects as a member of the Upper Salmon Basin Technical Team that reviews aquatic habitat restoration projects for funding requests. Another expressed support for the projects, especially since they were planned and supported by that local technical team. The third respondent was not supportive of tributary restoration actions for anadromous salmonids because of the risks to these fish in the ocean and the mainstem of the Columbia River, and shared a negative long-term outlook for these species.

2 Proposed Action and the No Action Alternative

2.1 Proposed Action

The Proposed Action consists of eleven mitigation projects. Some of these, namely the river and floodplain restoration projects and the irrigation diversion actions, are construction actions that require the use of heavy equipment such as excavators, backhoes, and graders. Other mitigation project actions that are elements of these projects, such as livestock exclusion fencing, planting, willow weaves, and beaver dam analogues[2] require no so such equipment and result in little, if any ground disturbance. For all of the eleven mitigation projects, design criteria, mitigation measures, and conservation measures from ESA consultations would be applied to minimize impacts and maximize effectiveness (see Section 2.3, *"Mitigation Measures";* and Appendices A, "*Design Criteria for Project Features";* B, *"General Conservation Measures Applicable to All Actions"*, and C, *"Conservation Measures for Invasive Plant Control"*). Appendix D, "*Project Maps and Designs*", contains location mapping and designs, as applicable, for each of the proje ct actions.

2.1.1 Construction Actions

Under the Proposed Action, BPA would fund three large river and floodplain restoration actions and three comparatively small irrigation diversion modifications on the Lemhi River. On its tributaries, three stream restoration actions, one irrigation diversion modification, and one culvert would be replaced. In addition to the construction actions these projects would entail planting, riparian-protection fencing, invasive weed treatments, and hydroseeding.

These actions are representative of well-established aquatic and terrestrial restoration techniques that have been applied throughout the Columbia River Basin and within the Valley over the past two decades. They have been demonstrated to be effective in the support and re storation of aquatic species and habitats. They would be conducted within stream channels, riparian areas, floodplains, wetlands, and uplands; and would be accomplished using manual labor, hand tools, all-terrain vehicles, trucks, and heavy equipment (*e.g.,* backhoes, excavators, bulldozers, front-end loaders, and dump trucks).

Within the mainstem of the Lemhi River, the following construction actions are proposed[3]:

1. Lemhi Headwaters, a river and floodplain restoration project
2. Narrows Reach, a river and floodplain restoration project
3. Eagle Valley, a river and floodplain restoration project
4. Lemhi/Big Springs, a river and floodplain restoration project
5. L-58C, an irrigation diversion relocation
6. L-63, an irrigation weir removal

On the Lemhi River's tributaries, the following actions are proposed:

7. Canyon Creek Confluence, a stream and floodplain restoration project on Canyon Creek near its confluence with the Lemhi River

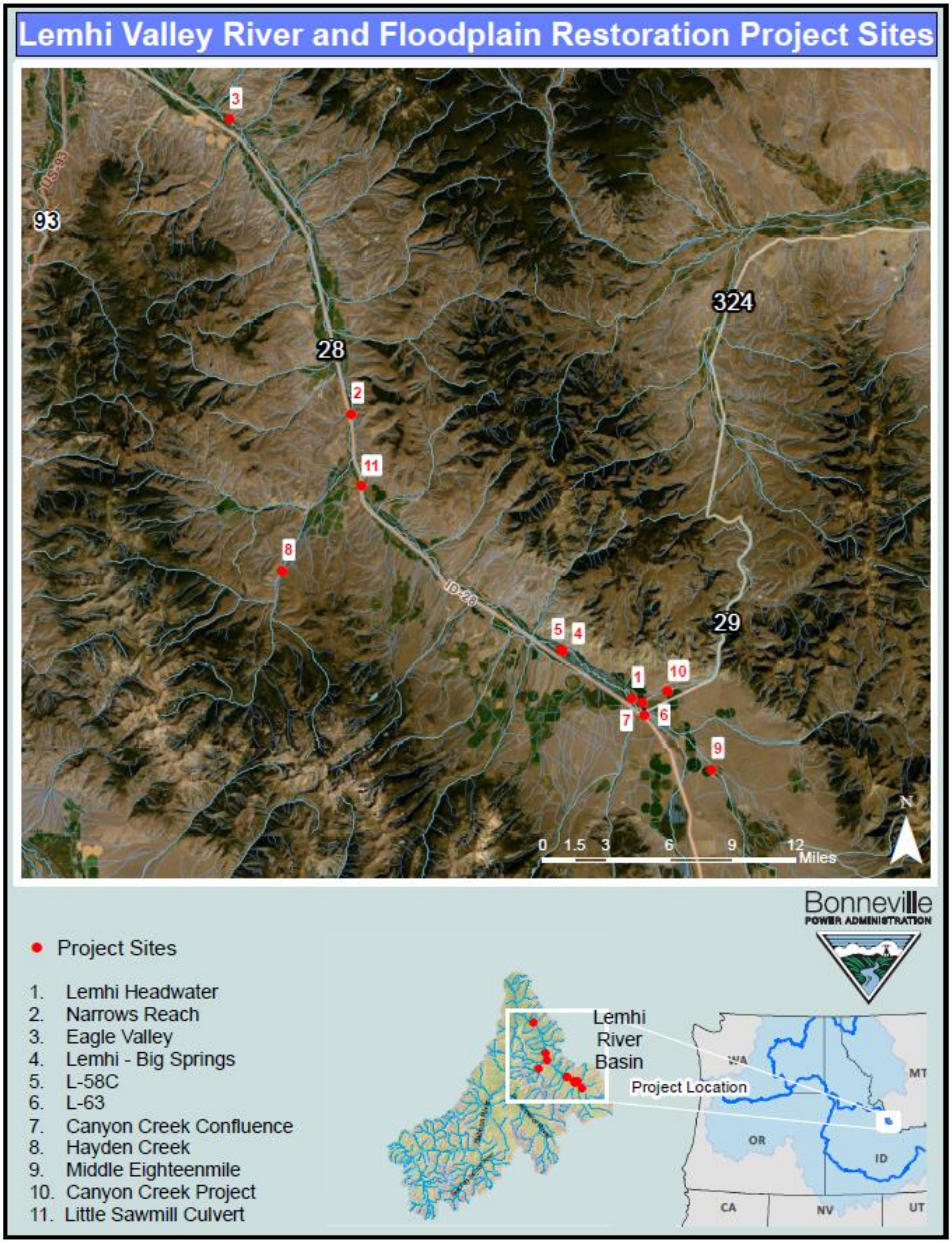
[2] A "beaver dam analogue" is a constructed feature of small posts with inter-woven willow branches designed to mimic the function of a beaver dam. A "willow weave" is of similar construction except that it would not span the entire creek.

[3] The numbering of these habitat improvement projects, 1 through 11, is used in many places throughout this EA as a reference short cut to identify these projects.

8. Hayden Creek, a stream and floodplain restoration action within the inset floodplain of Hayden Creek
9. Middle Eighteenmile, a stream reconstruction action
10. Canyon Creek Boundary, an irrigation diversion relocation and stream habitat improvement
11. Little Sawmill Culvert, a culvert replacement project

The locations of these actions (by number) are displayed in Figure 3.

Figure 3 Proposed Action Project Locations in the Valley



2.1.1.1 River and Floodplain Restoration projects

These actions would improve secondary channels and wetland habitats; protect streambanks using bioengineering methods; install habitat-forming instream structures using native materials; plant riparian vegetation; and reconstruct stream/river channels. The purpose of these types of projects would be to help restore river reaches[4] and their floodplains to their natural hydrologic structure and function for the benefit of juvenile and adult salmonids. The intent of these actions is to increase channel structure and complexity by replacing the existing single-channel river (often channelized and rip-rapped), with a more natural, multi-threaded, stream network, with intermittent and perennial side channels, alcoves, oxbows, and swales, that would increase the river's interaction with its floodplain at varying flows. Pools and riffles are often constructed within the river or stream, and large wood and vegetative structures of various configurations would be placed in and along it to develop pools and provide diverse fish habitats. Planting, fencing, and invasive species control are actions routinely applied as part of these projects as well.

The features and construction techniques for each of these projects (described in more detail below) are generally the same, though the specific designs and elements of each are tailored to the unique conditions and needs of the stream or river reach to be treated. Appendix D provides maps and design drawings for each of these project actions.

2.1.1.1.1 Lemhi Headwaters (Project #1)

This action is a river and floodplain restoration project on private land along the Lemhi River just downstream from Leadore, Idaho (61 river miles upstream of Salmon, Idaho). The project is proposed by Trout Unlimited and would improve aquatic habitats within 2.4 river miles of the Lemhi River and increase the river's connection with its floodplain. This project is located on property with a BPA-held conservation easement that has been in place since 2010. The current channel length would be increased by reactivating 16 former meanders that had been cut off due to past willow removal. The main channel would be narrowed by constructing about 23 islands, reshaping river banks, and installing over 33 large wood structures. Approximately 26 pools would be constructed, and dozens of individual logs and small wood structures would be placed to improve fish habitats. Low velocity habitats would be created by adding individual logs, willow plantings, and 8 beaver dam analogues. Riparian vegetation would be planted, and existing willows in key areas would be protected with fencing that would exclude browsing by livestock and big game. Fences would also be constructed at select sites to protect newly planted riparian vegetation.

The project is large enough to require multiple years to complete, and would thus be implemented in three phases over three years.

2.1.1.1.2 Narrows Reach (Project #2)

This action is located on private land along the Lemhi River approximately 30 river miles southeast of Salmon, Idaho. The project is proposed by IDFG and would restore a about 0.7 mile reach of the Lemhi River to its natural river and floodplain function using the same methods as described for the Lemhi Headwater action described above. This proposal focuses on narrowing the river, increasing its sinuosity, eliminating the riprap that channels it currently, and developing side channels with about 70 large wood structures, 20 log jams, and multiple beaver dam analogues. Planting and fencing for riparian restoration and protection would be applied where needed.

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[4] A "reach" is a length of a stream or river. Its beginning and ending points may be selected for many different reasons (geographical, historical, etc.) but its context throughout this EA refers to sections meaningful for restoration purposes.

2.1.1.1.3 Eagle Valley (Project #3)

This action is a river and floodplain restoration project on private land under conservation easement (not held by BPA) along a channeled section of the Lemhi River approximately 11 river miles southeast of Salmon, Idaho. The project is proposed by IDFG and would help restore a 1.3 mile reach of the Lemhi River to a more naturally functioning river and floodplain using the same methods as described for the Lemhi Headwaters action, above. This project would eliminate the existing channeled and riprapped Lemhi River altogether, and divert its flows into a stream network of three to four constructed channels to provide an effective connection to its floodplain. Approximately 70 large wood structures, 25 log jams, and excavation of 20 pools (designed with some of the proposed log structures) are proposed for these new channels. Planting and fencing for riparian restoration and protection would be applied where needed. This large project would be phased over a four year period.

2.1.1.1.4 Lemhi/Big Springs (Project #4)

Phases one and two of this Lemhi Regional Land Trust project were completed in prior years. This project is an adaptive management modification of some of the restoration work completed in phase one to align the results more closely with the intended outcomes of the original design. The project would modify the floodplain grade, and deepen a channel along the northeastern meander of the Lemhi River within the project area. This would accommodate more flow in the channel, and lower water levels across the floodplain during high water. Some rock and gravel riffle structures, which serve to back up and elevate water, would be removed; and existing large wood structures would be redesigned to accommodate the new channel and effectively conduct flows during high water in the new configuration. Soil lifts[5], small woody debris, and willow weaves would be added to provide diverse aquatic habitats and direct flows. Planting and fencing for riparian restoration and protection would be applied where needed. This project is located on property protected by a conservation easement (not held by BPA) that has been in place since 2015.

2.1.1.1.5 Canyon Creek Confluence (Project #7)

This project is a stream and floodplain restoration project proposed by Trout Unlimited and designed to restore a reach of Canyon Creek just above its confluence with the Lemhi River. The reach is located within an irrigated field under a BPA-held conservation easement; it is an artificially straight channel with no riparian vegetation with irrigation pivot tracks flushing sediment and nutrient loads into the creek. The project would redesign the single irrigation system from one circular pivot to two half-circular pivots, and would relocate and exclude the stream reach from between the two newly-formed half-circular irrigated fields. Canyon Creek would be reconstructed to form more meanders and pools; and wood, beaver dam analogs, and vegetative structures would be incorporated into the new stream course. Vegetation would be planted to form riparian habitats. Fencing would be installed to protect the developing riparian area from grazing livestock.

2.1.1.1.6 Hayden Creek (Project #8)

The Hayden Creek project is a stream restoration action proposed by Trout Unlimited. It is focused on increasing the variability of channel depths and velocities by the placement of large wood and large-wood structures within the stream. Gravel bars would also be constructed. Engineered large wood structures would be installed in strategic locations to capture additional loose wood that would be placed in the upstream sections. This loose wood would be naturally redistributed by Hayden Creek and provide a supply of material to the downstream engineered structures. Planting

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[5] A "soil lift" is a burlap-encapsulated layer of soil placed to achieve desired streambank configuration and to protect newly planted riparian vegetation.

for riparian restoration and fencing for protection from grazing livestock would be applied where needed. The Hayden Creek project includes a little over five acres of public land managed by the BLM, and approximately six acres of private land.

2.1.1.1.7 Middle Eighteenmile (Project #9)

The project site at Eighteenmile Creek has been straightened and redirected to the side of an irrigation pivot field. As a result, it has minimal instream fish habitat or riparian vegetation. The project is proposed by the Lemhi Soil and Water Conservation District, and would address this 0.3 mile section of Eighteenmile Creek to increase in-stream habitat complexity by restructuring the creek channel to increase channel sinuosity, reduce the channel width to depth ratio, create channel constrictions, and excavate pools that would be maintained by small woody debris structures. The riparian zone would be planted using native riparian potted plants and seed to develop riparian habitats.

2.1.1.2 Irrigation Diversion Modifications and Culvert Replacement

The purpose of the irrigation diversion modifications and culvert replacement project actions would be to improve and restore fish passage beyond the features subject to removal, relocation, or replacement.

2.1.1.2.1 L-58C (Project #5)

This project is proposed by IDFG, would adjoin the Lemhi/Big Springs project, and is located within the same property protected by the conservation easement as that project. This current irrigation diversion, L-58C, is simply a soil and gravel berm that needs to be continually built-up with heavy machinery throughout the irrigation season (April through October), producing recurrent unnatural sediment inputs into the Lemhi River all season. This project would remove the existing diversion berm and construct a new concrete irrigation diversion approximately 200 feet upstream to the east. A new length of irrigation channel would be constructed to connect the new diversion to the existing irrigation ditch. The former diversion site would be contoured to the surrounding floodplain and planted.

2.1.1.2.2 L-63 (Project #6)

This project is proposed by the Lemhi Regional Land Trust would improve fish habitat at the L-63 weir site on the Lemhi River protected under a conservation easement (non-BPA-held) adjacent to the town of Leadore, Idaho by improving fish passage capability, increasing river depth, and providing instream vegetative habitat features for juvenile rearing and overwintering. The project would replace a small existing weir used to elevate stream flow to supply an irrigation diversion, and replace it with a constructed riffle. The dam, a small concrete, steel, and wooden structure less than three feet tall, would be pulled out by heavy equipment. Excavation and fill within the active channel and stream banks would be used to deepen and narrow the stream, improve fish habitat conditions, and ensure water is adequately supplied to the irrigation headgate. The area would be planted and seeded to re-establish riparian vegetative conditions, and fenced to protect the plantings from livestock grazing.

2.1.1.2.3 Canyon Creek Boundary (Project #10)

The Canyon Creek Boundary project is proposed by the Lemhi Regional Land Trust and would remove an existing irrigation diversion weir from National Forest System Lands that is a barrier to fish passage. A new diversion with fish screen would be installed upstream on private property with a buried pipeline supplying water from below the new fish screen to the irrigation ditch previously supplied by the old diversion. An additional weir upstream on private property that impedes fish passage would also be removed. The project includes 0.5 acres of National Forest

System Lands, 3.5 acres of public lands managed by the BLM, and 20 acres of private land under conservation easement (not held by BPA).

The Canyon Creek Boundary project would also restructure approximately 1.3 miles of the creek using willow weave structures (partial channel spanning) to elevate the water table, reconnect the creek to its floodplain, and restore riparian and meadow habitats along its course. These actions would be designed to increase multi-threaded channel segments, provide in-stream structure to improve fish habitat, and create constrictions and pools. The developing riparian area s would be planted and protected by about 2,500 linear feet of fence.

2.1.1.2.4 Little Sawmill Culvert (Project #11)

The Little Sawmill project is proposed by the Lemhi Soil and Water Conservation District and would replace two 72-foot-long, 36-inch-diameter culverts currently conveying Little Sawmill Creek beneath Highway 28, the main north-south highway through the Valley, with an open bottom concrete culvert that would be approximately 18 ft. wide with a 3 ft. clearance above normal flows (2 ft. clearance above the projected 50-yr stream flow). The site is approximately 28 miles southeast of Salmon, Idaho. The existing culverts are undersized and form a partial barrier to fish passage.

2.1.2 Project Actions and Features

All of the projects proposed include construction actions, and require actions related to pre-construction, site-preparation, construction, and site restoration.

2.1.2.1 Pre-construction

Pre-construction activity includes planning, design, permit acquisition, surveying, minor vegetation clearing, placement of stakes and flagging guides, and minor movements of machines and personnel within the action area. The direct effects of these actions relate to vehicular traffic and human presence, which have minimal impact on resources. All of the actions require surveys and staking; and negotiation with land owners, downstream water users, and county, state, and federal officials to ensure water rights are protected and environmental requirements are fulfilled.

2.1.2.2 Site preparation

The next stage, site preparation, begins the modification of the vegetation and ground surface at a project site. These existing soil and vegetative conditions provide some measure of resource function and value at a project site, though such values were likely deemed as needing improvement. Nonetheless, site preparation activities that remove vegetation and modify the ground surface would reduce or eliminate those resource and habitat values, at lease for the short term (Darnell 1976, Spence et al. 1996).

Site preparation typically requires development of access roads and the construction of staging and materials storage areas. The more extensive the construction actions, such as in the Lemhi Headwaters and Eagle Valley projects, the more extensive the network of staging areas and temporary access roads needs to be.

Temporary access needs would capitalize on existing roads or wheel tracks where available to avoid unnecessary impacts to previously undisturbed soils, but some grading and filling may be necessary to meet project needs. Construction standards for these roads would be of the least grading, filling and surfacing needed to meet the needs, and these roads would be obliterated and restored following project activities.

Two types of staging areas would be used: materials storage for logs, rocks, and plants near the site of their planned placement; and equipment/supplies staging areas for machinery, fuel, and other storage. The equipment and supplies staging areas would be located a minimum of 150 feet from streams and other water sources, and would make use of previously disturbed or developed sites whenever possible. The materials staging areas would be located as close to planned placement sites as logistically feasible and would also make use of previously disturbed sites if available, but may just be located along streambanks in sections planned for subsequent modifications in the project. The materials staging areas are transient, and simply for temporary staging of plant material or rocks that would soon be placed in the streams. No fuel, lubricants, or other fluids, equipment or supplies would be stored there.

Staging areas and access roads require earthwork to clear, excavate, fill, and shape the site for its eventual use. The table below displays estimates of the amount of access roads and equipment/supplies staging areas for each project. Material staging area amounts are not shown because specific earth work would not be used to shape these sites for use.

Table 1 Access roads and staging areas

Projects	Estimated area needed for constructed staging areas*; equipment and storage / materials areas in acres	Estimated linear feet / miles of temporary access road needed
Lemhi Headwaters	0.4 / 4.5	14,800 / 2.8
Narrows Reach	0.2 / 0.0	2,500 / 0.5
Eagle Valley	3.3 / 2.3	26,533 / 5.0
Lemhi/Big Springs	0.2 / 0.0	800 / 0.15
Canyon Creek Confluence	0.2 / 0.0	625 / 0.12
Hayden Creek	1.25 / 0.0	35,603 / 6.7
Middle Eighteenmile	0.2 / 0.0	2,112 / 0.4
L-58C Diversion Relocation	0.2 / 0.0	800 / 0.15
L-63 weir removal	0.2 / 0.0	280 / 0.05
Canyon Creek Boundary	0.2 / 0.0	1,600 / 0.3
Little Sawmill Culvert	0.2 / 0.0	0.0 / 0.0
*These are for constructed staging areas only. Where "materials" is "0.0", then materials staging areas are not planned for construction. Staging of materials may still occur along stream where needed and site is suitable, but construction of a specific area is not required.		

2.1.2.3 Construction

Construction activities include those described above for pre-construction, but involve greater use of heavy equipment for vegetation removal and earthwork. Construction equipment would be used to entirely reshape and realign stream beds and banks, and to regrade floodplains; some construction actions are limited to the footprints where large wood or other structures are placed.

Table 2 displays the actions that would be taken in each project and a list of features that each would contain. The project numbers in the table correspond to the projects listed in Section 2.1, "*Proposed Action*". The action descriptions and drawings in Appendix D provide an overview of each project.

Table 2 Overview of Proposed Action activities and features, by project

Project elements	Project number (see Section 2.1)										
Actions	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Heavy equipment use	X	X	X	X	X	X	X	X	X	X	
Bypass channel	X		X			X	X		X		
Dewatering/fish salvage	X		X			X	X		X		
Channel reconfiguration	X	X	X	X			X		X		
Cut and fill	X	X	X	X			X		X		
Pool excavation	X	X	X				X	X	X		
Floodplain grading	X		X				X		X		
Structure removal (old dams, diversions, etc.)					X	X				X	X
Structure installation (new diversions, bridges, etc.)					X	X				X	X
Features											
New/reroute main channel		X	X	X					X		
New secondary channel	X	X	X								
Pools	X	X	X				X	X	X		
Alcoves	X		X								
Islands	X		X								
Riffles (new or enhanced)	X	X	X			X	X		X		
Gravel placement	X		X					X	X		
Large wood structures	X	X	X	X			X	X			
Single logs	X	X	X	X			X	X	X		
Sweeper log (log with branches in water)	X	X	X								
Beaver Dam Analogue/Post-Line with Willow Weave	X	X	X				X			X	
Brush/willow bank treatment (whole plant embedded in bank)	X		X	X			X	X	X		
Brush "mattresses" (horizontal platform of willow on water)	X						X				
Floodplain roughness (logs, boulders, plantings on floodplain)	X		X						X		
Planting	X	X	X	X	X	X	X	X	X	X	X
Sod transplant (wetland sedges, rushes, and grasses)	X		X	X		X		X	X		
Fencing	X		X	X		X	X	X			
Weed treatment	X	X	X	X	X	X	X	X	X	X	X

2.1.2.3.1 In-stream Work

For the in-stream actions for the stream restoration projects, the in-stream work area is isolated from the stream's flow using in-stream barriers to route the stream's flow around it. For the Lemhi Headwaters, Narrows, Eagle Valley Subreach 1, Canyon Creek Confluence, and L-63 projects, however, the stream itself would need to be temporarily relocated from the existing degraded channel so that a properly-functioning channel can be created and then receive back the stream's flows.

To accomplish this, a temporary bypass channel would be constructed (using a ditch or a culvert) with sufficient dimensions to route the river or stream's flows around the construction area. Temporary dams are erected upstream (to divert flow into the bypass), and downstream (to keep water from flowing up into the work area) which would produce the in-stream work effects discussed in Chapter 3, below.

Prior to dewatering, fish would be removed (termed "fish salvage") from the work area to be dewatered and relocated up or downstream as safely as possible. Though Section 2.3, "*Mitigation Measures*", includes specific measures to minimize harm to fish during any dewatering process, this process may result in injury or death to individual fish as discussed in Section 3.3, *"Fish and Aquatic Species"*. The work area is then dewatered using natural flow and pumping, and then kept dewatered by pumping throughout the work period.

Once dewatered, construction activities commence within the now-dry stream bed, often using heavy equipment. The dewatering and earthmoving that occurs in these former stream beds is lethal to all organisms not able to relocate or be relocated prior to the construction activity.

Following in-stream restoration construction actions, water would be gradually reintroduced into the dewatered work area.

2.1.2.3.2 Concrete Work

Concrete structures are a common feature in restoration actions, be they for new bridges, open-bottom culverts, irrigation diversions, fish screens, etc. The Proposed Action would install concrete structures for the irrigation diversions at L-58C and L-63 and for the new culvert over Little Sawmill Creek. Many structures can be precast, and placed on site using heavy equipment, but all structures in this Proposed Action would require the forming[6] and pouring of concrete on site.

2.1.2.4 Site Restoration

The final stage of project activity that includes construction is site restoration; this stage involves the restoration of ecological function and habitat-forming processes to maintain or launch the site along a trajectory toward conditions that support functional aquatic, riparian, wetland, and terrestrial habitats.

Site restoration may include the reshaping of streambanks as necessary for successful hydrologic function and revegetation. Additional actions require bioengineered solutions that include vegetation and large wood as the major structural elements to increase bank strength and resistance to erosion stabilization (Mitsch 1996, WDFW et al. 2003). The intent of these activities is to restore riparian function and allow habitat to develop, and allow the banks to respond more favorably to hydraulic disturbance than conventional approaches that used hard, inflexible, engineered structures. This streambank work routinely requires heavy equipment use, and though the effects and risks of this use is the same as described above, this shaping and construction work is designed to establish an effective foundation for natural hydraulic action to restore the stream course and banks; and for plantings that provide for vegetative recovery.

Bare earth would be re-vegetated by seeding, planting woody shrubs and trees, hydroseeding, and mulching. This is often done by hand. Hydroseeding is accomplished using a truck-mounted tank/pump/hose system, however, and the truck may travel off road to reach application sites.

The impacts of the site preparation, preconstruction, and construction actions would exist throughout the project area until project completion and the final designed restoration features have been put in place. This time period is routinely less than one year and most often only during the dry, low-flow, months with completion before winter and the following years' high flows. Projects that require more than one construction season would have protection measures in place to protect resources during fall, winter, and spring rains and increased flows. Implementation of mitigation measures in Section 2.3, *"Mitigation Measures";* and Appendices A, "*Design Criteria for Project Features",* and B, *"Mitigation Measures for Invasive Plant Control"*, would reduce, but likely not eliminate, the risk of soil erosion and increased sediment inputs to streams during this period.

[6] "Forming" is the erection of wooden structures designed to shape poured concrete into its intended form.

2.1.3 Actions without Construction Activities

2.1.3.1 Planting and Hydroseeding

In addition to the hydroseeding and planting that would occur on the sites proposed in this EA, these revegetation actions would be conducted on projects that were active in 2019, and on older constructed restoration sites that require subsequent rounds of seed or planting. Planting activity would occur when seasonally appropriate[7]. Approximately ten acres would be planted along approximately two miles of riparian habitat in multiple small patches ranging from about 0.1 to 1.0 acres in size across the Lemhi River Valley.

2.1.3.2 Invasive plant treatments using herbicide

Treatments for invasive plants would be applied for two primary purposes: first, to prevent establishment of invasive species on disturbed soils created by construction actions associated with habitat restoration projects and, second, to attempt to restore landscapes to their native plant associations that have been displaced by established populations of invasive species.

Early eradication of newly-established populations is critical for maintaining native plant communities following soil disturbance. New invasive plant infestations don't produce the same level of lingering legacy effects in soil conditions as those that are long established, and restoration of native plant communities following establishment often fails (Tekiela et al. 2017). The Proposed Action could include spot treatments of these restoration sites where the potential for colonizing invasive plants may be found in the years following project completion. For this reason also, this Proposed Action would treat sites from restoration projects in prior years. The effect on native vegetative communities by this type of invasive plant treatment is the positive effect of maintaining that native community by preventing its loss to invasive plants.

All of the projects would include some amount of invasive plant control. Invasive plants have the opportunity to establish themselves wherever bare soil conditions are created, thus every action with construction activities would treat the sites following construction activity. Construction sites in restoration actions from prior years would also be treated. Plant control actions would be either mechanical (*e.g.,* hand removal or cutting by machine) or by spraying with herbicide. Herbicide use is the most effective at treating invasive plants, and therefore would be the most widely applied.

The Proposed Action would chemically treat newly exposed soils on active and recently completed project sites for noxious and non-native weeds (thistles, star thistle, knapweeds). Ten sites totaling 198 acres along four miles of riparian habitats would receive this initial treatment. These treatments would be applied on the following habitat types:

- upland non-wetland habitat: 176 acres
- riparian non-wetland habitat: 8 acres
- riparian wetland habitat: 14 acres

The Proposed Action would also chemically treat older completed restoration project sites for noxious and non-native weeds. Multiple treatments over a series of years are routinely needed to prevent invasive species from establishing new populations. Twenty-six sites totaling 126 acres along 4.1 miles of riparian habitats would receive maintenance applications of herbicide (*i.e.* a 2nd, 3rd or 4th treatment).

[7] Springtime for conifers; spring or early fall for containerized plants and grasses.

- upland non-wetland habitat treated: 52 acres
- riparian non-wetland habitat treated: 42 acres
- riparian wetland habitat treated: 14 acres

The herbicides included in this Proposed Action were selected due to their low to moderate aquatic toxicity to listed salmonids, and only application methods that reduce potential exposure to aquatic species are proposed. Only aquatic-labeled herbicides would be applied within wet stream channels. To prevent direct herbicide delivery to surface waters, aquatic glyphosate and aquatic Imazapyr may be applied up to the waterline using spot spray or hand selective application methods in both perennial and intermittent channels. Triclopyr TEA and 2,4-D amine may be applied up to the waterline, but only using hand selective techniques. These application methods were selected for their low risk of contaminating soils and subsequently introducing herbicides to streams.

Each of the project actions described above would be constrained by the application of action-specific design criteria from Appendix A, "*Design Criteria for Project Features*", the "*General Conservation Measures Applicable to All Actions*" from Appendix B, and by the mitigation measures in Section 2.3, "*Mitigation Measures*". Mitigation measures for herbicide applications for invasive plant control are detailed in Appendix C, "*Conservation Measures for Invasive Plant Control*".

2.2 No Action Alternative

Under the No Action Alternative, BPA would not fund the Lemhi Valley Restoration Project actions and the various project sponsors would not construct or implement the actions. For the purposes of this analysis, the No Action Alternative would be considered to be one by which specific aquatic or upland habitat restoration actions as proposed above are not implemented.

2.3 Mitigation Measures

As discussed in Section 2.1, "*Proposed Action*", each project would be designed and constrained by the implementation of the action-specific design criteria detailed in Appendix A, by the General Conservation Measures from the HIP consultation in Appendix B, and the mitigation measures listed below.

Table 3 Mitigation Measures

Resource	Mitigation Measure
All	• The design criteria and conservation measures from ESA consultation found in Appendices A, B, and C shall be followed for all project action and when applying the mitigation measures below.
Water Resources	• The project sponsor would ensure that applicable permitting under Section 401 and 404 of the Clean Water Act is in place prior to ground-disturbing activities. • Use sediment barriers such as fences, weed-free straw matting/bales, or fiber wattles, as necessary, in all work areas to intercept any surface flow that might transport sediment to the water bodies. • Stage construction equipment in staging areas identified and approved in construction plans (over 150 feet from streams). • Operate construction equipment, to the extent feasible, from the top of the bank along adjacent uplands and in previously cleared areas. • Develop a Stormwater Pollution Prevention Plan to minimize stormwater runoff and erosion from construction areas; include directions for hazardous material handling and disposal. • Store construction fuel offsite and refuel equipment within temporary secondary containment in designed staging areas, no closer than 150 feet from water bodies. • Operate refueling areas using BMPs and equip these areas with appropriate spill containment systems constructed to contain 110% of the volume of fuel stored within the fuel tanks. • Use water trucks to apply water to the construction area as needed for dust control. • Wash all equipment that may work below the ordinary high water mark (OHWM) elevation before it is delivered to the job site. • Inspect equipment to remove vegetation and dirt clods that may contain noxious weed seeds. • Inspect machinery daily to identify and resolve fuel or lubricant leaks. • Cover and stockpile excess excavated materials away from water bodies and flank with sediment fencing to minimize opportunity for fine sediment to be transported into water bodies. • Protect existing riparian/wetland vegetation, to the extent possible.
Fish and Aquatic Species	• Isolate work area for the Lemhi Headwaters, Narrows Reach, Eagle Valley, Lemhi/Big Springs, L-63, Little Sawmill Culvert, Canyon Creek Confluence, and Middle Eighteenmile projects. For these projects, the Conservation Measures for "Work Area Isolation & Fish Salvage" from Appendix B and procedures outlined in the National Marine Fisheries Service's "Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act" (NMFS 2000) would be followed. • Minimize the amount of stream and riparian area impacted during construction to the extent practicable. • No instream or riparian construction activities would occur during nighttime hours and prior to 30 minutes after dawn or continue any later than 30 minutes before dusk. • Conduct excavation for project features in the dry season to the extent possible. • Operate machinery for below-OHWM construction from the top of the streambank along adjacent upland areas, to the extent possible. • Conduct work below the OHWM during designated instream work windows (generally mid-July through August 31) as approved by IDFG. • Retrofit hydraulically-operated equipment that may work below the OHWM with hydraulic fluids non-toxic to aquatic organisms. • Protect existing riparian/wetland vegetation, to the extent possible.
Vegetation	• Wash all construction equipment prior to entering into and leaving the site to prevent the spread of noxious weeds. • Pull noxious weeds by hand or treat with herbicide approved for application in wetlands. • Reseed and plant native herbaceous plants, shrubs, and trees appropriate to riparian or upland sites following construction.

	• Apply weed control measures following construction.
Wetlands and Floodplains	• Mark wetlands designated for protection as "avoidance areas" on construction drawings, and flag them on the ground as "no-work areas" prior to construction
Wildlife	• In the Eagle Valley project, no construction activities would occur within 660 feet of the known bald eagle nest and roost site during the January 1 through July 15 nesting period (USFWS 2007).
	• Use wildlife-friendly fence design wherever wire fencing is proposed for livestock exclusion
Geology and Soils	• Use sediment barriers such as silt fences and curtains, weed-free straw matting/bales, or fiber wattles, in all work areas to minimize soil loss. • Use water trucks to apply water as needed to the construction area to minimize air-borne soil loss. • Reseed and plant disturbed areas with appropriate native species effective for erosion control following construction.
Transportation	• Place signs and use flaggers on Highway 28 and Highway 29 to alert motorists of construction work along highway.
Visual Resources	• Retain, when possible, existing vegetation that visually screens construction activities. • Reseed and plant disturbed areas with appropriate native species.
Air, Noise, and Public Health and Safety	• Reduce the speeds of construction vehicles on access roads to minimize dust. • Maintain and replace defective mufflers on all construction equipment. • Operate construction equipment only during daylight hours when actions are within 0.25 miles of residences. • Signage and other routine safeguards for worker and public safety would be applied when heavy equipment is operating on, nearby, or traveling along public highways and roadways. • Have state-licensed applicators apply approved herbicides according to manufacturers' labels. • Dispose of non-hazardous wastes in approved landfills. • Dispose of hazardous wastes according to applicable federal and state laws. • Develop and follow the protocol for dealing with hazardous substances inadvertently discovered during project activities.
Cultural Resources	• Mark known cultural resource sites as "avoidance areas" on construction drawings and flag as "no-work areas" in the field prior to construction. • Protect any unanticipated cultural resources discovered during construction as follows: o Stop all work; cover and protect the find in place. o Notify Project Manager and BPA Environmental Compliance Specialist or archeologist immediately. o Implement mitigation or other measures as instructed by BPA Environmental Compliance Specialist or archeologist
Socioeconomics	• Use local labor and materials, to the extent practicable
Climate Change	• Regularly inspect, maintain, and replace defective emission control devices on all construction equipment.

3 Affected Environment and Environmental Consequences

This chapter evaluates the potential impacts of the project and the No Action Alternative on human and natural resources to determine whether either alternative has the potential to cause significant environmental effects. It includes an analysis of the potential effects of the Proposed Action and the No Action Alternative on human environment. This discussion includes a description of the potentially affected environment for a specific resource and an analysis of the direct and indirect effects on that resource. Effects on specific resources are characterized as "high", "moderate", "low", or "no impact". The impact levels are based on the analysis provided, which incorporates the considerations of context and intensity defined in the Council of Environmental Quality Regulations (40 Code of Federal Regulations 1508.27). Beneficial effects are noted where applicable.

The implementation of these projects is intended to benefit aquatic habitat and species over the long term. The activities covered by the Proposed Action would have some unavoidable, ephemeral or minor, short-term adverse effects such as soil impacts, increased stream turbidity and riparian disturbance, in order to gain the more permanent habitat improvements. In general, each action would create adverse *temporary* effects that would be expected to last for hours or days, adverse *short-term* effects that may last for weeks, and beneficial *long-term* effects that are expected to last for months, years, or decades.

The effects described in the sections that follow would result from implementation of the Proposed Action which would include application of the relevant design criteria and mitigation measures described in Section 2.3, "*Mitigation Measures*", and Appendices A, "*Design Criteria for Project Features*", and B, "*Conservation Measures for Invasive Plant Control*". These measures and criteria are integral elements of the Proposed Action.

Table 4, below, displays the types of actions included in the projects described in Section 2.1, "*Proposed Action*" and provides a high-level overview of the types of effects, both adverse and beneficial, that are discussed in detail in the sections that follow. Tables 11 and 15 display the scale over which these actions would be implemented for each project.

Table 4 Adverse and Beneficial Effects from different types of actions proposed.

Summary of Effects by Type of Restoration Action (with relevant project numbers)	Short-term adverse effects								Long-term beneficial effects									
	Handling, disturbance of fish or wildlife	Dewatering, entire stream or partial	Stream flow alteration	Stream bed modifications/impacts	Soil compaction, displacement, mixing	Chemical contamination potential/drips/spills	Aquatic and riparian vegetation loss	Sedimentation and turbidity	Restore or improve hydrologic flows & function	Improve floodplain connectivity and function	Improve fish habitat connectivity/fish passage	Reduce water temperatures	Improve sediment and LWD movement	Provide LWD or improve recruitment of LWD	Improve streambed grade and stability	Increase instream habitat complexity	Improve riparian and wetland habitats	Eliminate adverse impact source
Fish Passage Restoration (actions in projects 5, 6, 10, 11; (see Table 2, Section 2.1.2)																		
Dams, Water Control, or Legacy Structure Removal	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x
Consolidate or Replace Existing Irrigation Diversions	x		x		x	x	x	x	x		x	x	x				x	x
Headcut and Grade Stabilization	x	x	x	x	x	x	x	x	x		x		x		x		x	x
Low Flow Consolidation	x	x	x		x	x	x	x	x	x	x	x	x			x	x	x
Culvert Removal or Replacement	x	x	x	x	x	x	x	x			x		x					x
River, Stream, Floodplain, and Wetland Restoration (actions in projects 1, 2, 3, 4, 7, 8, 9; see Table 2, Section 2.1.2)																		
Improve Secondary Channel and Floodplain Connectivity			x		x	x	x	x	x	x						x		
Protect Streambanks Using Bioengineering Methods					x	x	x	x				x	x	x		x		
Install Habitat-Forming Natural Material Instream Structures (Large Wood, Small Wood & Boulders)			x	x	x	x	x	x				x		x	x	x	x	
Riparian Vegetation Planting												x		x			x	
Channel Reconstruction	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Install Habitat-Forming Natural Material Instream Structures (Sediment and Gravel)			x	x				x	x	x			x		x	x		
Invasive Plant Control and Upland Actions (all projects)																		
Manage Vegetation using Physical Controls							x										x	
Manage Vegetation using Herbicides (Riverine)						x	x										x	
Fence Construction for Livestock Control																	x	x
Upland Vegetation Planting												x					x	

3.1 Land Use and Recreation

3.1.1 Affected Environment

3.1.1.1 Land Use

Land ownership in the Valley is predominately federal (78.7%) with only 18.2% in private ownership. The State of Idaho manages the remaining 3.1%. Federal agencies (Bureau of Land Management [BLM] and US Forest Service [USFS]) also manage the majority of the stream miles (67.7%) with 28.7% under private management and the remaining 3.6% under State management (IDEQ 1999).

Table 5 Land ownership in the Lemhi Basin

Lemhi River land ownership	Total	BLM	USFS	State	Private
Acres in Basin	807,464	315,275	320,140	24,906	147,143

The private lands in the Valley are found primarily along watercourses where sufficient water allowed the more fertile and flat terrain to be developed. The primary uses are for agriculture, which include fields of irrigated alfalfa, grass hay, or pasture. These uses provide feed for cattle, sheep and some horses during the colder winter months. Irrigation water is diverted from both the Lemhi River and its tributaries through diversion headgates, and either used for flood irrigatin g the fields or conveyed in a pipeline for sprinkler systems (hand lines and wheel lines). Home sites or ranchettes are common and, as the population in the area increases, developments are taking place on the agricultural lands. No farmlands designated as “prime”, “unique”, or “farmland of statewide or local importance” have been designated on the soil types underlying any of the proposed projects (see Section 4.8, “*Farmland Protection Policy Act*”).

The public lands administered by the BLM are generally located on the upper benches, above the creek or streams. These are generally steeper with some rougher terrain, and provide habitat for a variety of wildlife, both big game and non-game species. The public lands also are used for livestock grazing, recreation, and a variety of other public uses.

Lands administered by the USFS are generally located on the higher forested slopes. These lands are used similar to the public and state lands, with grazing, timber harvest and recreation being the most dominant uses.

All projects are located on primarily private lands, though two project areas include some public lands. The Canyon Creek Boundary project includes 3.5 acres of BLM-managed property, and 0.5 acres of National Forest System lands with approximately 20 acres on private; and the Hayden Creek Project includes approximately 5.2 acres of public land managed by the BLM, with the remaining 6 acres on private lands.

3.1.1.2 Recreation

Lemhi Valley is a popular destination for hunters in the fall, seeking elk, deer, and antelope on the public lands rimming the valley, and by guided or pay-to-hunt access to the private lands on the valley floor; and upland game birds (chukar and Hungarian partridge) in the foothills.

Salmon, Idaho, at the confluence of the Lemhi and Salmon Rivers is a known recreation destination. The area offers whitewater rafting and kayaking, fishing, hunting, hiking, mountain biking, winter "fat-tire" biking, horseback riding, cross-country and downhill skiing, and guided back country jeep tours.

River recreation, however, is focused on the Salmon River for fishing and rafting, rather than the Lemhi. The Lemhi River is small, provides no rafting opportunity, and offers little public access for fishing or waterfowl hunting since most of it is surrounded by private lands. While the broader areas surrounding the project sites attract recreational use, the project sites themselves have no, or limited public access, and are not recreational destinations.

3.1.2 Environmental Consequences for Land Use and Recreation – Proposed Action

3.1.2.1 Land Use

The projects in the Proposed Action would not create a change in land uses over a large area, though there may be small-scale use modifications given the changes in water distribution and vegetation patterns on specific acres within a restoration project site.

There would be changes in how specific project sites might be used by the landowner or manager after project completion. There would be modification of some lands that had previously been grazed or farmed. New channels may be constructed that would change how lands are accessed, particularly in the Eagle Valley and Lemhi Headwaters projects. A new hydrologic regime with seasonal flooding might now be the norm when previously those high waters were contained within the channelized Lemhi River – which would alter how a pasture may be grazed. For protection of newly established riparian vegetation, grazing restrictions or a new grazing plan would be in practice, with fencing to maintain and timing and grazing intensity to be managed. The table (Table 6) below identifies the type of the projected land use changes expected from the Proposed Action.

Table 6 Projected land use changes

Project	Projected land use changes		
	No change	Change in grazing practices only	Reversion from agriculture use back to historical riparian, floodplain, or wetland (acres)
Lemhi Headwaters		X	
Narrows Reach			2
Eagle Valley			75
Lemhi/Big Springs		X	
Canyon Creek Confluence	X		
Hayden Creek	X		
Middle Eighteenmile		X	
L-58C	X		
L-63	X		
Canyon Creek Boundary			3
Little Sawmill Culvert	X		

On the National Forest and BLM-managed lands, there would be no change in the land management objective that would be driven by the restoration action and the projects would be consistent with their land management plans. These actions are being taken to fulfill mandates in their land management plans.

Other than the Eagle Valley project, where an estimated 75 acres would revert to floodplain, wetland, and riparian conditions and uses from the drained agricultural uses to which it had been historically converted, the land use changes are few, and mostly reflect a change in grazing pattern rather than a change in use. The effects on land use would be low.

3.1.2.2 Recreation

The project sites provide limited recreation opportunity. Access for recreation is available on the National Forest System lands within the Canyon Creek Boundary project and the BLM lands along Hayden Creek in the Hayden Creek project, but these areas support no campgrounds, access roads, or recreational trails that would be affected by these actions. Other project sites are on private land with no public recreation access or opportunity so there would be no effect. Project construction on public lands may cause a temporary disturbance to any dispersed recreationists, though due to the little recreational use of these areas, the impact is anticipated to be low. Over the long term, the improvements to riparian areas or floodplains on the public lands might possibly provide an increase in recreational attraction to some accessible lands, especially on public lands, though overall, this increase in recreational use would be anticipated to be small. Overall, the effects on recreation would be low adverse in the short term and low beneficial in the long term.

3.1.3 Environmental Consequences for Land Use and Recreation – No Action

The No Action Alternative makes no changes that would affect land use or recreation. There would however, be no improvements to riparian areas or floodplains that might possibly have provided an increase in recreational attraction to some accessible lands, especially on public lands.

Though there would be no opportunity to improve uses for the future, the effects on land use from the No Action Alternative would be low.

3.2 Water Resources

3.2.1 Affected Environment

The Lemhi River provides drainage for over 1,330 miles of rivers, creeks, and streams (31 tributaries), covering an area of more than 1,260 square miles. Its mean annual flow is about 251 cfs. Annual average precipitation in the Valley ranges from seven inches at lower, drier elevations to 23 inches at higher elevations. Most of this occurs during winter months in the form of snow and in the spring and fall as rain. Severe winters with six or more feet of snow on the ground occur at higher elevations while snow accumulations at lower elevations vary.

River hydrology is heavily influenced by spring creeks and ground-water inputs, but also receives considerable input from its snowmelt-dominated tributaries. The Lemhi River historically had many beaver dam complexes, and an extensive riparian area consisting of willows and cottonwoods (BLM 1998). The relatively broad river valley resulted in a historically complex and anabranching[8] channel structure. The river contained many side channels and braided reaches, as evidenced by the Shoshone-Bannock fishing weirs, which spanned four separate channels when the Lewis and Clark Expedition recorded their observations in August 1805 (Walker 1993). The Valley contains 31 major tributaries, most of which originate in the surrounding mountains, enter the valley across

[8] An anabranched river is one with channels or watercourses that branch off of the main channel then rejoin it downstream.

alluvial fans, and naturally lose some discharge to the aquifer (See Figure 4, Section 3.3.1.1. "*Aquatic Habitat Conditions*").

The hydrology of much of the Lemhi River has been changed dramatically since the mid-1840's, beginning with intensive beaver trapping and dam removal efforts, and continuing today with extensive irrigation diversions and related channel alterations including the construction of Highway 28 on an old railroad bed. Channelization, diversion of tributary streams and a lack of connectivity to the floodplain has changed the hydrograph of the system from one where beaver dams and a sinuous, meandering stream channel kept most water storage within the system itself, to one where most storage is off channel on the irrigated lands. It has also decreased seasonal fluctuations in flows, reducing the ability of the river to maintain historical characteristics, reducing deep pools and meanders which provided necessary fish habitat (IDEQ, 1998).

The project areas are primarily located along the Lemhi River, but some projects would also occur in or near tributaries to the Lemhi River. Table 7 shows the waterbodies in the project areas.

Table 7 Waterbodies in Project Area by Project Number

Waterbody name	Project number (see Section 2.1)										
	1	2	3	4	5	6	7	8	9	10	11
Lemhi River	X	X	X	X	X	X					
Haden Creek								X			
Canyon Creek							X			X	
Eighteenmile Creek									X		
Little Sawmill Creek											X

3.2.1.1 Water Quantity

The hydrology of the Valley is dominated by the cycle of winter snowfall and spring snowmelt, which are by-products of large winter snow accumulations in the surrounding mountain ranges. This cycle stores large quantities of winter precipitation in mountain snows through the late spring. The annual water yield for the Lemhi system has been estimated at approximately 1.1 million acre-feet. The average annual flow at the town of Salmon, Idaho is 180,000 acre feet. The difference is lost to evaporation, vegetative transpiration and underground flows (Haws et al. 1977).

The Lemhi River and nearly all of its tributaries are entirely or significantly diverted between late April and the end of October to meet the needs of the nearly 90,000 acres of cropland under irrigation (Brennan et al. 1998). Many of the tributaries only reach the river during spring runoff.

Water diverted for irrigation returns to the Lemhi River in the form of springs directly entering the river, overland flow from ditches, and direct returns from ditches. Return flows are estimated to provide 8-14 cfs per mile to the Lemhi River, not including repeat diversion, (Ott Water Engineers 1985). In 1998, the USGS estimated ground water return flow at 4.7 to 10.8 cfs per mile to the Lemhi River (Brennan et al. 1998).

3.2.1.2 Water Quality

Under the Clean Water Act, the Idaho Department of Environmental Quality (IDEQ) is required to regularly assess water quality and report to the U.S. Environmental Protection Agency (EPA) on the condition of the State's waters. As required in Clean Water Act Section 303(d), IDEQ identifies those waters which do not meet water quality standards for beneficial uses.[9] Where data is available, IDEQ also identifies specific water quality limitations and impairments for the State's waters. The summary report is commonly referred to as the 303(d) list and is used to identify where improvements to water quality are needed to meet state and national standards. States and tribes are also required to develop total maximum daily loads (TMDLs) for identified pollutants to achieve water quality standards under the Clean Water Act. Several waterbodies within the Lemhi River subbasin are listed under the Clean Water Act Section 303(d) as impaired, meaning that they do not currently meet water quality standards. Three water quality concerns relevant to project activities were identified: toxic pollutants, temperature, and sedimentation.

Table 8 Project Area Waterbodies with Impaired Water Quality

Waterbody name	Impairment (Category*)	TMDL
Lemhi River	Fecal Coliform (4), Temperature (4)	E. coli, Fecal Coliform, Temperature
Haden Creek	none	none
Canyon Creek	E. coli (4); E. coli (5/303(d))	E.coli
Eighteenmile Creek	Sedimentation/Siltation (4), Temperature (4)	Sedimentation/Siltation, Temperature
Little Sawmill Creek	--	--

* Category 5 streams are on the 303(d) list, Category 4 streams do not meet water quality parameters for one or more pollutants and have state-approved TMDLs to attain applicable water quality standards.

Source: IDEQ 2016

Toxic Pollutants

Major sources of impairment to water quality include pollutant run-off from agricultural activities. Though agriculture is one of the primary uses of private lands in the Lemhi Valley, agricultural runoff has not been identified in water quality assessments conducted for the Lemhi River (IDEQ 2012). However, the other major land use in the valley, grazing, has contributed to fecal coliform bacteria concerns for the river. Agricultural practices such as allowing livestock to graze near rivers and streams, spreading manure as fertilizer on fields during wet periods, and allowing livestock watering in streams all contribute to fecal coliform contamination. The State of Idaho developed a TMDL[10] for fecal coliform bacteria for the Lemhi River in 1999 (IDEQ 1999) and for Canyon Creek in 2012 (IDEQ 2012).

Temperature

The Lemhi River and some of its tributaries (Eighteenmile, Little Eighteenmile, Sandy, Bohannon, and Kirtley Creeks) both within and near the project areas were not meeting temperature standards established by the State of Idaho (IDEQ 2012), and approached upper limits of temperature tolerance for cold water fishes, including salmon. TMDLs for temperature were developed for these streams in 2012 (IDEQ 2012).

The EPA (2019) has identified multiple sources of elevated stream temperatures in the Columbia River Basin. Those relevant to the elevated temperatures in the Lemhi River and its tributaries include:

- Removal of trees or shrubs that would otherwise shade tributary streams

[9] Beneficial uses include domestic and industrial water supply; irrigation and livestock watering; fishing, boating, and water contact recreation; fish and aquatic life, wildlife, and hunting; aesthetic qualities; and hydropower, commercial navigation, and transportation.

[10] A TMDL is a plan under the Clean Water Act for restoring impaired waters that identifies the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards.

- Reduced flows by water withdrawals for irrigation or other purposes, and the introduction of warm water from irrigation return flows
- Water impoundments that create greater surface area for heating
- Reduced acreage in wetland
- Increased groundwater withdrawals,
- Land use actions that create shallower streams (*e.g.*, channel widening)

The IDFG identified elevated summer water temperatures in the mainstem of the Lemhi River as a result of altered channel morphology (i.e. no overhanging banks, high width to depth ratio, few pools, and streambed aggradation), disconnected riparian canopy cover, and reduced flow resulting from irrigation water withdrawals (DiLuccia 2017).

Sedimentation

Sediment is the loose sand, clay, silt and other soil particles that settle at the bottom of a body of water. Sediment can come from soil erosion or from the decomposition of plants and animals. Wind, water and ice help carry these particles to rivers, lakes and streams. Natural erosion and human activities both contribute sediment into river systems making it one of the most common pollutants in rivers, lakes, and streams.

The timing and size distribution of sediment transport in rivers can be a key determinant in riverine ecology, affecting plant and animal distribution and population dynamics, and the storage or flow of this sediment is influenced greatly by the condition of streams and their connections to their floodplains.

The development of TMDLs for excess sediment was needed for Bohannon, Eighteenmile, Geertson, Kirtley, McDevitt, Sandy, and Wimpy Creeks in 1999. Streambank erosion was identified as a primary source of sediment, but for most of these creeks, the problem of excess sediment accumulation is the result of the streams' current inability to flush sediment as they naturally would if it weren't for the altered hydrology (dewatered or reduced flows) from irrigation practices. For Wimpey and McDevitt Creeks, specific gullies and mass wasting features were identified as problematic sediment sources (IDEQ 1999).

3.2.2 Environmental Consequences for Water Resources – Proposed Action

3.2.2.1 Water Quantity

The Proposed Action would have no impact on water quantity. Irrigation diversions would not be consolidated nor would they be changed, and the irrigation diversion actions in the L-58C diversion relocation and L-63 weir removal projects would not change the amount of water being diverted from the Lemhi River for irrigation use.

3.2.2.2 Water Quality

Construction activities would be the primary factor affecting water quality, with sedimentation, turbidity, and temperature being the primary variables of concern. Another concern would be the potential fuel and fluid leaks from heavy equipment, but the probability of such an event is low, and the extent of the problem would likely be small given the mitigation measures in place for these actions (see Section 2.3).

3.2.2.2.1 Sedimentation and Turbidity

Many of the proposed activities are designed and would be implemented to restore more natural hydrologic processes that influence the production, transport, and deposition of sediments by the Lemhi River, Canyon Creek, Hayden Creek, Middle Eighteenmile Creek, and Little Sawmill Creek. Though restoration actions would have short-term adverse effects on water quality, the restored condition with ongoing natural recovery and passive restoration would improve stream sediment and turbidity conditions overall.

Non-construction actions, with no use of heavy equipment, would produce minimal sedimentation and turbidity. Hand pulling of emergent vegetation along stream banks, for example, could mobilize fine sediments and produce very minor amounts of localized turbidity. Most actions proposed, however, require the use of heavy equipment, which has the most potential to generate sedimentation and turbidity effects.

3.2.2.2.1.1 Riparian and Floodplain Heavy Equipment Operations Effects

In the short-term, heavy equipment use would compact soil, thus reducing soil permeability and infiltration by storm-water. New impervious surfaces allow for faster and increased delivery of soil and contaminants in storm-water runoff. Also, in construction areas where vegetation has been temporarily removed, soils can become warmer and drier which would loosen soil particles, organic matter, and dissolved minerals thereby increasing their transportability to streams by erosion and runoff, particularly in steep areas. This increased sedimentation and in-stream turbidity effect is amplified during high-frequency and high-duration flow events.

Short-term loss of vegetation on the project site could increase the rate of transport of water to streams during rain events, which could lead to higher peak flows. Higher stream flows increase stream energy that scours stream bottoms and transport greater sediment loads farther downstream than would otherwise occur. Sediments in the water column reduce light penetration, increase water temperature, and modify water chemistry. During dry weather, the physical effects of increased runoff appear as reduced ground water storage, lowered stream flows, and lowered wetland water levels. General mitigation measures (Section 2.3. *"Mitigation Measures"*) would address these concerns and would reduce the degree and extent of these direct effects.

Discharge of construction water used for vehicle washing, concrete washout, pumping for work area isolation, and other purposes can also carry sediments and a variety of contaminants to the riparian area and stream, though the mitigation measures in Section 2.3 "*Mitigation Measures*" require specific actions to prevent or minimize this.

3.2.2.2.1.2 Streambed and Streambank Heavy Equipment Operations Effects

In-stream work (see Section 2.1.2.3.1, "*In-stream Work*") would be required to complete restoration actions on the Lemhi Headwater, Eagle Valley, Hayden Creek, Middle Eighteenmile, and L-63 projects. This work routinely requires heavy, earth-moving, equipment operations in dewatered stream beds where it can compact or dislodge channel sediments. The stream bed would therefore have bare, loose, recently-placed soils in the bed and along the banks that would be subject to erosion with the initial reintroduction of water flows. This would produce a short-term pulse of sediment upon re-watering that would continue until the beds and banks stabilize (usually a matter of minutes or hours). The degree of this effect and its duration is highly variable, being dependent on the type of substrate in the stream bed and the characteristics of the flow being reintroduced. Resulting sediment plumes would be most concentrated within, and immediately downstream of, the immediate action area during construction smaller projects activities. For most actions, these plumes would extend no more than a few hundred feet, though the Eagle Valley and Narrows Reach projects may produce plumes more extensive than that because they include extensive work activity in at locations where the river is larger and the flows are greater. The duration of most plumes could be measured in hours or days, though some may continue to produce turbidity, (though gradually declining) for longer. Gradual and staged re-watering with close monitoring of erosion and turbidity effects (Section 2.3. *"Mitigation Measures"*) would minimize this impact as much as possible.

Historical side-channel re-activation actions would expose tens to hundreds of feet of channels to flow for the first time in decades. Exposing, or reactivating existing off- or side-channels by removing fill plugs, would mobilize site or stream-reach sediment and increase turbidity either during initial water flows or during the first high flows.

The river, stream, floodplain, and wetland restoration projects (Lemhi Headwaters, Narrows Reach, Eagle Valley, Lemhi/Big Springs, Canyon Creek Confluence, and Middle Eighteenmile) would be those most likely to produce the sedimentation and turbidity impacts of short-term consequence described above. The Hayden Creek and Canyon Creek Boundary projects, however, both focus on the placement of instream structures, but lack the bed, bank, and channel reshaping inherent in the actions discussed above, and their potential to produce consequential short-term sediment releases would be less. Instream log structure placements, however, also require the use of heavy equipment in and along riparian areas, and direct sediment delivery to streams would occur when excavators disturb stream banks during placement. Excavator tracks push soil into streams, and dragging and pushing logs and boulders moves soil into channels, but he volume of soil displaced would generally be small (less than two cubic yards). The movement and placement of materials sometimes uproots stream-adjacent trees causing soil to enter streams. Options for placing more than one instream structure per access route would occur, if space and materials permit, limiting bank disturbance. Bank contouring with the excavator when it leaves the placement site and bank planting would further minimize soil delivery.

3.2.2.2.1.3 <u>Other Actions' Effects on Turbidity</u>

Fence construction and invasive weed treatments would have no potential to add sediment to the waterways.

Fish passage restoration projects (L-63 weir and Little Sawmill Creek culvert) would require the removal of instream structures such as culverts and weirs. These actions would require the use of heavy equipment or other earth-moving tool or technique within the stream course which would mobilize or introduce sediment into the stream and create turbidity. The degree of the impact would likely be similar.

Removing instream structures would facilitate the release of bedload materials stored behind the structure. As the structures are removed, a short pulse of suspended sediment and turbidity would be expected. Downstream habitats would likely be degraded for a short period of time.

The first few higher-flow events of the fall, winter, or spring following any of the actions discussed above would transport, sort, and deposit displaced soil remaining in impacted areas. This volume of action-related soil or sediment transport, however, would represent a small fraction of the sediment that is naturally moved through and deposited by a stream in these seasons. Scarifying (i.e., shallow ripping of the soil surface with excavator bucket tines), seeding, and mulching access routes and affected sites prior to the onset of fall and winter rains would prevent or minimize overland sediment movement to streams from this potential source.

3.2.2.2.1.4 Long-Term Habitat Restoration Effects

The removal of passage barriers that had also restricted natural hydrologic flows would restore a more natural and functional hydrologic condition, which would be expected to increase the fluvial transport of sediment thereby providing for more diverse habitat formation downstream.

Reactivating existing, vegetated side-channels that are morphologically suited to their environment would generate less sediment than turning flow into a recently constructed side channel that would need time to reach equilibrium with the stream.

Instream log placements, however, would increase the sediment storage capability of a stream reach. Instream structures reduce flow velocity resulting in the sorting and deposition of sediment and the creation of features (*e.g.,* gravel spawning beds and gravel/sand/silt/clay bars) and floodplains storing shallow groundwater. Project designs typically locate structures in series along a stream reach, and it takes years for downstream structures to capture material if the stream has limited sediment to move. In the case of a debris flow entering a project's stream reach, one or more structures could capture tens to hundreds of cubic yards of sediment and wood that would otherwise be lost through the project's stream reach in the absence of placed structures.

Pulling or pushing trees into stream channels would create short-term turbidity (minutes to hours) and long-term (years to decades) benefit to sediment routing. The amount of soil displacement (likely less than two cubic yards) per placement site would be inconsequential to channel form and function.

Removing the undersized Little Sawmill culverts and their associated fill, and replacing it with an open-bottom culvert sized to accommodate high flows could mobilize sediment for deposition downstream, which would increase sediment and turbidity in the short-term (days to weeks). Undersized culverts and fill act as grade-control structures by storing sediment at their inlets and scouring away sediment at their outlets. Replacement or removal of this grade-control feature can result in upstream headcut migration, deepening of the channel, bank erosion, and other responses (Castro 2003) if design criteria and mitigation measures was not in place to prevent this action. The size of the stream and culvert being removed or replaced would correspond to the amount of sediment potentially mobilized. Larger culverts would generally produce more sediment than small culverts.

It is anticipated that essentially all project-related sediment would be flushed out during the first high flows after project completion; and site restoration measures would be expected to prevent future project-related sediment inputs into the streams.

Sedimentation and turbidity impacts to domestic water supplies during construction activities would not be expected because design criteria that would be applied would focus on minimizing turbidity.

3.2.2.2.1.5 Long-Term Risk and Benefits Regarding Sedimentation and Turbidity

Excavating new channels or reconnecting historic stream channels have a risk of failure during high flows; they could be filled with sediment, or supporting large wood structures could be washed downstream, which would be likely to create a pulse of suspended sediment in the localized area. The risk of channel failure would be greatest during the first year after channel construction, and would decrease as riparian vegetation becomes established and floodplain roughness[11] increases.

[11] Floodplain roughness is a term used to describe the presence of vegetation, logs, rocks, or other structures or vegetative debris on a floodplain's surface that serves to slow the flow of flood waters allowing the deposition of sediments and the infiltration of water into the ground.

However, mitigation measures and ESA consultation design reviews[12] are prescribed to minimize or eliminate these risks. These projects would be designed to achieve restoration goals and to minimize the risk of failure. Also, all projects that involve streambank excavation resulting in bare earth exposure would include erosion controls, revegetation plans, and riparian fencing if appropriate.

Over the long term, implementation of the Proposed Action would improve conditions related to stream sediment and turbidity. Newly constructed meandering stream channels established through channel reconstruction or relocation would be more sinuous than the relatively straight streams or ditches that they replace. They would be lower in gradient, and have lower water velocity with less erosive power. Sediment entering a meandering reach would likely be sorted and stored to create stream and habitat features than would sediment entering a shorter, steeper, and more high-energy straight stream reach.

3.2.2.2.2 Temperature

The Proposed Action could cause short-term increases in stream temperature due to construction-related disturbance of riparian vegetation and stream channels and in some limited cases, increased stream length.

The culvert removal at Little Sawmill Creek may provide long-term downstream temperature benefits as sediment trapped upstream of the barrier, is released. Morphological channel changes downstream from the deposition of sediment released by such removals can create habitat features conducive to cooler water temperatures (NMFS 2013).

River and stream restoration actions, combined with the ongoing natural recovery and passive restoration, would be expected to have long-term beneficial effects on stream temperature by restoring riparian vegetation, channel conditions, surface-groundwater interaction, and other critical watershed processes that influence water temperature. Activities would improve streamside shade through revegetation of riparian areas; restore stream channel morphology in channels that are currently unnaturally wide and shallow, or lack pools; and improve surface water-groundwater interactions and hyporheic exchange.

Relocation of streams into historic or newly constructed channels that are more sinuous and complex would, depending on site conditions, expose more stream surface area to sunlight, leading to short-term temperature increases, until streambank vegetation recovers to provide shade. But planting a new channel with fast-growing willows and larger riparian plants would reduce stream surface exposure over time; and a more sinuous channel, well-connected with its floodplain, would increase hyporheic exchange and bank storage which would maintain cooler temperatures and provide temperature heterogeneity within the stream system over the long-term.

Riparian planting would increase shade on streams and rivers depending on site aspect and other factors. The amount of shade provided by streambank planting, and the effectiveness of local shade to cool the water, would be a function of channel width and flow volume at the specific action site. Past experience has shown that wider channels would be more difficult to fully shade even with mature vegetation.

Reconnecting historic side-channels with floodplains, and constructing new side channels and alcoves, would increase temperature heterogeneity; create diverse habitat by increasing channel length and stream-floodplain interaction; and supply large amounts of subsurface flow to the main

[12] The programmatic ESA consultation process under HIP IV requires design reviews by BPA, NMFS, and USFWS engineers and biologists for high and medium risk projects.

channel (IMST 2004). Streams and rivers with greater flow volume, however, would be less responsive to these stream cooling processes than lower volume streams and rivers.

Heavy equipment use, necessary in these river and stream restoration actions, would damage or remove stream-shading vegetation. Placements of logs and boulders by heavy equipment would require access routes and staging areas for storage of trees, logs, and rocks for instream placement. The removal of shade-producing trees and shrubs, if necessary to facilitate this movement, storage, and placement, would have the potential to cause localized temperature increases for one or more years, or until vegetation is reestablished. Careful equipment use that avoids trees would lessen damage to existing shade-producing riparian vegetation during instream project implementation. Such care would be easier to accomplish, but more necessary, in areas with sparse vegetative cover. The loss of scattered individual trees within densely-vegetated riparian areas, however, would likely not produce a measurable increase in stream temperature.

Replanting project sites and minimizing shade loss during project implementation would reduce or eliminate project-related stream temperature increases, and lessen the time to desired stream-temperature recovery. In-stream shade provided by constructed log and boulder habitat structures would offset the loss of vegetative shade in the near term by providing some immediate shade; and they would have a positive effect on stream temperature in the long term by deepening pools. Logs placed over the channel would also provide some measure of shade.

Restored sediment-deposition processes, and the action of narrowing and deepening channels, would increase flows and decrease the surface area of the stream exposed to direct sunlight. In addition, streams with well-connected floodplains and deep gravels would typically be connected to ground water and would thus have cooler water temperatures. Alluvial sediment[13] in channels and along stream banks store cold water from periods of high runoff, and release it gradually during periods of low runoff (Coutant 1999).

Groundwater stored in and along stream banks is an important component of cooler water temperatures (Winter *et al*. 1998). Simplified channels that prevent flows from connecting with their floodplains lack this cool water storage. Water moves into stream banks when streams and rivers rise; but if those streams do not overtop their banks, that water returns to the channels relatively quickly. When streams and rivers are structured properly and rise high enough to regularly inundate floodplains and overtop banks, more widespread recharge of the water table throughout the flooded areas would occur. The volume of floodwater returned to the channel via groundwater is increased, as is the time it takes for that return. Both conditions - greater return volume and greater return time - favor lower stream temperatures.

Overall, the project would create short-term, localized, sediment inputs from the actions of heavy equipment in and along streams (though not in amounts greater than what occurs naturally during annual, natural, high flow events); and the removal of riparian vegetation could cause small increases in water temperature in the short term (but would be offset to some degree by shade from new instream structures and deepened streams and pools). But these are short-term effects and would also be lessened by the application of mitigation measures such as phased rewatering, existing vegetation protection, minimizing areas to be impacted, and replanting. The long-term effects of these actions, however, would be a decreased potential for unnatural sediment inputs, an increased potential of the floodplain to effectively manage its sediment loads, and a reduction of stream temperatures from stream form, instream habitat structure, and increased riparian

[13] Alluvial sediment is sediment deposited by flowing water, usually from episodes of increased flows and elevated stream stages that causes water to move from the stream into the stream banks.

vegetative cover. When the short-term, temporary effects are considered in the context of the long-term benefits of the project, the overall effects on water quality would be low.

3.2.3 Environmental Consequences for Water Resources – No Action

Under the No Action Alternative, there would not be the short term water quality impacts associated with project construction (such as short-term increases in sediment and water temperature increases with the removal of riparian vegetation), but there would also be no improvements to stream structure, no increased connectivity to floodplains, stream-shading riparian vegetation would not be improved, and the sediment-controlling and water-cooling effects of these actions would not be realized. The degraded stream and floodplain hydrology would remain and thus the effect of No Action would be moderate.

3.3 Fish and Aquatic Species

The Lemhi River and its tributaries support numerous species of fish, some anadromous and some resident, as well as the invertebrates (snails, mussels, insects, zooplankton, etc.) and amphibians common in similar riverine systems throughout the western U.S.

The Lemhi River has been identified as critical spawning and rearing habitat for anadromous species listed as threatened under the ESA: steelhead trout (*Oncorhynchus mykiss*), and spring/summer Chinook salmon (*Oncorhynchus tshawytscha*). The Lemhi River and its tributaries are also important habitat for resident and migratory bull trout (*Salvelinus confluentus*) listed as threatened under the ESA as well as westslope cutthroat trout (*Oncorhynchus clarki lewisi*), which have been petitioned for listing under the ESA.

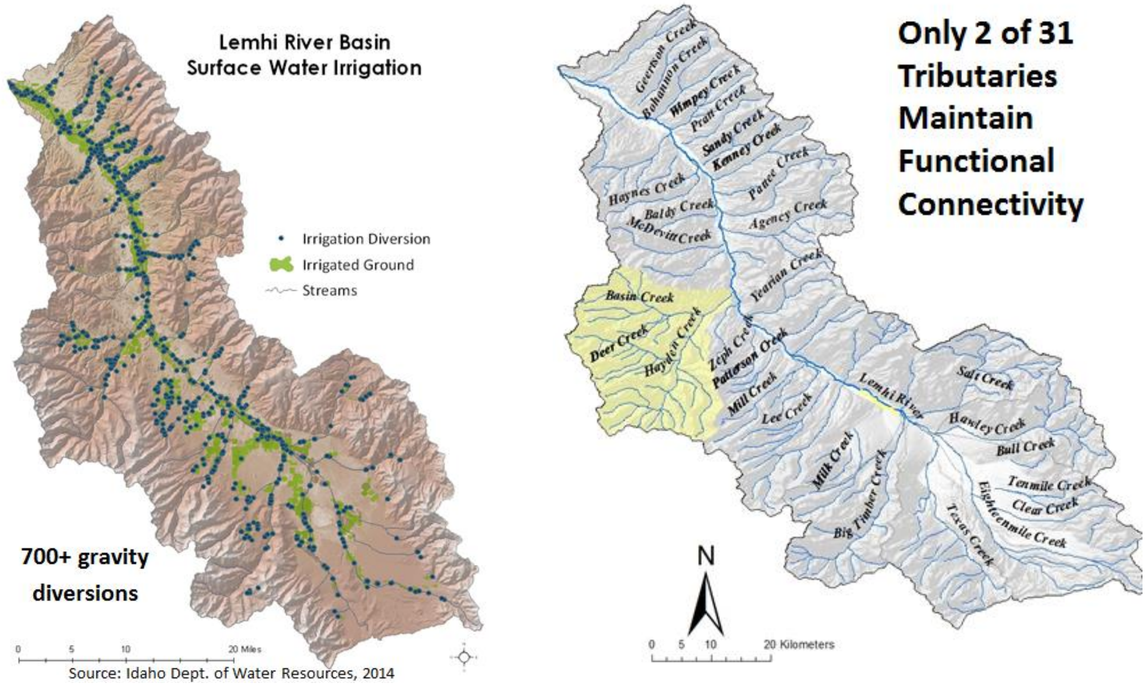
3.3.1 Affected Environment

3.3.1.1 Aquatic Habitat Conditions

The quality and quantity of freshwater habitat in much of the Valley has declined dramatically in the last 150 years as many stream and riparian areas have been degraded by the effects of grazing, agriculture, road and railroad construction, mining, water diversions, and river channelization and bank stabilization (see Section 3.1, "*Land Use and Recreation"* and Section 3.2, "*Water Resources*", for further description). Each of these activities has contributed to the decline of salmon, steelhead, and non-ESA-listed fish and aquatic species through simplified stream channel morphology, degradation of spawning substrates, reduced in stream roughness and cover, loss of wetlands, loss and degradation of riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants) degradation, blocked fish passage, direct impacts to fish, and loss of habitat refugia.

Undersized and poorly positioned road culverts (as at the Little Sawmill crossing) and irrigation diversion weirs without adequate fish passage (as at the L-63 project) have extirpated anadromous fish from upstream spawning and rearing habitats. Remaining habitats often are affected by dramatic flow fluctuations during the irrigation season (April through October). These changes have so severely altered flows in most of the Lemhi River's tributaries that until recent completion of fish-passage restoration projects, only Hayden Creek and Little Springs remained connected (for fish passage capability) to the Lemhi River (Figure 4).

Figure 4 Lemhi River irrigation diversions (2014) and tributary connectivity (2017) (connected tributaries highlighted in yellow)



These tributaries also provided much of the rearing and over-wintering habitat for juvenile salmon and steelhead, which is a greater limiting factor on these populations in the Lemhi Valley than spawning habitat (IDEQ 1999).

Aquatic habitat in many headwater stream sections is, in general, in better condition than in lands in the lower portions of Valley. In the past, valley bottoms were among the most productive fish habitats (Stanford and Ward 1992, Spence *et al*. 1996, ISG 1996). Today, agricultural development and water withdrawals have significantly altered the habitat for fish and wildlife in this valley bottom. Streams here typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

The water quality and quantity conditions in the Valley (see Section 3.1, "*Water Resources*") are also adversely impacting fish and other aquatic species' habitat.

Past and Ongoing Habitat Restoration Actions

Aquatic habitat restoration in the Valley has been underway, however, for the past two decades. Federal, state, tribal, and private entities have—singly and in partnership—begun restoration efforts to help slow and, eventually, reverse the decline of federally-listed fish populations under the ESA. Since the early 2000's, BPA has funded irrigation and water withdrawal changes and habitat restoration actions similar to those in this Proposed Action along the Lemhi River and up its tributaries. The USFS and BLM have completed restoration and natural resource management projects on lands they manage in the Valley, which, implemented in conjunction with these agencies' aquatic conservation strategies, are designed to avoid or minimize effects on fish and wildlife and their habitat; or to restore natural stream habitat-forming processes. Many private initiatives have also been implemented with public funding to restore stream flows and improve aquatic and riparian habitats on private land.

3.3.1.2 Aquatic Species

The Lemhi River subbasin supports a diverse community of fish, including ESA-listed anadromous and resident fish.

3.3.1.2.1 ESA-listed Anadromous Fish

Anadromous fish populations have declined dramatically since explores and settlers first came to the Lemhi River valley in the early 1800s. Two species of anadromous fish occupy the Valley's waterways that are federally listed under the ESA as threatened and have designated critical habitat (specific geographic locations critical to their existence) under the ESA (Table 9).

Table 9 ESA-listed anadromous fish and their listing status

Species	Federal Status	Critical Habitat status
Snake River spring/summer Chinook salmon (*Oncorhynchus tshawytscha)*	Threatened	Designated
Snake River Steelhead (*O. mykiss*)	Threatened	Designated

3.3.1.2.2 Non-Anadromous Fish

The following table displays the species found in fish surveys of the Lemhi River since the 1990s and shows their habitat preferences.

Table 10 Fish species in the Lemhi River

Species[1]	Federal/State listing status	Habitat preferences[2]
Brook Trout *(Salvelinus fontinalis)*	Not listed; non-native	Clear, cool (<61 F), well-oxygenated creeks, small to medium rivers
Bull Trout *(Salvelinus confluentus)*	Listed as Threatened under ESA / Critical Habitat designated	Clear, cold (45-50 F), rivers and large tributary streams; stable channels and flows, high habitat complexity, low levels of fine sediments
Sucker species *(Catostomus spp.)*	Not listed	Backwaters of creeks and small to medium rivers with swift, cold water and gravel or rocky bottoms
Chiselmouth *(Acrocheilus alutaceus)*	Not listed	Warmer sections of fast to moderately fast water
Sculpin (*Cottus spp.*)	Not listed	Cold, clear riffles of streams, and slow-moving water along shoreline and backwaters
Westslope cutthroat trout (*Oncorhynchus clarki lewisi*)	Federal Species of Concern, Idaho State Vulnerable Species, BLM and USFS sensitive species	Cold water, clean gravel substrate, diverse stream habitat and ample cover
Dace *(Rhinichthys spp.)*	Not listed	Cool and slower moving waters
Mountain Whitefish *(Prosopium williamsoni)*	Not listed	Bottom of streams; clear cold water and large deep pools
Northern Pikeminnow *(Ptychocheilus oregonensis)*	Not listed	Slow moving portions of streams
Rainbow trout *(Oncorhynchus mykiss)*	Not listed	Cold water, clean gravel substrate, diverse stream habitat and ample cover
Inland redband trout *(Oncorhynchus mykiss gairdneri)*	Not listed	Cold water, clean gravel substrate, diverse stream habitat and ample cover
Redside Shiner *(Richardsonius balteatus)*	Not listed	Ditches, springs, sloughs, and rivers where the current is slow or absent
[1] From Idaho Fishing Planner website; *https://idfg.idaho.gov/ifwis/fishingplanner/water/113891451879* ; accessed 12/24/19		
[2] Habitat data primarily from American Fisheries Society webpage https://www.idahoafs.org/; accessed 3/23/20		

Bull trout were historically known to be found in Kirtley, Geertson, Kenney, Pattee, Hayden, Mill, Big Eightmile, Little Eightmile, Timber, Texas, Hawley, and Eighteenmile Creeks, their tributaries, and in the Lemhi River itself. Current populations are generally limited to the headwaters of these systems due to seasonal dewatering for irrigation purposes (IDEQ 1999, Lamperth *et al* 2007). The migratory portion of the population has been severely diminished because of this lack of connectivity to the Lemhi River tributaries, with Hayden Creek likely supporting the last remaining historical fluvial[14] subpopulation (Lamperth *et al* 2007). Ongoing efforts to reconnect the Lemhi River with its tributaries is anticipated to allow bull trout to expand their distribution and reestablish fluvial subpopulations beyond Hayden Creek (Lamperth *et al* 2007).

Westslope cutthroat trout is a BLM and USFS sensitive species and is found in almost every watershed of the Lemhi subbasin. The USFWS has received a petition for proposal for listing of the Westslope cutthroat. The species is on a decline throughout its range due to habitat loss, dewatering of migration corridor streams, spawning and rearing streams, sedimentation, elevated stream temperatures, and competition from introduced species. Some of the introduced species, such as rainbow trout, have affected the genetics of cutthroat stocks through hybridization. No populations of Westslope cutthroat trout are present in the proposed project areas, given the degraded habitat conditions in those areas.

3.3.1.2.3 Other Aquatic Species

The Lemhi River and its tributaries supports the aquatic invertebrate biota typical of the Salmon River and the Columbia Basin, supporting numerous species of insects (dragonflies/damselflies, mayflies, stoneflies, caddisflies, butterflies, beetles, flies, midges, true bugs). Surveys of the nearby Salmon River also identified non-insect species of mites, leeches, nematodes, aquatic worms, seed shrimp, sponges and mollusks that are also found in the Lemhi River and its tributaries. These macroinvertebrates inhabit most streams and are a key component in the processing of organic material and in nutrient cycling; and are an important food source for fish, amphibians and other macroinvertebrates.

3.3.2 Environmental Consequences for Fish and Aquatic Species – Proposed Action

All of the actions listed in Chapter 2 are intended to improve environmental conditions for fish and aquatic species for the long term. Most of the actions are designed specifically to benefit fish, but nearly all of them would have short-term, adverse effects in the course of providing for those long-term benefits.

3.3.2.1 Short-Term Effects to Fish and Aquatic Species from Construction Activities

The effects of the construction actions would have short-term, adverse effects on fish and aquatic species.

Preconstruction actions would require foot traffic across streambanks, and through streambeds, where aquatic species would be disturbed, with invertebrate species displaced or trampled.

Construction actions would be more disruptive. In the short term, aquatic organisms could be disturbed, injured, and killed through inadvertent crushing by heavy equipment during implementation of instream, side-channel, and floodplain restoration; and passage barrier removal actions. The noise and vibrations from heavy equipment operations may temporarily disturb

[14] The term "fluvial" refers to a life form of fish that migrates to spawn in smaller tributaries but spends most of its life in larger rivers.

aquatic species residing in the immediate area, and they may be temporarily displaced up stream or downstream by equipment operations or a pulse of turbidity.

In addition, use of heavy equipment creates the opportunity for accidental spills of fuel, lubricants, hydraulic fluid and similar contaminants into the riparian zone or water, where they can injure or kill aquatic organisms. Fishes exposed to petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, are likely to be killed or suffer acute and chronic sub-lethal effects. Acute sub-lethal effects could range from disturbance to minor irritation of skin or membranes, chronic sub-lethal effects could cause gill damage, with resultant respiratory difficulties or illness which would affect growth, and make fish more prone to predation. As discussed in Section 3.2.2.2 "Water Quality", the probability of such a spill event is low, and the extent of the problem would likely be small given the mitigation measures in place for these actions (see Section 2.3).

Discharge of contaminated water used for vehicle washing, concrete washout, pumping for work area isolation, and other purposes can carry sediments and a variety of contaminants into a riparian area and stream. For example, cement is highly alkaline (commonly exceeding pH of 10) and can result in lethal and sub-lethal effects to aquatic life if not properly maintained on-site or treated prior to discharge. High pH effects on fish include death, damage to gills, eyes and skin; and inability to dispose of metabolic wastes (NMFS 2013).

Aquatic species could also be harmed by the isolation and dewatering of in-water work areas in a stream segment. Though most actions would provide downstream passage in a bypass channel, dewatering a segment of river would displace native fish from their home ranges and limit their movement during implementation. Aquatic species salvage would occur, but it would be focused on fish, and small vertebrate (amphibian) and invertebrate aquatic insect and non-insect species could be overlooked, or simply not salvaged, due to their size and location, and could become desiccated and die during the dewatering. Some species occupying habitat below the streambed surface may survive during the construction period if there is enough interstitial water and flow available, and streambed disturbance is minimal (Bo *et al*. 2007).

The most lethal biological effects of the proposed activities on fish would be caused by their handling and removal from dewatered water work areas. All aspects of fish handling, such as electroshocking, dip netting, time out of water, and data collection (measurements and tissue collections) are stressful and can lead to immediate or delayed mortality (Murphy and Willis 1996). Although fish would only be exposed to these handling stressors for a few minutes or less, some may be injured or die. Electrofishing causes physiological stress and can approach or exceed a fish's physiological tolerance limits causing physical injury or death, including cardiac or respiratory failure (Snyder 2003) or impairment of reproductive success, growth, resistance to infectious diseases, and survival (Wedemeyer *et al*. 1990). The primary contributing factors to these effects are differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma; and though impactful to fish and other species, work area isolation is itself a mitigation measure intended to reduce adverse effects to aquatic species from construction impacts. If construction took place without work area isolation, even more fish could be injured or killed (NMFS 2013).

BPA proposes several mitigation measures to limit stress and mortality during work area isolation and fish relocation; and limiting nearly all in-water work activities to designated in-water work periods would greatly reduce the chance of affecting adult anadromous fish, as these periods are designated to avoid times when most of these fish are in-migrating and spawning.

Completed construction activities can be expected to redirect flows in streams in a designed manner that would likely cause sediment and rock to be deposited so as to raise the level of the stream bed and alter the hydrologic regime. In the new construction's initial exposure to higher flows, there may be disturbance to gravel in fish redds that can agitate or dislodge developing young, causing their damage or loss. Depending on site conditions, these re-directed flows can also mobilize sediment, creating a turbidity pulse, the effects of which are described below, that may last a few hours.

Construction-related activities that expose, displace, reconfigure, or compact earth through the use of heavy equipment in, or beside, streams or other water bodies may create conditions where sediment is released once flows are restored. This sediment might then be delivered downstream to reaches where ESA-listed salmonids may be present. Though severe sedimentation is known to adversely impact fish physiologically (Servizi and Martens 1987 and 1991, Bash *et al*. 2001, and Wenger and McCormick 2013) and behaviorally (Berg and Northcote 1985, Bisson and Bilby 1982, Servizi and Martens 1992, and Sigler *et al*. 1984), mitigation measures would be in place to minimize potential sedimentation to amounts that fish are known to tolerate naturally (Gregory and Northcote 1993) and avoid the duration and concentrations that are known to be harmful (Bisson and Bilby 1982, Gregory and Northcote 1993, Servizi and Martens 1987, and Newcombe and Jensen 1996).

Application of the turbidity monitoring protocol (Appendix B, "*General Conservation Measures Applicable to All Actions*") during restoration actions would maintain turbidity levels below those harmful to fish. Although fish would be exposed to elevated turbidity and suspended sediment, and thereby experience negative effects commensurate with the severity of the suspended sediment, the anticipated level of exposure is not anticipated to cause harm at durations expected to be typical (less than 12 hours). Turbidity from in-water work may persist for 8-12 hours per day to accommodate a typical work day, as proposed in the mitigation measures.

3.3.2.2 Effects to Fish and Aquatic Organisms Unique to Specific Actions Common to Multiple Projects

Though individuals would be adversely impacted by the effects of construction activities in the short term, the fish and aquatic organism populations would be expected to benefit in the long term. The comparatively small scale of an action's disturbance in relation to the overall distribution of the species, and species' diverse life history, is anticipated to sustain the population over the short term, with long-term benefit as the habitat improves because of the action.

The long-term beneficial effects for fish and aquatic organisms include:

- Restoration of access to historic habitats through removal of impassable barriers
- Creation of more complex habitats through the addition of wood and boulder structures to streams and floodplains
- Increased stream length, floodplain connectivity, and riparian vegetation corridors through channel reconstruction, reconnection of side channels and removal of berms, dikes, and levees
- Reduction or elimination of nonnative fish that compete with native species

The following sections discuss the effects to fish and other aquatic organisms that might be unique to specific types of actions that are included in multiple projects in the Proposed Action.

3.3.2.2.1 Fish Passage Restoration

Barrier removal at L-63 and culvert replacements at Little Sawmill Creek with the stream simulation designs proposed would directly and immediately (hours to days) provide habitat connectivity for aquatic species. It would restore access to currently inaccessible and unoccupied spawning and rearing habitats, increase population ranges, and allow unrestricted movement throughout these stream reaches during seasonal changes in water levels (Hoffman and Dunham 2007). Improved passage for both anadromous and resident fish would result in additional available spawning and rearing habitat, which would result in increased population abundance, productivity, and genetic diversity (Wofford *et al*. 2005). Fish populations that are well-distributed spatially with unobstructed passage throughout their range are at a lower risk of detrimental effects from random and unpredictable harmful events. Increased access can lead to increased spawning and rearing success and can increase numbers and health of individual fish and populations (NMFS 2001).

For the Little Sawmill Creek project, the replacement of the existing deteriorating and undersized culverts over Little Sawmill Creek with a properly designed open-bottom culvert would reduce stream velocities, prevent potential road failures[15] at high water, and reduce the potential for those failures to introduce un-naturally large amounts of fine sediment to fish habitats downstream. The installation of an open-bottom culvert would increase the naturally-metered fluvial transport of sediment that is needed to form diverse habitats downstream, and increase the stability of the streambed.

The L-63 project would address a stream profile discontinuity[16] by removal of a weir that blocks fish passage during the irrigation season. A grade-control structure (constructed riffle) would be added downstream of the removed weir, which would require substantial in-water work. The end result, however, would ensure that instream substrates would remain stable, with no potential for head cutting upstream of the action. This grade-control structure would reduce stream velocities, capture gravel and fine substrate for aquatic species' habitat, and facilitate uninhibited passage for all life stages of fish and amphibian species.

Removing the instream barriers at L-63 and Little Sawmill Creek would also enable additional recruitment and transport of instream woody debris to downstream reaches when compared to existing conditions. Under existing conditions, this material collects behind these structures only to be removed from the system during maintenance activities. The streams in these reaches are small, and the woody plant material that would be transported is also small, but the stream's collection and positioning of this material creates rearing and overwintering habitat that is essential to listed species.

Barrier removal actions may remove a few trees within the work site, but adverse effects to adjacent aquatic habitats from this degree of tree removal would be minimal. In most cases, it would occur in such a limited area, and the action would incorporate design features to reestablish vegetation in those disturbed areas. Removing the existing instream structures (culverts and old weirs) would likely release the small amounts of bedload materials collected upstream of these structures. As the structures are removed; this would cause immediate increases in suspended sediment and turbidity, and may degrade downstream habitat for a short period of time. Long-term effects include increased access to spawning, rearing and migration habitat above the site, increased gravel recruitment for spawning downstream of the project site, and increased floodplain connectivity and channel migration capacity.

In summary, improvements in fish passage would provide a net long-term beneficial effect to many aquatic species, improve the capacity of the streams to develop and maintain diverse aquatic habitats, and contribute to increased survival and recovery of ESA-listed fish. Adverse effects

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[15] Undersized culvert have the potential to restrict flows during high water and thereby create a pool of water pushing against the road prism. Roads aren't designed as dams, and thus frequently wash out.

[16] A stream profile discontinuity is a vertical drop in the stream bed caused by erosion or the presence of a structure.

would be those related to construction activities (dewatering, fish handling, and minor sediment after construction) and would be short-term and are not anticipated to adversely affect populations (though individual animals may be harmed). The long-term effect of these types of actions would be beneficial, with improvements expected to aquatic species' productivity, survival, spatial structure, and diversity at the population scale.

3.3.2.2.2 River, Stream, Floodplain, and Wetland Restoration and Channel Reconstruction

Channel reconstruction, relocation, and off- and side-channel habitat restoration activities (in the Lemhi Headwaters, Narrows Reach, Eagle Valley, and Middle Eighteenmile projects) would improve or restore stream reaches by reconnecting side-channel habitats and floodplains that were previously inaccessible to aquatic organisms, removing accumulated sediment within those habitats that contributed to habitat degradation, and clearing obstructions to aquatic species movement. Reconnecting channels with floodplains would provide periodic delivery of water, nutrients, and sediment to floodplains. It would also provide flood attenuation and reduced stream energy. These activities would aid in the re-establishment of hydrologic regimes, increase the area available for rearing habitat for fish, improve access to rearing habitat, increase the hydrologic capacity of side channels, increase channel diversity and complexity, provide resting areas for fish at various levels of inundation, provide flood water attenuation, increase floodplain nutrient and sediment storage, and establish and augment native plant communities.

The stabilization of headcuts, a frequent component of these projects, would have a long-term positive affect for aquatic species and habitat by removing passage barriers, preventing further head cutting and channel incision, which would otherwise disconnect a stream from its floodplains, and degrade fish habitat.

The placement of large wood and plant material (*e.g.*, dormant willow cuttings and other plants that root easily), in a structural way to reinforce and stabilize eroding banks, would decrease streambank shear stress by increasing the surface area of the substrate over which it flows and reduce stream velocity (Washington State Aquatic Habitat Guidelines Program 2003). Reduced stream velocity would lead to beneficial sediment deposition and the creation of refugia for aquatic organisms (Washington State Aquatic Habitat Guidelines Program 2003). The placement of large woody debris and riparian plantings (all projects except L-58C, L-63, and Little Sawmill culvert), would directly increase aquatic habitat by providing overhead thermal and predator cover for fish, and reduce sediment inputs that degrade aquatic habitat. Indirectly, the stabilization of streambanks would enhance stream complexity over time by providing overhanging banks and in-channel root systems. As the roots of vegetation along streambanks increase, the velocity of the stream and erosion decreases (Comfort 2005), and overhanging streambanks and vegetation provide shade to the stream system and thermal cover, which moderate water temperatures.

Instream habitat structure and complexity would be increased by the placement of large wood structures in stream reaches deficient in these habitat elements. They provide effective pool-forming agents in smaller streams or during low flows by focusing flow and flow velocity in ways that create scour and pools that are valuable to fish habitat (Bisson *et al*. 1987). These structures would create localized areas with reductions in water velocity at high flows (Beschta and Platts 1987), which would result in sorting and increased deposition of smaller bedload materials (Bilby and Ward 1989, McHenry *et al*. 2007) in the form of sand, gravel, and cobble that would improve or create spawning areas for fish (McHenry *et al*. 2007). In low-gradient reaches they would improve and promote gravel deposition, decrease flow velocities, and increase low-flow pool volume, which would then provide additional spawning, rearing, and resting habitat for fish, increasing their survival and productivity.

The placement of instream structures would also tend to shift the force of the flowing water to other parts of the channel and change the existing pattern of erosion and deposition. Stream channels naturally meander back and forth across the valley bottom and have alternating periods of aggradation and degradation, which are driven by episodic disturbance events (*e.g.*, fires, floods, and windstorms) followed by periods having no disturbance events. Providing more channel structure encourages these natural processes to develop again, creating channel complexity, and a variety of stream habitat conditions often lacking in a simplified channel. Adding structure and channel complexity would result in better overwintering habitat for salmonids, improved summer pool habitat, and abundant spawning gravels, which would increase the quantity of available spawning habitat for salmonids, Pacific lamprey, and other native fish.

Adding wood to newly constructed side channels, or to restored historic side channels would increase the amount and quality of these habitats, thereby increasing juvenile salmonid numbers, (Roni *et al*. 2006, Roni and Quinn 2001, Rosenfeld *et al*. 2008). The proposed large wood and boulder placement would provide valuable habitat structures for macroinvertebrates and fish, improving rearing conditions for fish and increased juvenile salmonid abundance (Roni *et al*. 2006, Roni and Quinn 2001). Studies in Washington have shown that juvenile Coho densities were 1.8 –3.2 times higher in stream reaches with large wood than without wood (Roni 2001). Wood also provides cover from predators during summer low flow periods, and improve the distribution and amount of hiding cover for adult salmonids as they migrate upstream.

Instream structures would provide benefits to fish during the first high flow conditions and continue to develop more complex habitat each winter. Studies have shown that overwinter survival of salmon, steelhead, and cutthroat trout increased in stream reaches that were treated with wood (Solazzi *et al*. 2000). Project actions would provide overwintering and summer rearing habitat for juvenile fish and address limiting factors for salmonid production in the Lemhi River such as reduced stream complexity and channel structure, excessive fine sediment, and degraded riparian conditions (NMFS 2019).

Placement of wood and boulder structures would entail the full suite of construction activity effects outlined in Section 3.2.2.2.1, "*Sedimentation and Turbidity*". Instream work would disturb or disrupt juvenile salmonids and other resident fish species from their normal feeding and resting behavior; and may cause the direct mortality of individual fish, though the probability or number would be difficult to quantify. Adult fish would be expected to move away from ongoing construction activities, but then readily occupy the improved or newly created habitats and resume normal behaviors upon completion of the project. Seasonal restrictions (see Section 2.3, "*Mitigation Measures*") imposed by instream work periods would prevent heavy equipment from smothering or crushing salmonid eggs.

Aquatic habitat restoration actions include vegetation planting to restore native riparian plant communities and structure. Diverse, healthy vegetation has a major influence on stream channel shape and size. Under the Proposed Action, riparian vegetation treatments, including the planting of native trees and shrubs, would occur as stand-alone actions, or as an action to stabilize disturbed areas. These actions would directly affect riparian vegetation and would increase the health and diversity of riparian areas, which in turn would provide a large variety of habitat features for fish and aquatic organisms, including food sources, shade, and future large wood. Well-vegetated streams tend to be narrow and deep due to the binding nature of plants and their root systems (Comfort 2005). Planting riparian vegetation would decrease areas of bare soil and provide a sediment-filtering buffer, which would reduce or minimize sediment delivery to fish habitat. As planted riparian vegetation matures, the width-to-depth ratios of disturbed channels and fine sediment delivery would decrease, thus improving the nearby aquatic habitats.

Healthy riparian plant communities provide primary and secondary productivity that drive the food base that juvenile salmonids consume when rearing and migrating to the ocean. A healthy riparian plant community increases the prey base for juvenile salmon and steelhead by increasing the amount of terrestrial insects that drop into the stream. Riparian vegetation also provides organic material directly to the stream, which makes up about 50% of the stream's nutrient energy supply for the food chain (Cummins 1974 cited in Platts 1991). This introduced organic material provides an important food source for salmonids' prey items, such as aquatic insects.

Research by Beechie *et al*. (2000) shows that aquatic habitat is maintained and improved over the long term as the result of increased large wood production resulting from riparian tree plantings. It is anticipated that healthy riparian vegetation can improve the survival of juvenile fish by providing appropriate substrate for pre-emergent fry, and cover from predators and high flows. Properly functioning riparian habitats increase the availability of pools, spawning substrate, cover, and holding/resting areas that would enhance growth and survival for fish through improved conditions for food sources, and improved reproductive success for adult salmonids.

Habitat forming materials (i.e. sediment, sand, and gravels) would be placed where a documented deficit of these materials is hindering natural fish production. Gravel would be placed to provide spawning substrate for salmonids as part of a larger restoration action or as a stand-alone action below reservoirs where gravels are frequently deficit. In many cases, such deposits would be dependent on the stream or river to move and place this material in a natural configuration attractive to spawning fish. Spawning areas for migrating salmon and steelhead would thereby be increased, providing the potential for increased production of wild salmonids.

3.3.2.2.3 Invasive Plant Control

BPA's proposed use of chemicals to control non-native plants is structured so as to minimize the risk of adverse effects on non-target species and aquatic habitats. Mitigation measures (see Section 2.3, "*Mitigation Measures*") guide chemical and fuel transport and storage; and emergency spill plans would be implemented to reduce the risk of an accidental spill of chemicals or fuel. Invasive plant control would not create construction-related effects to aquatic species' habitats, but there could be effects from the ultimate loss of vegetation, and from the toxicity effects of herbicide application.

Effects of Invasive Plant Control on Aquatic Habitats

NMFS analyzed the effects of herbicide application programs using the active ingredients and conservation measures similar to what is proposed here (NMFS 2010, NMFS 2012). They found that short-term toxicity effects to aquatic habitats could include a reduction in oxygen, an increase in carbon dioxide, a lowering of the pH, an increase in bacterial populations, and a change in the nutrient status of the water and in plant communities. Long-term ecological effects depend on the degree of vegetation loss, the persistence of the herbicide (which suppresses new plant growth), and the suitability of any colonizing or non-susceptible plant species to provide for the habitat needs of the fauna affected. The degree of these aquatic habitat effects from the application of herbicides as prescribed in this Proposed Action would be very low.

The removal of some invasive plants could produce minor changes in stream shade/cover, and thereby, water temperatures or dissolved oxygen levels, all of which are critical to fish. Substantial shade loss, however, would be rare, likely occurring only where treating streamside knotweed and blackberry monocultures, and possibly from cutting streamside woody species (tree of heaven, scotch broom, etc.). Most riparian invasive plants are understory species of streamside vegetation that do not provide the majority of streamside shade, and would, in time, be replaced by planted native vegetation or persistent native vegetation. Shade recovery may take one to several years, depending on the success of invasive plant treatment, stream size and location, topography, growing conditions for the replacement plants, and the density and height of the invasive plants when treated.

Effects of Invasive Plant Control on Aquatic Species

Direct herbicide delivery to surface water could result in mortality to fish during incubation, or lead to altered development of embryos. Though direct herbicide delivery to surface water is not part of the Proposed Action, there are mechanisms that transport appropriately-applied herbicides into aquatic habitats and expose aquatic species to their toxicity. NMFS (2011) identified three scenarios by which herbicide can come into contact with, and affect, aquatic habitats and species: (1) Runoff from riparian application; (2) application within perennial stream channels; and (3) runoff from intermittent stream channels and ditches when herbicides are applied intentionally or accidentally into ditches, irrigation channels or other bodies of water.

The level of contamination from runoff would vary depending on site and application variables, although the highest pollutant concentrations generally occur early in storm-runoff periods when the greatest amount of herbicide is available for dissolution (Stenstrom and Kayhanian 2005, Wood 2001). Lower exposures are likely when herbicide is applied to smaller areas, as in this Proposed Action, when intermittent stream channels or ditches are not completely treated, or when rainfall occurs more than 24 hours after application. Under the Proposed Action, some formulas of herbicide can be applied within the bankfull elevation of streams and in some cases up to the water's edge. Any juvenile fish in the margins of those streams are likely to be exposed to herbicides as a result of overspray, future inundation of treatment sites, percolation, surface runoff, or a combination of these factors.

However, mitigation measures in Appendix C, "*Conservation Measures for Invasive Plant Control*", specifically dictate herbicides, adjuvants, carriers, handling procedures, application methods, drift minimization measures, and riparian buffers that would greatly reduce the likelihood that significant amounts of herbicide would be transported to aquatic habitats. Also, the application of herbicides in accordance with EPA label instructions, as required, would not result in mortality to ESA-listed fish.

However, there is no certainty that chemicals would not reach streams with aquatic species or ESA-listed fish. The effects of these chemicals on aquatic species are dependent on the level of toxicity to which the organism becomes exposed, which is determined by the herbicide, its concentration in the water at the point of contact, the environmental conditions (water temperature, flow rates/time of exposure), and sensitivity of the species exposed. Accidental or incidental contact between herbicides and surface waters from the actions proposed here, when administered according to the measures in Appendix C, "*Conservation Measures for Invasive Plant Control*", would result in only very low levels of exposure. Though the exposure amounts would be very low, there would likely be some sub-lethal effects.

Stehr *et al*. (2009) found that the low levels of herbicide delivered to surface waters are unlikely to be toxic to the embryos of ESA-listed salmon, steelhead and trout, but mortality or sub-lethal effects to juveniles would be likely. These effects include reduced growth and development, decreased predator avoidance, or other modified behaviors that could adversely affect the survival, reproductive success, or migratory behavior of individual fish. Herbicides are likely to also negatively impact the food base for listed salmonids and other fish, which includes terrestrial organisms of riparian origin, aquatic macroinvertebrates and forage fish.

Due to the underlying level of toxicity of the herbicides proposed combined with the implementation of the mitigation measures in Appendix C, the degree of effects to aquatic species from the application of herbicides as prescribed in this Proposed Action would be low.

3.3.2.2.4 Fencing

This action is primarily in habitats that would have no direct adverse impacts on riparian or aquatic habitats or species. Many, however, are designed to protect riparian and aquatic habitats from being impacted. Fencing, to control cattle grazing and keep them from riparian areas would, for example, remove the impacts of livestock trampling and grazing on streamside vegetation which would immediately improve streambank stability and riparian vegetation which provides habitat benefits for aquatic species.

3.3.2.2.5 Irrigation, Water Delivery, and Water Use Actions

The relocation of the irrigation diversion in the Canyon Creek Boundary project would eliminate a structure that functioned as a physical barrier to fish movement. The beneficial effects for fish would be the same as those as those for removal of culverts as discussed in Section 3.3.2.2.1, above.

The installation of a new fish screen in the Canyon Creek Boundary project would eliminate the lethal trapping of fish in the irrigation canal that flowed from the unscreened downstream diversion being relocated in this same project.

These actions require the installation of concrete structures. Fresh concrete and cement-related mortars are toxic to fish and the aquatic environment. The lime found in cement and concrete products easily dissolves in water. It is alkaline, and water that comes into contact with concrete slurry, cement, or uncured concrete becomes strongly alkaline, and deadly to aquatic organisms, including fish. Mitigation measures, however, would minimize this potential for this effect. They require that concrete be sufficiently cured or dried (48-72 hours depending on temperature) before coming into contact with stream flow to minimize the potential for this toxic effect on fish. The mitigation measures also require that concrete wash water be contained and not allowed to enter flowing or standing waters (Section 2.3, "*Mitigation Measures*").

3.3.2.3 Effects to ESA-Listed Fish Species

The effects to ESA-listed fish species would be the same as those described above. The Proposed Actions listed in Chapter 2 have all been consulted on under Section 7 of the ESA for BPA's Habitat Improvement Program (HIP), and NMFS (NMFS 2013) and USFWS (USFWS 2013) personnel concluded that the actions have predictable, short-term adverse and long-term beneficial effects to federally listed threatened and endangered species and their habitats, regardless of where they are executed. They also concluded that allowable numbers for capture, injury, and mortality of federally-listed fish species under these actions is far too few to affect the abundance, productivity, distribution, or genetic diversity of any salmon, steelhead, and other fish populations and would not likely contribute to a trend toward Federal listing or cause a loss of viability to the population or species.

3.3.2.4 Effects Conclusion for the Proposed Action on Fish and Aquatic Species

The short-term effects from construction actions on fish and aquatic species may be moderate, though reduced by the implementation of mitigation measures; but the long term benefits to fish and aquatic species from the improved habitat conditions would be high, which would balance the short-term and long-term overall effects on fish and aquatic species to be low.

3.3.3 Environmental Consequences for Fish and Aquatic Species – No Action

Under the No Action Alternative, the Proposed Action would not be implemented. None of the short-term aquatic impacts, such as sedimentation or removal of riparian vegetation due to construction would occur.

The existing degraded aquatic habitat conditions within the Valley would remain unaddressed, and land use actions that created and maintain those conditions would likely continue to adversely affect fish habitats and aquatic species.

Fish passage barriers would continue to hinder or prohibit fish use of many stream and river reaches, or be a source of mortality for ESA-listed fish. Stream connectivity would not improve under this alternative. Inaccessible fish habitat upstream of culverts would remain inaccessible to juvenile and adult fish.

Degraded streams and rivers would continue to limit fish reproduction, rearing and overwintering. Within the Valley, streams that lack structure would remain deficient in their ability to capture and hold sediment entering the streams from episodic disturbance events or other existing sources. Streams with bedrock channels caused by historic activities would remain bedrock channels and offer poor fish habitat conditions. Aquatic and riparian habitats that have undergone adverse anthropogenic changes would recover slowly (50–100 years), or not at all, because most streams' habitat recovery is dependent on a change in the human activities that degrade them. Fish habitat and aquatic populations would continue to be dependent upon ecological processes resulting from the current riparian stand conditions and their developmental trajectories, if any.

Invasive plants would continue to displace native riparian and aquatic species and lower the carrying capacity of aquatic species' habitats.

The adverse effects of the No Action Alternative on fish would be high.

3.4 Vegetation

3.4.1 Affected Environment

Though the Lemhi River basin starts at the crest of the Bitterroot, Beaverhead and Lemhi mountains and includes alpine and forest habitats, none of those lands are included in, or would be affected by, the Proposed Action and will not be considered here. The eleven project areas in this Proposed Action are located in the bottoms of the Lemhi River and its tributaries, and these are the focus of this assessment. These lands support sagebrush-steppe and riparian vegetation communities, with lands adjacent to the river and its tributaries converted in many areas to agricultural uses.

Sagebrush Steppe and Agricultural Zones

Sagebrush-steppe is a relatively xeric (dry) habitat that is dominated by shrubs, especially sagebrush (*Artemisia* spp.), or co-dominated by shrubs and perennial bunchgrasses. The most common shrub species in the Columbia Plateau is big sagebrush (*Artemisia tridentata*), though other types of sagebrush and other shrubs can be locally dominant. In a shrub-steppe understory, one or more perennial bunchgrass species are usually dominant. A wide array of forbs was an important herbaceous component historically, although cover of those species today has been greatly diminished by a long history of livestock grazing and invasive competitors.

Riparian Plant Communities

The largest riparian areas along the Lemhi River are on private land, because settlers characteristically chose to homestead along the river and major creeks. The most extensive stands of cottonwoods occur in a narrow band on the lower half of the Lemhi River. On the upper river, near Leadore, riparian vegetation widens out into wet meadows dominated by willows (*Salix* spp.) and sedges (*Carex* spp.). Shrubs and aspen (*Populous tremuloides*), with occasional cottonwoods (*Populus trichocarpa*), dominate side tributaries. Sedges dominate small areas around seeps and wet meadows (IDEQ, 1998).

Modified Plant Communities

Human-caused modification of waterways within sage-steppe and riparian plant communities has been extensive in the project areas. These areas are now readily colonized by non-native and invasive plant species such as knapweeds, Dalmatian toadflax (*Linaria dalmatica ssp. Dalmatica*), and the winter annual grasses such as medusa head rye (*Taeniatherum caput-medusae*), cheat grass (*Bromus* spp.) and other annual grasses.

Project Area Plant Community Descriptions

The table below displays the vegetative composition of each of the project areas.

Project area	Riparian plant Community	Sagebrush steppe	Agricultural/modified
Lemhi Headwaters	Scattered willow patches and individual plants interspersed with wet meadow along both side of Lemhi River throughout project area. No riparian woodland, no cottonwood.	Sagebrush steppe is present on benches immediately above the wet meadows on the northeast side of the project area. No project features are located in the sagebrush steppe community.	Flood-irrigated pasture in project area only – no plowed or planted areas.
Narrows Reach	The entire project area is primarily cottonwood and willow riparian woodland, with a 3-acre sedge wetland surrounded by willows.	No sagebrush steppe in the project area.	Flood irrigated pasture (1.5 acres) at the upstream extent of the project, through which a secondary channel would be constructed.
Eagle Valley	Narrow riparian strip on each side of channelized river; mostly with scattered clumps or individual cottonwood trees and willow along banks. Two patches of cottonwood-dominated riparian woodland: 1.7 acres downstream on right bank; and a 5-acre patch at upper end of project on left bank. Large wet meadow in floodplain on southwest side of river near center of project area.	No sagebrush steppe in the project area.	Large areas of former pasture and flood irrigated hayfield on northeast side of river – where most of the new channels would be located; Southwest side of river dominated by two large irrigation pivots; project features are located between these pivots and the river in the riparian woodland patch and large wet meadow discussed under "Riparian Plant Community"
Lemhi/Big Springs	Scattered willow patches and individual plants interspersed with wet meadow along both side of Lemhi River throughout project area. No riparian woodland, no cottonwood.	No sagebrush steppe in the project area.	Flood-irrigated pasture in project area only – no plowed or planted areas.
Canyon Creek Confluence	No riparian community present in upper 0.66 of project area. Downstream area supports scattered willows.	No sagebrush steppe in the project area.	Nearly all of project area is in an alfalfa field under an existing irrigation pivot

Project area	Riparian plant Community	Sagebrush steppe	Agricultural/modified
Hayden Creek	Narrow riparian valley supporting Cottonwood riparian woodland strips (2-5 cottonwood-tree widths) along entire length of project area.	No sagebrush steppe in the project area.	Irrigated pasture and hayfields along most of Hayden Creek just outside the riparian woodland strips
Middle Eighteenmile	No riparian vegetative conditions	Sagebrush steppe vegetation along the right banks of Eighteenmile Creek	Alfalfa field/pivot irrigation fringe along the left banks of Eighteenmile Creek
L-58C	Willow patches and riparian wetland in this small project area	No sagebrush steppe in the project area.	Riparian area grazing only
L-63	Willow patches and riparian wetland in this small project area	No sagebrush steppe in the project area.	Irrigated pasture and watered backyard lawn form the southwestern boundary of the project area.
Canyon Creek Boundary Project	Few scattered individual willow plants (no patches). Heavily grazed riparian zone; Riparian vegetation lacking.	Project area is dominated by sagebrush-steppe vegetation on both sides of Canyon Creek. Lightly grazed on public land parcels.	Heavily grazed dryland pasture on both sides of Canyon Creek on private land in project area.
Little Sawmill Culvert	No riparian vegetation in project area	No sagebrush steppe in the project area	Roadside, irrigation ditch, and pasture on downstream side of road; roadside and pasture on upstream side of road.

Sensitive or ESA-listed plants

There are no federally ESA-listed, "Sensitive" (including BLM and USFS sensitive and management species), or other special-status plant species identified within any of the project areas.

3.4.2 Environmental Consequences for Vegetation – Proposed Action

The restoration of healthy riparian and upland vegetative communities is a major element in the restoration actions proposed for funding by BPA, and the actions of seeding and planting native species is expected to be a part of any action that includes ground-disturbing activity. Controlling invasive plants is also a component of these actions. Over the long term, therefore, the effects to vegetation from such actions would be the restoration, improvement, or maintenance of native plant communities. In the short term, however, these projects would impact vegetation.

Preconstruction actions would require vehicular and foot traffic that would damage vegetation in off-road travel where minor amounts of vegetation might be disturbed or removed.

Construction actions would have the greatest impact on vegetation, and in the short term would impact plant communities rather dramatically. When heavy equipment is put to use, soil is turned and plants are uprooted, buried, torn apart, etc., but the actions vary greatly in size. Some of the projects under the Proposed Action would impact less than a tenth of an acre while some can heavily impact nearly a hundred acres (Figure 5 and Table 11).

Figure 5 Range of construction activity impacts from restoration projects

Other, non-construction activities would also impact plant communities, though they would do so without the intense soil disturbance associated with heavy equipment use. These activities include those that remove vegetation by applying herbicides or by applying water flows (permanent or seasonal).

Table 11 displays the mechanism and extent of vegetative disturbance by the different projects proposed. As stated above, some actions impact very little ground (*e.g.,* fencing, culvert or replacement, etc.). River and stream restoration actions, however, would be those most likely to disturb large numbers of acres of soil and vegetation.

Table 11 Mechanism and Extent of Short-Term Impact to Vegetation by Actions Proposed

Types of Projects	Mechanism of disturbance			Anticipated extent of disturbance				Vegetation communities primarily affected		
	Machine/manual	Chemical	Watering/Flows	< ¼ acre	¼ to ½ acre	½ to 1 acre	> 1 acre	Riparian	Sagebrush-Steppe	Agriculture/Modified
River, stream, floodplain, and wetland restoration										
Lemhi Headwaters	x		x				90-100 acres*	x		
Narrows Reach	x		x				25 acres	x		
Eagle Valley	x		x				80-90 acres*	x		x
Lemhi/Big Springs	x		x				10 acres	x		
Canyon Creek Confluence	x		x				3 acres			x
Hayden Creek	x		x				10 acres	x		
Middle Eighteenmile	x		x				3 acres		x	x
Irrigation diversion mods and culvert replacement										
L-58C Diversion Relocation	x				x					x
L-63 weir removal	x				x			x		
Canyon Creek Boundary	x					x			x	
Little Sawmill Culvert	x			x						x
Fencing and Planting										

Weed treatment (per treatment site)	x	x		x				x		x
Fence Construction for Livestock Control	x					x		x		x
Upland Vegetation Planting	x			x				x		

* This acreage figure represents the area within the outside boundary of the total area that would be disturbed; actual disturbed acres within this boundary could be as few as 75% or less of this total.

3.4.2.1 Effects on vegetation from construction actions

The direct effect of construction activities on soils and vegetation can be moderate in the short term by actions that require the use of heavy equipment such as backhoes, bulldozers, and loaders.

Most actions with construction activities would impact small, discrete sites such as culvert locations, irrigation diversions, and fish screens. The footprints of these ground-disturbing actions are generally small, less than one or two acres (see Table 11), and the time between short-term adverse disturbance and the completed action being in place to provide long-term beneficial restoration is usually a matter of days or weeks.

The projects with river, stream, floodplain, and wetland restoration actions that would impact dozens of acres of riparian, floodplain, and wetland habitats at each location (see Table 11) would be implemented in phases with generally less than 20 acres at any one site would be altered in any one year. The Eagle Valley and Lemhi Headwaters projects may have riparian area disturbance exceeding 50 acres in a single year, though these projects, implemented by adjacent phases may impact up to 100 acres (Lemhi Headwaters and Eagle Valley projects) over a multi- year time frame.

In addition to the short-term mechanical damage to plants and plant communities from construction activities, the creation of bare soil sites would make the project areas suitable for colonization by invasive plants. Therefore, all construction actions in this Proposed Action would also include follow-up treatments of invasive plants on affected sites.

3.4.2.2 Effects on vegetation from reintroduction of seasonal flooding flows

Many river restoration projects introduce flows into side channels or floodplains that have not experienced consistent flowing water for many decades. In the absence of frequent watering, these channels have often converted to wet meadow or upland plant communities. When the flows are applied however, the plants not suited to saturated soils for long periods of time would die out, and would be replaced by plants that are so suited. Plant communities would thereby change to riparian or wetland communities. Some changes can be dramatic, such as the conversion of upland sagebrush/steppe plant communities to riparian plant communities. Figure 6 displays an example of the degree of change possible when beaver dam analogues are successfully applied.

Figure 6 Plant community change from sagebrush to riparian plant community

3.4.2.3 Effects on vegetation from invasive plant treatments

The primary potential impacts from herbicide use would be to non-target terrestrial plants and animals as a result of intended herbicide application, and any unintended direct application or spray drift. Unintended direct spray could result in an exposure level equivalent to the application rate, and it is plausible that some non-target plants within and adjacent to an application site could be sprayed directly. Unintended direct spray at a full application rate would result in mortality to most plants sprayed. Herbicide may also be transported off-site by percolation, runoff, or by wind erosion of soil and contact with other plant species thereby. Effects to vegetation at an individual plant level (both "target" and "non-target") directly sprayed would likely be high, since the killing of vegetation is the purpose for this action, but application of the prescribed mitigation measures listed in Appendix C would minimize exposure of non-target species outside of any treatment area such that effects there would be low to moderate.

3.4.2.4 Effects Conclusion for the Proposed Action on Vegetation

Though the effects on vegetation from construction actions may be moderate in the short term, the long-term beneficial effects of increased riparian habitats and improved vegetative conditions would be high, thus when the short- and long-term effects are considered together, the overall effects of the Proposed Action on vegetation would be moderate.

3.4.3 Environmental Consequences for Vegetation – No Action

Under the No Action Alternative, no actions would be funded by BPA to restore vegetative conditions in riparian areas, wetlands, and floodplains within the riparian and sagebrush-steppe vegetative types in the Valley. Agricultural water withdrawal and delivery systems would not be modified and would thus maintain the degraded hydrology in place today that reduces stream flows, lowers water tables, and thereby favors invasive species and degraded riparian vegetative conditions. There would be no short-term adverse effects, but there would also be no long-term beneficial effects.

No planting or invasive species treatments would be funded to restore native vegetative conditions and ecosystem processes. This could allow for invasive species encroachment and its resulting reduction in plant species diversity and fire resilience in sagebrush steppe communities.

The No Action alternative would maintain the existing plant communities, but it would also maintain the degraded conditions that favor invasive plants and provide no improvements toward development of native plant communities. The effect of the No Action alternative would be moderate.

3.5 Wetlands and Floodplains

3.5.1 Affected Environment

The actions proposed in this EA would all be located on wetlands and floodplains low in the watershed, where the floodplains were historically very wide, and tributary streams and side-channels were well-connected[17] with them through the actions of seasonal flooding, beaver activity, and sediment supply and movement. The conditions being addressed with BPA funding in this Proposed Action are channelized main-stem rivers and streams with reduced flows or now-ephemeral flows, with little riparian vegetation. The former side channels and over flows are mostly cut off from their historical water sources (except during the highest of flood events) and the main flows no longer migrate across floodplains. Floodplains and wetlands in the project areas are functionally disconnected from adjacent streams flows, and the natural system of sediment transport and deposition has been disrupted (Figure 7). The Lemhi River and its tributary streams have been channelized or vertically down cut in the project areas. Figure 8 displays such down-cutting conditions common in the Lemhi River's tributaries, though these pictures are from elsewhere.

Figure 7 The Lemhi River disconnected from its floodplain at Eagle Valley Ranch

As streams and rivers interact with adjacent groundwater, and as these channels down-cut, they pulled the water tables down with them. These lowered water tables de-watered the extensive wetlands and meadows that frequently were supported along rivers and streams through these arid habitats. Riparian communities are now confined to incised channels (Figure 8) with extensive loss of the sub-irrigated wetland conditions that existed before. Seasonal high flows and periodic flooding, which historically might have flowed over adjacent floodplain wetlands and deposited sediment, are now confined to incised channels where erosive forces are increased and focused, thereby producing more downcutting and further lowering of the water table.

[17] A "connected" floodplain is one where high stream flows have the capability at varying flood levels to flow onto and across adjacent floodplains where its transported sediment can be deposited as the flows spread out, slow down, and lose energy

Figure 8 Examples of incised channels and degraded stream conditions in sagebrush steppe wetlands

In both agricultural and sagebrush steppe lands, the Lemhi River and its tributaries are now mostly disconnected (see footnote 17, Section 3.5.1) from their floodplains, and the wetlands once supported there have been converted to irrigated agricultural uses, or have been dewatered and converted naturally to sagebrush-dominated plant communities.

3.5.2 Environmental Consequences for Wetlands and Floodplains – Proposed Action

3.5.2.1 Wetlands

Wetlands would be affected in the short term in most of the construction actions proposed here, but would be restored, expanded, or improved a few days or weeks later by that same action[18]. Fish passage restoration actions (L-63, Canyon Creek Boundary, and Little Sawmill Culvert projects); and river, stream, floodplain, and wetland restoration actions (all other projects in the Proposed Action) would be those most likely to be affected by construction, then restore, wetlands as described here, with specific actions' effects differing in scale (see Table 11). Wetlands that are connected to streams being restored could be bladed over with a tractor and then re-constructed to be larger or better connected to that stream's flows, or the wetlands could be displaced by a newly-constructed river or stream channel and moved or expanded into an adjacent location. These are restoration actions, with the end result designed to improve the wetland condition and function in the project areas. Though appreciable, the short-term effects would be temporary, with full or greater restoration being the end result. Figure 9 displays the same site during and after a stream restoration action showing the extent of short-term impacts and the improved end result for the long term.

The sponsoring entities (IDFG, LRLT, TU, LSWCD, and the Upper Salmon Basin Watershed Program of the State of Idaho's Office of Species Conservation) would obtain appropriate Clean Water Act

[18] See Section 4.3, "*Wetlands, Floodplains, and Water Resources*", for the Clean Water Act permitting information relevant to these actions.

Section 404 permits and Section 401 water quality certifications prior to the implementation of any work within these identified wetlands.

Figure 9 Example of the degree of disruption during and after stream restoration action in same year

Vegetative actions such as planting or herbicide treatment would not affect the connectivity of floodplains or their hydrologic function, though there would be a short-term adverse impact to vegetation with loss of plants from contact with spray, or displacement by the plantings of more desirable species.

Actions with no construction activity or herbicide application (*e.g.*, fencing, surveys, etc.) would have no, or inconsequential, short-term adverse effects, but would provide some long-term beneficial effect.

Pre-project wetland acre estimates and the amount likely to be affected are shown in the table below, but as described above, new wetlands would be created by project actions and some existing wetlands could be reduced in size or even eliminated if located in sites of new side channels, river meanders, or other constructed aquatic or wetland features.

Table 12 Pre-project wetlands and wetland impacts

Project	Pre-project wetland acres	Pre-project wetland acres within footprint of planned project excavation actions
Lemhi Headwaters	Approx. 61 acres	Approx. 4 acres
Narrows Reach	Approx. 17acres	Approx. 1 acre
Eagle Valley	Approx. 13 acres (see Figure 11)	Approx. 5 acres
Lemhi/Big Springs	1.6 acres	Approx. 0.25 acres
Canyon Creek Confluence	Margins of entire 3,100-ft length of stream/ditch; no off-channel wetlands	all
Hayden Creek	Approx. 2.5 acres	None; No excavation planned
Middle Eighteenmile	Margins of entire 1,584-ft length of stream/ditch; no off-channel wetlands	all
L-58C Diversion Relocation	.04 acres	all
L-63 weir removal	0.22 acres	Approx. 0.15 acres
Canyon Creek Boundary Project	Margins of entire 6,580-ft length of stream/ditch; no off-channel wetlands	None; No excavation planned
Little Sawmill Culvert	None	NA

Though the effects on the individual wetlands that are disturbed by project construction may be moderate to high in the short term, considering the minimization measures and the long-term restoration and enhancement benefits, the overall effects would be low.

3.5.2.2 Floodplains

As with wetlands, projects within floodplains would be intended to improve long-term function, but the associated construction activities would have short-term adverse effects.

Typically, projects within floodplains would include the construction of secondary channels, side channels, and alcoves. They also could include floodplain roughness[19] treatments. For construction feasibility, there may also be stream bypasses, staging areas, and access roads temporarily located on the floodplain (Figure 10, lower). Figure 10 also displays the type and scale of effect anticipated for the Lemhi Headwaters and Eagle Valley projects.

Figure 10 Short-term impacts to a floodplain during restoration project showing conditions before (upper photo) and during (lower photo).

The floodplain would be greatly modified during construction, and its function would be compromised. This would be occurring, however, at a time of year when flows are low and floodplains would naturally have no, or limited, surface connections to their associated channels. Such projects would usually be completed in phases so that a segment of floodplain would be

[19] Floodplain roughness treatments includes the scarification or low level reshaping of soil surfaces, the planting of vegetation, and the placement of woody debris with the intent that these actions would slow the flow of water across the floodplain surface thereby increasing the potential for sediment to be deposited.

improved and capable of improved long-term function before the next high flows. If a section required multiple seasons, then mitigation measures, such as maintaining effective erosion control in place throughout the duration of the project (Appendix B, "*General Conservation Measures Applicable to All Actions*"), would be in place to protect incomplete work, prevent erosive or polluting impacts to the river or stream, and ensure effective flow capacity and control during high seasonal flows.

Excavating new channels or reconnecting historical stream channels, and then diverting a live stream into it can be disruptive to the landscape. Locations and amounts of flows are changed, and the initial flows of water through a newly constructed area, though gradually introduced, would begin the process of molding the new floodplain features: digging pools, establishing gravel bars, moving instream gravels and large wood water, and refining banks, diversions, and confluences. Projects in this Proposed Action, are designed and would be constructed, to provide the Lemhi River and the subject tributaries the opportunity for flows and woody materials to be naturally moved and placed as the stream might dictate with a goal of proper floodplain function and resilience. While the design would be expected to function effectively, some degree of change can be embraced if hydrologic conditions create something different from the conditions constructed.

With these types of projects, however, there is a risk that the newly-constructed channel may fail during subsequent high flows. This is especially the case if uncommonly high flows impact a newly restored reach before design flows[20] have a season or two to refine and stabilize that reach, and before vegetation has a chance to become established. The channel could return to its pre-project channel, or channel avulsions may cut off the constructed meanders, resulting in a relatively straight channel with little habitat complexity. The former would be more likely to occur when floodplain roughness is low, which can be the case when floodplains are reshaped and temporarily devoid of vegetation or large wood. The chance of channel avulsion would be greatest during the first year after channel construction and would decrease as riparian vegetation becomes established. Liberal placement of large woody debris, wood structures, planted (or transplanted) riparian vegetation, erosion controls, and fencing would all contribute to early and effective floodplain roughness and minimize this risk of channel avulsion.

By restoring stream flow connection to historical floodplains, either through raising the stream base level to floodplain elevation, or by increasing anastomosed conditions, the floodplain's historic function of acting as a "sponge" and reservoir for runoff would be restored. When floodplain function is restored, a portion of winter and spring runoff is stored in floodplain soils where it is available for release later in the spring and summer. This restored function would result in some degree of improved flow timing, including augmentation of some seasonal flows, potentially resulting in benefits for aquatic species and downstream irrigators. The primary flow augmentation effect would typically occur in late spring as stored groundwater from winter and spring runoff flows out of floodplain soils to the stream channel. This augmentation of channel flow would often extend into summer months, but the degree of this effect would vary from site to site.

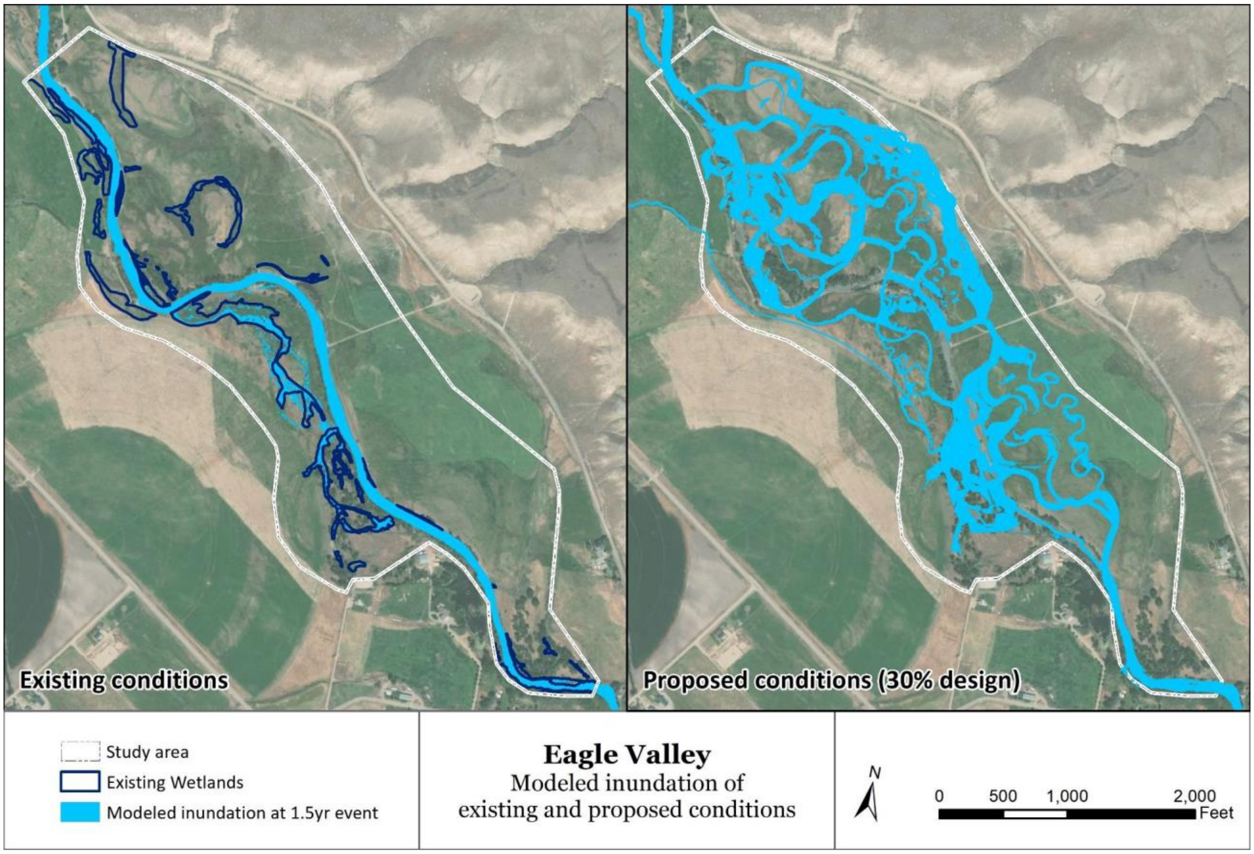
Restoration of floodplain function would result in increased transpiration of groundwater where ground cover would be converted from dry-land species like sagebrush to riparian species from which transpiration would be greater (Loheide 2005; Hammersmark 2008).

Reconnection of a stream to its floodplain would create conditions for that floodplain's flood response to be closer to historic condition by increasing water storage capacity and slowing the flow of flood waters. This could result in a flood-control benefit for downstream landowners and

[20] "Design flows" are the varying amounts and elevations of river or stream flow to which a restoration project has been designed and that are typical for the river or stream reach being restored.

municipalities (Plumas N.F. 2010) since, at the project level, most projects would be expected to attenuate the peaks of flood flows. The degree of such attenuation, however, would vary based on the degree of flooding, the size of the floodplain, the degree of reconnection, and the degree of saturation of floodplain soils before the flood (saturated or not) (Hammersmark 2008). Figure 11 displays the degree of functional floodplain recovery possible from the actions proposed. This example is from the Eagle Valley project, but similar results are anticipated from the Lemhi Headwaters and Narrows Reach projects as well.

Figure 11 Increased floodplain connection anticipated from Eagle Valley project



The short-term effects on floodplains would be high from the impacts of heavy equipment operations and the temporary but complete disconnection of the stream from its floodplain while in bypass channels. The beneficial effects, however, of greatly improved stream/floodplain connection and restored floodplain function for the long term with the combined short-term and long-term overall effects being low.

3.5.3 Environmental Consequences for Wetlands and Floodplains – No Action

Under the No Action Alternative many areas of floodplain and the associated wetlands would not temporarily be impacted by construction of the projects. But, in the long term, wetlands would not be expanded and floodplains would remain disconnected from their rivers and streams, and the dysfunction of those waterways' flood attenuation, water storage, sediment transport and deposition, and floodplain and wetland habitat dynamics would continue. The continued adverse effects by the No Action Alternative from these uncorrected ongoing adverse effects would be high.

3.6 Wildlife

3.6.1 Affected Environment

3.6.1.1 Wildlife Habitats and Use

As described in Sections 3.2, "*Water Resources*", and 3.4, "*Vegetation*" all major habitat types have been altered by human uses and activities. For the most part, these alterations have degraded the habitats for use by many native wildlife species.

The wetland and riparian habitats support more wildlife species than do other habitats. This habitat type has been impacted more than any other in the Valley by historical land uses, and it is this habitat type that the Proposed Action would primarily impact (short-term) and ultimately improve (long-term), as discussed further in Section 3.6.2, "*Environmental Consequences – Proposed Action*". Some species, such as beaver (*Castor Canadensis*), muskrat (*Ondatra zibethicus*), otter (*Lontra Canadensis*), mink (*Neovison vison*), kingfisher (*Megaceryle alcyon*), etc. are dependent on aquatic and riparian habitats, and have the most to gain from the Proposed Action. Even if not dependent on riparian or aquatic habitats, most species in the Valley are known to forage in riparian areas at least 50 percent of the time (Kauffman et al. 2001).

Riparian areas in the project areas contain more habitat-generalist species such as deer or coyote, which have a high degree of habitat adaptability but use riparian habitats opportunistically. Species with very large home ranges such as elk (*Cervus canadensis*), bears (*Ursus americanus*), or wolves (*Canis lupus*) are also present in the riparian habitats. These species may use aquatic, riparian, or wetland habitat conditions incidentally as they occur within their home ranges, but they are not dependent on them for their forage, seasonal survival, or reproductive needs.

The privately-owned shrub-steppe habitats within the proposed project areas have mostly been converted to agricultural uses (e.g., Eagle Valley, Canyon Creek Confluence, and Middle Eighteenmile) or very heavily grazed (e.g., Canyon Creek Boundary), eliminating or reducing their habitat value for native wildlife species. The habitats created by agricultural development, however, have some value for wildlife, providing forage for ungulates (elk and deer (*Odocoileus spp.*)), waterfowl, and small mammals, and thereby focal foraging areas for avian predators (hawks and owls) and predators, mammalian predators (*e.g.,* coyotes (*Canis latrans*)).

3.6.1.2 Wildlife Species

Amphibians

Amphibians can be found in all habitat types in the Valley, but they are more common in riparian areas, being especially dependent on aquatic habitats. Nearly all amphibians found in the Columbia River Basin breed in riparian zones (Johnson et al. 2001). These species are therefore highly sensitive to habitat changes, and are good indicators of aquatic and riparian health.

Conversions of wetlands to agriculture, and water diversion for irrigation needs, have resulted in declines of amphibian (and reptile) populations across the west, and certainly within the Valley. Ongoing stressors to these species include the application of pesticides and herbicides, by which they can be killed outright or adversely affected physiologically (Hayes, 2013); livestock grazing, which reduces streamside vegetation (thereby diminishing foraging habitat); and by livestock trampling of burrows with destruction of eggs and nests (Kauffman et al.). Ongoing threats to amphibians include road traffic, fires (both wild and prescribed), and annual agricultural activities such as mowing and disking.

Reptiles

Reptiles are not considered closely associated with any specific habitat type in the Valley, though in shrub-steppe habitats their species diversity is relatively high. Reptile choice of habitats is driven more by the need for warm climates, rocks, talus, and soils than by the presence of general vegetation types, thus most reptiles are found in lower-elevation grassland and shrub-steppe habitat types than in the higher forests or alpine areas (Sallabanks *et al.* 2001) where their desired thermal conditions are more consistently available than in other habitats (Vander Haegen et al. 2001). Within these thermally-preferred grassland and shrub-steppe habitats, however, reptiles are drawn to riparian areas because of the relative of abundance of prey species there over that in the surrounding grass or shrublands.

As with other species, reptiles in the Valley have declined in response to changes in their habitats including the reduction of shrub-steppe habitat and an increase in agriculture. Ongoing pressures come from road traffic, fires, and agricultural activities which all take their toll of reptiles each year.

Birds

Over 245[21] species of birds have been identified across the Valley, but their habitat use is generally clustered around riparian areas within the larger habitat types. Over 70 percent of birds use freshwater riparian and wetland habitats, and close to 80 percent breed there (Kauffman et al. 2001). The alteration of historic vegetation communities (see Section 3.4.1, above) has impacted bird habitats through species' range reductions, population declines, and some local and regional extirpations.

Riparian areas are especially important to bird populations in the Valley. Diversity of avian species in wetlands and riparian habitats is higher than in upland habitats, and more than half of the bird species are closely associated with this habitat type. Kauffman et al. (2001) found that over 82 percent of inland bird species in Oregon and Washington use riparian and wetland habitats and 77 percent breed there (similar percentages would be applicable to the Lemhi Valley). Riparian areas are essential for breeding for many bird species, and the reduction of them has resulted in a reduction in breeding bird populations (USFWS 1995).

Riparian areas are also critical wintering habitats for resident land birds and critical migratory habitats for species that winter north of the U.S. border (Knopf, et al 1988 and 1994). Neotropical migratory birds[22] focus on riparian areas for their breeding and migration, with the diversity of migrating species being as much as 14 times higher in riparian than in non-riparian habitats (Henke and Stone 1979). Stevens *et al. (*1977) found that the abundance of migrating Neotropical migratory birds may be ten times greater in riparian zones than in surrounding uplands.

The Lemhi Valley hosts the "Lemhi Backroad Subloop" (IDFG 2019) a publicized birdwatching trail where riparian habitats along the Lemhi River provide a habitat rich in observable birdlife. Species identified here include willow flycatcher (*Empidonax traillii*), American dipper (*Cinclus mexicanus)*, veery (*Catharus fuscescens)*, gray catbird (*Dumetella carolinensis)*, yellow warbler (*Setophaga spp.)*, Wilson's warbler (*Cardellina pusilla*), MacGillivray's warbler (*Geothlypis tolmiei*), yellow-breasted chat (*Icteria virens)*, black-headed grosbeak (*Pheucticus melanocephalus*), and lazuli bunting (*Passerina amoena)*, red-tailed hawk (*Buteo jamaicensis)*, Lewis's woodpecker (*Melanerpes lewis)*, red-naped sapsucker (*Sphyrapicus nuchalis)*, western wood-pewee (*Contopus sordidulus*), Bullock's oriole (*Icterus bullockii)*, and western tanager (*Piranga ludoviciana)* near cottonwoods. Common

[21] From eBird,org - https://ebird.org/region/US-ID-059?yr=all&m=&rank=hc&hs_sortBy=count&hs_o=desc ; accessed on January 29, 2020

[22] A Neotropical migratory bird is a bird that breeds in Canada and the United States during summers and spends the winters in Mexico, Central America, South America, or the Caribbean islands.

nighthawk (*Chordeiles minor),* and all six species of swallow (*Hirundinidae)* found in Idaho can also be found here (IDFG 2019).

Wetland and marsh habitats in the Valley support cinnamon teal ((*Spatula cyanoptera)*, Virginia rail (*Rallus limicola)*, sora (*Porzana carolina)*, Wilson's phalarope (*Phalaropus tricolor)*, and Brewer's blackbird (*Euphagus cyanocephalus)* (IDFG 2019).

Upland habitats in the Valley, primarily shrub steppe, provide habitat for greater sage-grouse (*Centrocercus urophasianus)*, gray partridge (*Perdix perdix)*, chukar (*Alectoris chukar)*, golden eagle (*Aquila chrysaetos)*, horned lark (*Eremophila alpestris)*, rock wren (*Salpinctes obsoletus)*, sage thrasher (*Oreoscoptes montanus)*, and Brewer's sparrow (*Spizella breweri)* and Vesper sparrow (*Pooecetes gramineus)*. Gambel's quail (*Callipepla gambelii)*, introduced to the Lemhi Valley in 1921, also inhabits the Valley in dry upland habitats near agricultural fields and riparian zones. This is the only place in Idaho where the species occurs.

Greater sage-grouse populations are healthy in the sagebrush-steppe habitats in the Valley, though the species has experienced declines and local extirpations from habitat loss and fragmentation across much of the Columbia Basin. These birds, listed as "Sensitive" by both BLM and USFS[23], require expansive sagebrush habitat that encompasses a mosaic of conditions including wet meadows and riparian fringes with abundant native forbs for brood-rearing. These are habitats on productive soils, the type of soils historically converted to agriculture, but the Lemhi Valley still provides good sage-grouse habitat and supports numerous leks (their breeding sites). The birds are sensitive to human disturbance at these leks, though none of the project areas support, or are within two miles of such sites.

No bird species listed under the ESA as threatened or endangered occupy habitats in project areas. There is, however, a bald eagle nesting pair that occupies a patch of cottonwoods within a riparian area along the reach of the Lemhi River within the Eagle Valley project area. No additional bald or golden eagle nests have been identified near (within 0.5 mile) the other project areas.

Mammals

The Lemhi Valley, more than many others in the Columbia River Basin, still supports a near-full complement of native mammals, including large ungulates and mammalian predators. Mule and white-tailed deer, pronghorn (*Antilocapra americana*), elk, and moose (*Alces alces*) are frequently visible from the local highways, especially in the winter as the valley bottom in winter range around and downstream from Leadore is heavily used winter range for elk, moose, and deer. Big horn sheep (*Ovis canadensis)* occupy the surrounding mountain ranges and river canyons of the Salmon River up and downstream of the Lemhi's confluence. Wolves occupy the valley and black bears are commonly seen, but there are no grizzly bears (*Ursus arctos horribilis*).

Mammalian species most likely in the project areas are those most closely associated with riparian and aquatic habitats such as beaver, muskrat, mink, and otter.

3.6.1.3 Wildlife Species Listed Under the Endangered Species Act

Three species in the Valley are listed under the ESA, though none are likely to use sites that could be proposed for restoration activities (Table 13).

[23] The greater sage-grouse is the only wildlife species listed as Sensitive by the USFS or the BLM with suitable habitat in or near the project areas.

Table 13 ESA-listed wildlife species potentially present in the Lemhi Valley

Species, ESA-listing status, Critical Habitat designation in project areas			Likelihood of consequential* project actions within a species home range (with rationale)
Species	ESA Status	ESA Critical Habitat at project sites	
Canada Lynx (*Lynx Canadensis*)	Threatened	Not designated	Highly unlikely (large home range and preferred habitats and concentrated use areas are remote from all action sites)
Gray Wolf (*Canis lupus*)	Endangered	No	Highly unlikely (large home range; concentrated use areas are remote from all action sites; animals avoid human use areas)
North American Wolverine (*Gulo gulo*)	Candidate	Not applicable	Highly unlikely (large home range and preferred habitats and concentrated use areas are remote from all action sites)
*for the purposes of this discussion, the term "consequential" indicates a situation where a proposed action within a listed species' home range could, at a minimum, disturb or otherwise affect the behavior of the species considered.			

Among these species, none are closely associated with riparian or wetland habitats commonly found within river or stream corridors, nor is their foraging preference identified as riparian, wetland, or floodplain habitats. Their species ranges, however, overlap areas and habitats in the project areas. Wolves, for example are known to occupy the Lemhi Valley, but rarely frequent the high-human use areas in the farmlands along the Lemhi River. Similarly, the Lemhi Pass area in the upper elevations of the Valley is recognized as an area with habitat features of value to the lynx (USFS 2002), but they would not use the non-forested habitats along the valley floor for anything but pass-through areas on their way to someplace else.

3.6.2 Environmental Consequences for Wildlife – Proposed Action

In general, restoration activities would have short-term adverse impacts with long-term positive effects on most wildlife species and their habitats. The goal of the proposed restoration actions is to restore the ecological function of native habitats, primarily aquatic habitats, riparian corridors, and floodplains. Improvement of impaired aquatic and riparian habitat function and condition is expected to increase and improve wildlife habitat resiliency, carrying capacity, and connectivity within and between watersheds. This would increase wildlife's reproductive potential both at the individual level (from improved site conditions within a home range) and at the population level (by improving dispersal capabilities between disjunct subpopulations).

During implementation of restoration activities, however, there would be some level of disturbance to wildlife individuals and their habitats. Though project design criteria (such as avoidance of known nest or den sites) and mitigation measures (such as timing restrictions and retention of large trees, logs, and snags) are routinely applied to minimize such disturbance, some measure of disturbance impact would likely remain. Table 14 displays the type of impacts to wildlife and wildlife habitat each type of action is likely to create. The mechanism and scale of these impacts on vegetation and the associated habitat from the projects proposed are displayed in Table 11, Section 3.4.2.

Table 14 Types of Impacts from restoration actions relevant to effects on wildlife

Actions common to multiple projects	Types of impacts to wildlife and habitat			
	Direct impacts to the animal (disturbance, handling, etc.)	Habitat losses short-term (earth moving, vegetation destruction)	Habitat changes (non-destructive log placement planting, etc.)	Changes to habitat type (*e.g.,* agric. or shrub-steppe to wetland)
Fish Passage Restoration (actions in projects 5, 6, 10, 11; see Section 2.1.1)				
Dams, Water Control, or Legacy Structure Removal	X	X		
Consolidate or Replace Existing Irrigation Diversions	X	X		
Headcut and Grade Stabilization	X	X		
Low Flow Consolidation	X	X		
Culvert Removal or Replacement	X	X		
River, Stream, Floodplain, and Wetland Restoration (actions in projects 1, 2, 3, 4, 7, 8, 9; see Section 2.1.1)				
Improve Secondary Channel and Floodplain Connectivity	X	X		X
Set-back or Removal of Existing, Berms, Dikes, and Levees	X	X		X
Protect Streambanks Using Bioengineering Methods	X	X		
Install Habitat-Forming Natural Material Instream Structure (Large & Small Wood & Boulders)	X		X	
Riparian and Wetland Vegetation Planting	X		X	
Channel Reconstruction	X	X		X
Install Habitat-Forming Natural Material Instream Structures (Sediment and Gravel)	X		X	
Invasive Plant Control (all projects)				
Manage Vegetation using Physical Controls	X		X	
Manage Vegetation using Herbicides	X		X	
Irrigation and Water Delivery/Management Actions (action in project 10)				
Install New or Upgrade/Maintain Existing Fish Screens	X	X		
Fencing and Planting (all projects)				
Fence Construction for Livestock Control	X		X	
Upland Vegetation Planting	X		X	

The vulnerability of wildlife to disturbance or displacement from restoration sites would be dependent on the degree and type of use a species makes of the habitats affected. For species with small home ranges that are closely-associated with riparian habitats, short-term construction effects can be devastating; but for species with larger home ranges that use that same riparian area for foraging some of the time, that same action may simply have a temporary displacement effect.

3.6.2.1 Short-term Effects

Effects to species closely associated with habitats affected by restoration actions

For species that are dependent on habitats affected by restoration actions for part or all of their life history requirements, the effects of restoration actions could be highly consequential. As shown in Figure 5 (Section 3.4.2, "*Environmental Consequences for Vegetation – Proposed Action*"), some larger actions, such as the river and floodplain restoration projects would temporarily eliminate the habitat upon which certain individuals depend. Smaller actions, such as the irrigation diversion projects and the culvert replacement would likely not. Table 11 displays the scale of habitat disturbance associated with each proposed project.

The degree of effect is determined mostly by the degree of disturbance. Some actions disturb wildlife by the simple presence (sound, movement, shadows) of human beings, though no vegetation is destroyed. For these, the larger, more mobile, species such as birds and small mammals may be temporarily displaced from their home territories. Such displacement forces individuals into nearby territories likely occupied by others of their kind where there would now be increased competition for space and resources. This intra-species competition would be sustainable for the short term (days or weeks) if individuals could return to their former habitats once the human disturbance had passed. For longer durations, the likelihood of mortality of displaced wildlife increases. For non-mobile species (*e.g.,* invertebrates and amphibians), the presence of humans would be a source of stress (disrupted feeding, breeding, hiding, etc.) that the animals could not escape for the duration of the activity. Such stress or disturbance can make the animal more vulnerable to predation, or impact its physical condition perhaps affecting its survival.

Other types of disturbance can affect wildlife apart from the restoration site. These include noise, smoke, humans walking in the stream, turbidity, smells, etc. While these actions do not modify habitats, they can temporarily disrupt wildlife behavior and displace them from their habitats. Birds, for example, would be directly affected and some amount of nest abandonment could occur due to noise disturbance.

Some actions (*e.g.,* herbicide application) may affect the structure and condition of habitats while not eliminating the habitat altogether. Direct exposure of terrestrial wildlife to applied herbicides can occur when mammals and birds contact chemical residues with their skin or eyes or when they inhale vapors or particulates. Small resident mammals such as mice would likely be present when herbicide is applied and could receive direct contact; medium and large-sized mammals (such as coyotes and deer) would likely flee the site before any direct contact with spray. Indirect exposure to mammals and birds can occur through dermal contact with contaminated vegetation, grooming activities, or ingestion of contaminated vegetation, prey species, or water. A wide range of exposures can be anticipated from the consumption of contaminated vegetation with the highest exposures immediately after application. Such exposures, however, are unlikely to be lethal because the herbicides and application rates proposed in this action are structured to be less than known levels of toxicity; and chronic exposure over a long period of time is unlikely given the short, singular, annual seasons of application and the naturally short life-span of small animals likely to receive direct exposure. Effects on wildlife would be moderate.

Most actions, however, remove the vegetation (the wildlife habitat) in part or in whole in the short-term. In these actions, mobile species would be permanently displaced (at least as far as their individually short lifespans are concerned) as it may take three to ten growing seasons for desired habitat conditions to be restored. Intra-species competition because of increased densities from displaced individuals in habitats adjacent to action sites would not be sustainable over multiple seasons. There would likely be a loss of individuals or breeding pairs depending on the time period required before restoration of the species' habitat requirements on the sites affected. This is especially the case in aquatic and riparian habitats where available habitat is usually limited, and the ability of wildlife species that are closely associated with those habitats (see Section 3.6.1.2) to relocate is limited. Once the habitat has recovered, however, the number of breeding would likely be restored to its original amount, if not increased.

For less mobile species such as invertebrates and amphibians, mortality from crushing by heavy equipment would be likely as equipment and personnel work the project area. Even if not impacted directly, riparian vegetation projects would affect this type of species through unavoidable disturbance and changes in habitat structure.

Some restoration actions would modify habitats with the intent of converting the vegetation permanently to a more desired condition. River and floodplain restoration projects would have this goal, with the conversion of sagebrush flats or agricultural fields back to a wet-meadow floodplain reconnected to its stream or river. Species dependent on the condition being converted by these restoration actions would be permanently displaced, and then replaced by species associated with the desired future condition.

Effects to "habitat generalist" species

Habitat generalist species are those that can use a variety of habitat conditions and would not be direly affected by the temporary loss or modification of one component of their home range conditions. Larger or more mobile species of this type (*e.g.,* deer, coyote, and red-tailed hawk) have a high degree of adaptability and thus an ability to focus on other habitat types within their home range, or slightly shift their home range boundaries. The competition and mortality risks triggered by actions in riparian areas are much lower for these species than for those closely associated with habitats affected by restoration actions. However, immobile species, and those with very small home ranges (*e.g.,* invertebrates, amphibians, and reptiles) can anticipate the same kinds of risks and losses discussed for closely associated species. For these, the risk comes from their immobility (as discussed above) or their limited home range, rather than from a dependency on a specific habitat type. Though not dependent on the habitat condition affected by the restoration action, that action may encompass their entire home range and thus displace or destroy them.

Some species in this category would be affected primarily because their prey species may be dependent on a specific habitat type or area impacted by restoration actions. There would be a loss of habitat and cover for prey species (small mammals, birds, insects, and eggs), and by avoidance of the area by prey species within the project area. The temporary loss of insects from aquatic restoration projects may adversely affect bat reproduction and survival, or the survival of fish downstream of the site. The loss of small bird and mammal habitats in a large stream or river restoration project may affect the foraging area of a Cooper's hawk or weasel, who may have to hunt more intensively on remaining portions of their territory, or move into another's territory and compete for resources there.

The application of herbicides has the potential to impact both closely-associated and habitat generalist species. Though applications of herbicide in this proposal would be of very small scale on small plots and highly focused on target species, some wildlife could be impacted. Direct exposure of terrestrial wildlife to applied herbicides can occur when mammals and birds contact chemical residues with their skin or eyes or when they inhale vapors or particulates. Small resident mammals such as mice would likely be present when herbicide is applied and could receive direct contact; medium and large-sized mammals (such as coyotes and deer) would likely flee the site before any direct contact with spray. Indirect exposure to mammals and birds can occur through dermal contact with contaminated vegetation, grooming activities, or ingestion of contaminated vegetation, prey species, or water. A wide range of exposures can be anticipated from the consumption of contaminated vegetation with the highest exposures immediately after application. Such exposures, however, are unlikely to be lethal because the herbicides and application rates proposed are structured to be less than known levels of toxicity; and chronic exposure over a long period of time is unlikely given the short, singular, annual seasons of application and the naturally short life-span of small animals likely to receive direct exposure.

Fencing for livestock control would have the potential limit the movement of ungulates, or, in the case of wire fencing, ensnare them causing their death. Installations proposed here, however, are of the wildlife–friendly pole type, not wire, with no potential for ensnaring animals. Fence construction may use tractors or other small power equipment to dig holes for posts, deliver materials, etc. with the potential for disturbing and displacing wildlife temporarily. These construction-related direct effects would be very low. Long term beneficial effects would include the accelerated vegetative and streambank habitat restoration of protected areas.

Overall short-term effects on wildlife would be moderate.

3.6.2.2 Long-term beneficial effects

The adverse effects described above would be short-term (one to ten years) and would occur on habitats that would likely have had some need of improvement. In nearly all cases, however, the resulting condition of the restoration action would be habitat conditions that would be restored, improved, or expanded over what had been there previously, with the intended vegetative conditions having a higher carrying capacity for both dependent and generalist wildlife than that of the existing condition.[24] Though these restored conditions would likely not benefit the individuals affected by the original action, the local population of their species is anticipated to benefit for the long term.

Most habitat improvements would take the form of increased plant species richness and diversity (numbers and proportions of species), increased habitat structural diversity (increased foliage layers, down woody debris, woodpiles, and dense vegetation), increased habitat heterogeneity (increased numbers of habitats within a broader area), and increased extent of riparian habitat. Most restoration actions would be applied in riparian areas, rather than in their surrounding upland habitats, so most of these increases would be seen within the unique and specific expression of riparian conditions located in forests, floodplains, grasslands, sagebrush-steppe, or agricultural settings.

Some habitat improvements affect wildlife populations by actions other than vegetative modification. Improved aquatic function in streams and rivers would provide increased habitats for fish which would increase the foraging opportunities for piscivorous (fish eating) species such as ospreys, eagles, mergansers, otters, and bear. Beaver dam analogues and beaver relocations would increase and expand beaver populations. Fence construction for livestock control would protect riparian areas from livestock impact, but also from their presence, increasing both cover and forage opportunities along riparian areas for ungulates.

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[24] Some actions, such as the installation of a fish screen or culvert, may not result in an improvement of wildlife habitat at the site of short-term construction activity impacts.

3.6.2.3 Effects on Threatened and Endangered Wildlife Species

As discussed above, no species listed as threatened or endangered under the ESA are likely to use sites proposed for restoration activities (Table 13). At most, these species may wander through a construction site at night, or after it is complete, and find site conditions less than desirable for foraging or resting, or for some other use, and simply move on. None of these are closely associated with, or dependent, on riparian or wetland habitats, nor is their foraging preference for these areas; therefore, BPA determined that the project would have no effect on ESA-listed wildlife species.

3.6.2.4 Effects Conclusion for the Proposed Action on Wildlife

Though the short –term effects on wildlife may be moderate to high for individuals that are harmed or killed by construction activities or by displacement from habitats rendered unsuitable for occupancy for a period of time; the long-term effects on wildlife populations would be beneficial from the increased habitat quality and carrying capacity resulting from the proposed projects. The overall effects would be low.

3.6.3 Environmental Consequences for Wildlife – No Action

There would be no habitat disturbance, or disturbance to wildlife from human presence or activity. There would be no short-term adverse effect to wildlife from the No Action Alternative. The wildlife species and numbers living in the degraded aquatic, wetland, and riparian habitats in the project areas would remain unchanged.

However, there would also be no improvement to wildlife habitats in riparian areas or wetlands, providing no opportunity for increase in wildlife numbers or productivity. There would also be a lesser potential to increase anadromous fish runs, which would otherwise be an increased food source for fish-eating wildlife such as bears, otters, bald eagles, osprey, kingfishers, etc.

The overall adverse effect from the No Action Alternative of maintaining the existing sub-optimal wildlife habitats and the reduced wildlife populations they support would be moderate.

3.7 Geology and Soils

3.7.1 Affected Environment

The Lemhi River sub-basin is the northernmost of the Basin and Range fault block valleys, and lies within the Northern Rocky Mountain physiographic province where its broad valley is bordered by steep-sided, narrow mountain ranges. The valley bottoms are covered by thick layers of sediments consisting primarily of sand and gravel with varying amounts of finer sediments and boulders. Many of the deposits, especially in the Leadore area, are large alluvial fans extending down from the surrounding mountains.

The project areas are found primarily in the bottoms of the Lemhi River and its tributaries: Canyon Creek, Little Sawmill Creek, and Hayden Creek. The soils in these areas have been categorized into two "general soil map units": 1) "cool soils on flood plains, stream terraces, fan terraces, and outwash fans"; and 2) "cool soils dominantly on hills and mountains" (NRCS 2006). The Lemhi Headwaters, Eagle Valley, Lemhi/Big Springs, L-58C, L-63, Canyon Creek Confluence, Middle Eighteenmile, and Canyon Creek Boundary projects are located on the first soil map unit, the "flood plains, stream terraces, fan terraces, and outwash fans" unit; and the Narrows Reach, Hayden Creek, and Little Sawmill Culvert projects are located on the "dominantly on hills and mountains" unit.

Projects high in the mainstem of the Lemhi River (Lemhi Headwaters, Eagle Valley, Lemhi/Big Springs, L-58C, L-63) are all located in the first unit, in a set of soil types (the *Mooretown-Tohobit-Bursteadt* types) described as being as "very deep, nearly level, somewhat poorly drained and moderately well drained soils that formed in mixed alluvium[25]" (NRCS 2006). Projects along Canyon Creek and Middle Eighteenmile Creek (Canyon Creek Confluence, Middle Eighteenmile, and Canyon Creek Boundary), upstream of those described above, are also in this first unit, and are in a set of soil types (*Simeroi-Whitecloud-Ringle*) described as "very deep, undulating to hilly, somewhat excessively drained and well drained soils that formed in alluvium derived from limestone" (NRCS 2006).

The Narrows Reach, Hayden Creek, and Little Sawmill Culvert projects are all located in an area where the Valley narrows, and the surrounding hills close in upon the Lemhi River (see Figure 3 in Section 2.1.1 "*Construction Actions*"). The soils from these hills extend onto the floodplain in the area of these projects. Projects 8 and 11, are in the *Calcids-Dawtonia-Venum* soil types (NRCS 2006) which are described as "Moderately deep to very deep, rolling, well drained soils that formed in colluvium[26] and alluvium derived from quartzite and mixed rock sources". The Narrows Reach project is located where the valley is at its most narrow, where hillsides confine both banks of the Lemhi River as in no other location in the valley. Soils here (the *Dacont-Gaciba-Farvant* types according to NRCS (2006)) are described as "very deep, rolling, well drained soils that formed in colluvium".

In summary, the projects are located on soils that are all deep, and for those not in the very broad bottoms of the Lemhi Valley (Lemhi Headwaters, Eagle Valley, Lemhi/Big Springs, L-58C, and L-63 projects), are fairly well drained. None of these soils, however, are identified as meeting the requirements for prime farmland (if irrigated) (NRCS 2006).

3.7.2 Environmental Consequences for Geology and Soils – Proposed Action

Some restoration actions (*e.g.,* weed treatments, fencing, and beaver dam analogues) would create little to no ground disturbance and thus would have minimal, if any, effect on soils. Other actions, particularly those that require heavy machinery, would result in a larger soil disturbance.

During construction, there would be a greater extent and higher degree of soil displacement. Construction equipment would be used to entirely reshape and realign stream beds and banks, and to re-grade floodplains; some construction actions are limited to the placement footprints of large wood or other structure placements.

The combination of soil compaction, erosion, and mineral loss from heavy equipment operation can reduce soil quality and site fertility in upland and riparian areas. There would be a greater potential for the mixing of soil horizons as well, however, mitigation measures would minimize this by requiring the segregation, storage, and protection of topsoil for post-construction restoration purposes (Section 2.3, "*Mitigation Measures*" and Appendix B, "*General Conservation Measures Applicable to All Actions*").

Of the projects proposed, the Lemhi Headwaters and Eagle Valley projects would create the most extensive of these types of effects; while the other construction projects may impact about ¼ acre or less of the effects of these larger projects. Table 15 displays the type and estimated extent of these construction effects by project.

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[25] Alluvium is a deposit of clay, silt, sand, and gravel deposited and shaped by flowing streams in a river valley, typically producing fertile soil.

[26] Colluvium is material which accumulates at the foot of a steep slope by rain, sheet erosion, and/or slow continuous downslope creep. These are usually loose, unconsolidated sediments.

Table 15 Estimated scale of short-term construction effects by each proposed project

Project		Soil impact type			Soil impact area (acre)*					
		Reshape stream beds and banks	Grading of floodplains	Structure placement only	< 0.25	¼ to 1	1 to 3	3 to 5	5 to 10	10 to 100 acres
1	Lemhi Headwaters	X	X							X
2	Narrows Reach	X							X	
3	Eagle Valley	X	X							X
4	Lemhi/Big Springs Confl.	X							X	
5	L-58C Diversion			X		X				
6	L-63 Weir			X		X				
7	Canyon Creek Confluence	X						X		
8	Hayden Creek			X			X			
9	Middle Eighteen Mile	X						X		
10	Canyon Creek Boundary			X		X				
11	Little Sawmill Culvert			X	X					
* these figures represent the full extent of disturbance, including staging areas and access roads										

Tables 11 and 15 display those restoration actions that would have short-term construction impacts, and provides a likely indication of the scale of those actions' impact. For the actions displayed in these tables, soil impacts can be intense, as displayed in Figures 5, 9, and 10. To minimize the impact of these actions, relevant design criteria, mitigation measures, and best management practices, such as the use of erosion control devices and revegetation, would all be applied to minimize impacts and maintain long-term productivity of soils in riparian ecosystems and facilitate long-term recovery of soil properties and function where needed (see Section 2.3, "*Mitigation Measures*", and Appendix B, "*General Conservation Measures Applicable to All Actions*").

The use of heavy construction equipment would directly impact soils. Heavy equipment use can compact, displace (move it from one place to another), mix horizons, and cause puddling[27] of soil. These impacts can be expected throughout any construction site but would be limited to the footprint of the projects in both scope and scale. Soil productivity and function would be impaired in the short-term, but should be recovered within 15 years (Fleming et al 2006; Lloyd et al 2013; Page-Dumroese et al 2006).

Herbicide use could also affect soils adversely. Studies generally indicate that the impacts of herbicide application on soil function are only minor and temporary, but there some studies that suggest herbicides that could more substantially alter soil function. These effects could include disruptions to earthworm ecology in soils exposed to glyphosate and atrazine; inhibition of soil N-cycling (including biological N2-fixation, mineralization and nitrification) by sulfonylurea

[27] Soil puddling is the effect of operating heavy machinery in soils with a high moisture content to produce uniformly soft structure-less mud. It can be an intentional condition created for rice production, or an unintentional effect of heavy equipment operation in saturated soils.

herbicides in alkaline or low organic matter soils; and site-specific increases in disease resulting from the application of a variety of herbicides (Rose et al 2016). The application of herbicides proposed here, however, would be on very small areas (< 0.1 acre) and generally administered plant-by-plant at rates generally below the maximum allowed by label instructions. There would thus be no applications with the potential to "significantly alter soil function" as described above.

As discussed throughout this EA, these restoration actions are for long term improvement of the ecological function of streams, riparian areas, wetlands, and floodplains. Though short term impacts to soil will be experienced, the long-term effects of these restoration actions would ultimately improve soil quality and productivity.

Many projects are designed to restore natural flooding and sediment deposition regimes. In a natural or restored environment, seasonal flooding contributes to fine sediment deposits, which promote riparian growth of vegetation with propagules[28], seeds, and organic matter. The deposited sediment also amends the soil's physical function by increasing water-holding capacity and providing a substrate for seedlings to establish. Reestablishment of these processes in riparian areas and floodplains allows soil hydrologic, biologic, and nutrient-cycling functions to be restored and maintained (Stromberg et al 2007; Tabacchi et al 1998).

Planting and invasive plant control are both intended to restore native plant communities. Soil biology and nutrient cycling is highly tied to these plant communities and vegetation dynamics since the below-ground soil organism populations are closely tied to that vegetation. By restoring the aboveground vegetation, the below-ground soil biology would result in improved biological and nutrient cycling functions (Barrios 2007; Ettema 2002).

The effects of the Proposed Action on Geology and Soils would be moderate to high in the short-term, but with implementation of mitigation measures and the long-term benefits, the overall effects would be moderate.

3.7.3 Environmental Consequences for Geology and Soils – No Action

There would be no construction activity associated with the No Action Alternative, with no potential to affect soils or geology.

3.8 Transportation

3.8.1 Affected Environment

The transportation infrastructure of the Lemhi Valley is very simple. There is one major highway, State Highway 28, that runs the length of the Lemhi Valley, intersecting with Federal Highway 93 at the north in Salmon, Idaho, and with Interstate 15, outside the Valley near Hamer, Idaho in the south. Highway 28 travels generally along the southwest edge of the Valley. Another set of roads traverses the northwest edge of the Valley.

The Old Lemhi Road and Back Road combine to traverse the northeast side of the lower Lemhi Valley, from Salmon, Idaho almost to the Narrows project area. Upstream of the Narrows project area, the Lemhi Road (also known as old Idaho 28) leaves Highway 28 at the town of Lemhi to traverse the northeast side of the valley to where it connects to Highway 29 at Leadore, Idaho.

[28] Propagules are vegetative structures that can become detached from a plant and give rise to a new plant, *e.g.,* a bud, sucker, or spore.

This system of roads that run the length of the Valley form the backbones of the transportation system here. From these roads branch nearly all the local and private roads accessing tributary streams and local homes, farms, and ranches.

Another State Highway, Highway 29, leaves from Highway 28 at Leadore, Idaho, and crosses the Bannock Pass into Montana. It becomes Montana State Highway 324 and ultimately connects with Interstate 15 at Clark Canyon Reservoir, southwest of Dillon, Montana.

3.8.2 Environmental Consequences for Transportation – Proposed Action

Six of the project sites are accessed primarily from Highway 28 (Lemhi Headwaters, Narrows Reach, Lemhi/Big Springs, L-58C, L-63, and Little Sawmill Culvert projects). Of these, the Little Sawmill Culvert which is located on this road, would directly affect it. This culvert installation would require the entire highway width at this site to be removed (in phases over three to four weeks, to allow at least one-way traffic to flow) and then restored once the new culvert is in place. Equipment would be operating on and along the highway and flaggers would be deployed to stop and direct traffic during construction (see Section 2.3, "*Mitigation Measures*").

None of the other projects would have actions that would affect Highway 28 or the traffic flowing along it. The Narrows Reach project, would be within 100 feet of this highway, but likely would not be visible from the highway because of the dense willows that would block all view, and all staging areas and construction activity would be conducted away from Highway 28.

The L-63 weir removal, would be within 220 feet of Highway 29 but no staging or operations of equipment would occur on that road.

The Canyon Creek Confluence project would be directly adjacent to Old Highway 28 near the town of Leadore, but no equipment staging or construction activities would occur on this road.

All other projects are located far enough from the highways and nearest access roads such that the only effect might be short-term increases in construction-related traffic.

There would be no changes to the transportation system in the Valley and any temporary increase in construction-related traffic would be small relative to the road capacity. The effect on transportation would be low for most projects, except for the Little Sawmill Culvert replacement, which would have a moderate temporary localized effect on transportation.

3.8.3 Environmental Consequences for Transportation – No Action

The No Action Alternative would have no construction actions that would result in temporary restrictions or increases in traffic; therefore, there would be no effect to transportation under the No Action Alternative.

3.9 Visual Resources

3.9.1 Affected Environment

Visual resources consist of natural and human-made features that give a particular environment its aesthetic qualities. Views are considered sensitive when they have high scenic quality and are experienced by relatively large numbers of people (i.e., views from publicly accessible areas). Scenic quality is a measure of the overall impression or appeal of an area created by the physical features of the landscape, such as natural features (landforms, vegetation, water, color, adjacent scenery, and scarcity) and human made features (roads, buildings, railroads, other built elements, and agricultural patterns).

The scenic values throughout the Lemhi Valley are remarkable. Scenic views of shrub-steppe or rural agricultural landscapes with dramatic mountain backdrops are common.

The primary observation points to the project areas are from the local roadways, primarily Highway 28 (see Section 3.8, "*Transportation*"), and local residential landowners. There are no sensitive viewing areas under the BLM and USFS land management plans identified on or viewing the portions of the project areas located on federally-managed lands.

3.9.2 Environmental Consequences for Visual Resources – Proposed Action

The potential effects of the activities in this Proposed Action would be visible primarily in foreground views, but none would be large enough, or would introduce visible changes or impacts large enough, to alter scenery in middle or background views. None of the project areas, however, are located in areas that would be considered as foreground in any viewshed (with the exception of the Little Sawmill Culvert and L-63). Most are in middle ground or background, and barely visible, if at all, from Highway28 (the major highway traversing the valley – and the one from which scenic values would be evaluated).

There would be short-term visual impacts from the Proposed Action. Heavy equipment use that denudes an area of vegetation to create new river channels or connected floodplains would look barren until the newly planted grasses, forbs, shrubs, and trees begin to visually restore the setting (see Figures 5 and 9 as examples). Such sites, however, would be hydro-seeded with a mixture of water, seed, and mulch, immediately upon completion of project actions for erosion and invasive plant control. The sites wouldn't look barren for long, and the long term result would be a natural-appearing riparian area or floodplain; or a new piece of agriculture infrastructure (in the case of fish screens or diversions in the L-58C and L-63 projects) consistent with similar structures throughout the area.

For example, an agricultural field in the Eagle Valley or the Lemhi Headwaters projects might be replaced with a new stream channel or wetland. These changes would be evident to someone standing at the site with knowledge of the past and current settings; but for most viewers, driving by the area for the first time, there would be nothing evident to identify a completed action, once revegetation has completed. The character of the overall scenic landscape would remain unchanged and consistent with that of the larger setting.

The effects on visual resources from the Proposed Action would be low.

3.9.3 Environmental Consequences for Visual Resources – No Action

Under the No Action Alternative none of the changes to riparian areas, structures, or roads would occur. There would be no changes from the current condition and, thus, no change from the current visual character of the area.

3.10 Air, Noise, and Public Health and Safety

3.10.1 Affected Environment

3.10.1.1Air Quality

Under Sections 108 and 109 of the Clean Air Act, 42 U.S.C. §§ 7401 et seq., the EPA established National Ambient Air Quality Standards to protect the public from air pollution. These standards identify six criteria pollutants which are of particular concern for human health and the environment: particulate matter (PM 2.5 or PM 10)[29] , carbon monoxide, nitrogen dioxide, sulfur dioxide, ozone, and lead.

Idaho, through Idaho Department of Environmental Quality, has a monitoring program which measures the levels of these pollutants to identify attainment, nonattainment, and maintenances areas across the state. When an area's monitoring results exceed the National Ambient Air Quality Standards a certain number of times, the EPA designates this area as a "nonattainment area". In Idaho, there are two areas, one in the southern part of the state, and one in the north, where air quality standards are not being met. The Lemhi Valley is not one of these areas. There are three areas of the state, however, that are identified as "Areas of Concern" bordering on non-attainment. The lower half of the Lemhi Valley is included in one of these, and includes the sites of the Narrows Reach, Eagle Valley, Hayden Creek, and Little Sawmill Culvert projects. This area is identified because of elevated PM 2.5, which comes from all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes.

3.10.1.2 Noise

Noise is generally defined as unwanted sound that disrupts normal activities or that diminishes the quality of the environment. It is usually caused by human activity that adds to the natural acoustic setting of a locale. The A-weighted decibel scale (dBA) is used here to describe sound and noise levels. This is a logarithmic scale that ranges from 0 dBA to about 160 dBA and approximates the range of human hearing. The threshold of human hearing is about 0 dBA; less than 30 dBA is very quiet; 30-60 dBA is quiet; 60-90 dBA is moderately loud; 90-110 dBA is very loud; and 110-130 is uncomfortably loud. A 10-decibel increase in sound levels is perceived as a doubling of the loudness. Ldn is also a noise level measurement used to indicate the average noise level over a 24-hour (day and night) period.

The dominant character of nearly all restoration action sites is rural, either in an agricultural or range setting. Ambient noise levels in these locations are primarily from scattered farm or forestry operations, low-level traffic on local highways, and human activity in the several small towns scattered in the subbasins. These noise levels vary with the season and time of day, with traffic noise generally greater during the summer months when tourists venture into these rural areas. Typical day/night average sound levels for agricultural crop land is around 45 dB (EPA 1974). Table 16 displays different levels of noise, typical sources of specific nose levels, and the likely noise level created by different restoration actions.

[29] PM 2.5 and PM 10 is the nomenclature for fine particulate matter (referring to less than 2.5 or 10 microns in diameter), that reduce visibility, cause the air to appear hazy, and is able to lodge deep in human lungs when levels are elevated.

Table 16 Noise Levels, Relevance, and likely Proposed Actions that create them

Source(s)[1]	Sound levels[2] (dBA)	Relevance of sound at this level	Proposed Action potential sound level
Shotgun, Rifle, Handgun Fireworks (at 3 ft.)	>160	Sounds created by a shock wave	No proposed activities would produce this sound level
Jet engine (taking off)	150	Harmfully loud	
Airplane (taking off)	140		
Stock car races Jet takeoff (at 100-200')	130	Threshold of pain	
Heavy machinery Chainsaw	120	Threshold of sensation or feeling	Restoration actions with short-term construction activities (equipment operator)
Car horn Baby crying / Maximum vocal effort.	110	Regular exposure of more than one minute risks permanent hearing loss. Physical discomfort.	Restoration actions with short-term construction activities (equipment operator)
Snowmobile Garbage truck Jet takeoff (at 2000')	100	> 95 dBA- no more than 15 minutes/day unprotected exposure recommended; One hour per day risks hearing loss.	Restoration actions with short-term construction activities (at construction site, 50' away)
Heavy truck (at 50 ft.) Motorcycle (operator) Power lawnmower Jet ski Shouted conversation	90	Very annoying	Restoration actions with short-term construction activities (at construction site, 50' away)
Heavy traffic Many industrial workplaces Electric razor	85	Level at which hearing damage begins with eight-hour exposure	Restoration actions with short-term construction activities (at construction site, 50' away)
Average city noise Freight train (at 50 ft.)	80	Annoying; interferes with conversation	Restoration actions with short-term construction activities (at construction site, 50' away)
Freeway traffic (at 50') Urban housing on major avenue (Ldn) Inside a car TV audio	70	Interferes with telephone conversation. EPA Ldn sound level for lifetime exposure without hearing loss.	Restoration actions with short-term construction activities (at construction site, 100' away)
Normal conversation Sewing machine	60	Intrusive Interference with human speech begins at about 60 dBA	Fencing
Rainfall Refrigerator Wooded residential (Ldn) Light auto traffic (at 100 ft.)	50	Quiet Comfortable Sleep disturbance may occur at less than 50 dBA.	Invasive plant control Planting
Quiet office, library Quiet residential area Rural Residential (Ldn)	40		Surveys, monitoring
Soft whisper (at 15 ft.)	30	Very quiet	
Normal breathing	10	Just audible	
	0	Threshold of human hearing	

[1] Adapted from multiple sources, including EPA 1974, League for the Hard of Hearing, www.lhh.org ; and The Canadian Hearing Society, www.chs.ca

[2] These are typical levels and some may be approximate averages of ranges; actual levels may depend on several factors, including distance from the sound source.

Noise can be a concern when actions are located near sensitive receptor sites, such as schools, hospitals or residences.

Because the Proposed Action would be implemented on private agricultural or public lands not adjacent to schools or hospitals, these sensitive receptor sites would not be an issue. Some sites, however, are near residences. For all but the L-63 project, the residences near those projects (some actions within ¼ mile of residence) are those of the landowner partnering with the sponsor for the project being implemented. At L-63, the project is immediately adjacent to the town of Leadore, with two residences within 250 feet of the project (one within 100 feet), two more within 300 feet, and three more within 400 feet. These residences, however, are likely not highly sensitive to construction activity or vehicle noise. Leadore is a small agricultural community (103 people in 2020) housing owners and workers of the surrounding ranches, and owners of construction companies or heavy equipment operators frequently hired to implement the many restoration actions in the valley. Additionally, the closest residences to the L-63 project are situated even closer to State Highway 29, and all have farm or construction equipment on their property and storage buildings for large motorized equipment.

3.10.1.3 Public Health and Safety

Existing risks to public health and safety on sites envisioned for restoration projects are few, and would be those common to agricultural and rural settings along rivers such as those associated with operations of agricultural machinery and equipment, livestock related, collapse of old structures, falling trees, drowning, falls, and electrocution.

Emergency services such as fire, medical, and law enforcement in the Lemhi Valley are less funded, includes volunteer services, has fewer equipment options, and has longer response times than in urban areas. Any disruption to these in time of emergency need could have consequential impact to people and property.

3.10.2 Environmental Consequences for Air, Noise, and Public Health and Safety – Proposed Action

3.10.2.1 Air Quality

Air quality can be impacted by a multitude of land management activities, including the types of actions included in the Proposed Action. Any project that raises dust or smoke, or generates exhaust from construction equipment would contribute particulate matter to the air, even with the BMPs prescribed in Section 2.3, *Mitigation* Measures, to minimize these impacts.

Project impacts to air quality are expected to be low both in concentration and duration. Construction equipment would emit some carbon monoxide, nitrogen oxide, unburned hydrocarbons, and particulates (primarily soot) from tailpipe emissions and cause dust during ground disturbance and travel along unpaved access roads. These could affect air quality locally for short durations. While use of herbicide for invasive species control could cause air quality degradation if applied during high temperatures or inversions, herbicide label requirements restrict application during these conditions, and this is not expected to occur.

Implementation of the Proposed Action is not expected to generate long-term or short-term violations of state air quality standards. Impacts from site-specific restoration projects would primarily occur from construction and would be temporary and localized in nature and would not have long-term impacts on air quality.

In construction areas where vegetation has been temporarily removed, a drier and warmer microclimate is created with a corresponding increase in soil temperatures. In such areas, loose soil can temporarily accumulate, and in dry weather, this soil can be dispersed as dust.

Implementation of minimization measures (see Section 2.3, "*Mitigation Measures*" and Appendix B "*General Conservation Measures Applicable to All Actions*"), such as dust control measures and maintaining emission control devices on construction equipment, would minimize the potential for air quality impacts and the effect on air quality from the Proposed Action would be low.

3.10.2.2 Noise

Restoration efforts implemented in the Valley as a part of the Proposed Action would have minor short-term effects to local noise levels. Implementation of restoration actions would involve the use of heavy equipment for short periods on the larger projects (see Table 16), such as river and stream restoration. These noises however are consistent with the ambient noises of the Lemhi Valley where farm and heavy equipment operations are common.

There are no sensitive noise receptors near the project areas, with the exception of the L-63 project adjacent to Leadore, Idaho, where heavy equipment operations would be limited to daylight hours to minimize noise disturbance to nearby residents. The other project areas are more than 0.25 mile from residences.

Though the Proposed Action would generate construction noise, once completed, the function of restored rivers and the operation of new irrigation structures would not affect ambient noise levels. Overall, the effects from noise would be low.

3.10.2.3 Public Health and Safety

The primary impact of the Proposed Action on public health and safety would be the potential to hinder traffic flow and response time to emergency vehicles for those projects that are situated on or near roads (*e.g.,* culvert replacement), or by the presence of construction equipment or supply vehicles on rural roads and highways. The short-term construction and restoration activities would not be expected to overburden the existing health and safety infrastructure near site-specific projects. The potential health and safety risks to workers and the public during construction would not be greater than a standard construction project, and therefore the short-term effects of the project to health and safety would be low. Adequate signage and other routine safeguards for worker and public safety would be applied to minimize these effects (see Section 2.3, "*Mitigation Measures*").

The exception to this would be the Little Sawmill Culvert replacement project. This action would require the removal of existing road surface from Highway 28, excavation, reconstruction, and repaving. This would require closure of parts of this road during construction activities and restricting flow to one-way traffic, controlled by flaggers or lights. This restriction has the potential to hinder emergency vehicle traffic, but such traffic would be given priority in crossing during an emergency response, so this potential effect would be low.

Restored flow regimes and seasonal flooding at restoration sites are intended results from many restoration projects. The restored sites could create low-lying or poorly-drained areas which could pond water that could provide breeding habitat for mosquitoes, which are a nuisance and a public health threat, since they can serve as vectors for disease. This effect is anticipated to be negligible given the minimal incremental increase in such habitat any project area would create along any river when its entire course is at high flows.

Application of herbicides in this Proposed Action, with full application of mitigation measures (See Section 2.3, "*Mitigation Measures*" and Appendix C, "*Conservation Measures for Invasive Plant Control*") and adherence to the label restrictions, would not result in human exposure to these chemicals beyond the incidental contact experienced by the applicator. Further, there would be no potential for herbicide application to water sources, gardens, or other areas with a likely human contact. Human behavior, however, cannot be controlled, and even with proper application there is potential for humans to come in contact with the compounds. It is possible people may walk into a treatment area during or after application even if adequate signage and other measures are taken to prevent such exposure. Workers that handle and apply the herbicides would likely be exposed. However, careful application of the mitigation measures would prevent or minimize exposures, and if exposure did occur, the concentration and toxicities would be low such that effects on humans would be low.

The effects of the Proposed Action on public health and safety would be low.

3.10.3 Environmental Consequences for Air, Noise, and Public Health and Safety – No Action

There would be no air quality or noise impacts associated with the No Action Alternative as no construction that would generate emissions, dust, or noise would occur. Under the No Action Alternative, there would be no effect on public health and safety as no effects on traffic and the potential slowing of emergency vehicle response time would occur.

3.11 Cultural Resources

Cultural resources include things and places that demonstrate evidence of human occupation or activity related to history, architecture, archaeology, engineering, and culture. Historic properties, as defined by 36 CFR Part 800, the implementing regulations of Section 106 of the National Historic Preservation Act (NHPA) (54 U.S.C. § 300108), are a subset of cultural resources that meet defined eligibility criteria for inclusion on the National Register of Historic Places (referred to as the National Register). Historic properties may be districts, sites, buildings, structures, artifacts, ruins, objects, works of art, natural features important in human history at the national, state, or local level or properties of traditional religious and cultural importance to an Indian tribe.

The NHPA requires that a federal agency to identify and evaluate cultural resources for eligibility for listing on the National Register. It also stipulates that federal agencies evaluate, consider, and minimize effects of their actions on these resources. Cultural resources are evaluated for eligibility in the National Register using four criteria which include an examination of the cultural resource's age, integrity (of location, design, setting, materials, workmanship, feeling and association), and significance in American culture, among other things. A cultural resource must meet at least one criterion to be eligible for listing on the National Register.

3.11.1 Affected Environment

The Proposed Action covers 10 discrete project sites (there are 11 projects, but two are adjacent to each other). These are the locations where potential impacts to cultural resources resulting from construction actions may occur. The proposed project actions would occur almost exclusively on the floodplain; in deep soils that have been deposited and worked by the actions of the shifting Lemhi River for millennia. Ground and shovel test surveys on these soils routinely fail to locate prehistoric cultural resources, and even cultural screening of pit-testing sites where excavations reach down to 8 feet in depth have failed to locate artifacts (Larsen 2020). What is commonly identified from cultural surveys in these areas, however, are historical finds representative of the early homesteading, farming, and ranching activities from the early 1800's. Typical finds include homestead sites and structural remains; historical water diversions and irrigation ditches; historical roads and agricultural equipment. The Lemhi Valley is known for its early homesteading history and early farming and irrigation practices.

The Valley is also known for the passage of the Lewis and Clark Expedition, where they entered the Valley through the Lemhi Pass from Montana, engaging with the Lemhi Shoshone band of Northern Shoshones who lived in the lower Lemhi Valley area., (including Sacagawea's relatives) before moving north, down the Valley to the Salmon River. Evidence of these native peoples' occupancy here is usually found in the shrub-steppe vegetation on the dry-land benches immediately above the bottomlands of the Lemhi River.

The Valley is also known for its part of the Nez Perce National Historic Trail, where the Nez Perce Tribe entered through the Bannock Pass above Leadore and fled south, up the Valley, fleeing from the U.S. Cavalry. The Canyon Creek Boundary project and the Middle Eighteenmile project would be near this historic route, but no evidence of that event was found in surveys of these sites.

Survey results from these project areas have identified the resources displayed in the table below.

Table 17 Cultural resources identified in surveys of project areas

Project site	Survey finds	Eligibility for National Register of Historic Places	Section 106 Status
Lemhi Headwaters	Obsidian, basalt, and other flakes and pieces representing stone tool use	Not eligible	No adverse effect
Narrows Reach	Two historic ditches and a corral	Not eligible	No effect
Eagle Valley	riverbank channelization; irrigation ditch; Debris dump; historic Old State Highway 28;	Only Hwy 28 is eligible, but the section in the project area does not contribute to eligibility	No adverse effect
Lemhi/Big Springs Confluence	None	NA	No adverse effect[2]
L-58C Diversion	L-58c irrigation ditch	Not eligible	No adverse effect
L-63 Weir	Historical ditch	Eligible, but the section in project area does not contribute to eligibility	No adverse effect
Canyon Creek Confluence	Historic ditch (since filled in by landowner)	Eligible – but only in sections outside of project area where it has been filled in	Consultation ongoing at time of Draft EA
Hayden Creek	Multiple known sites; no new sites identified	Eligible – but all sites avoided by project design	Consultation ongoing at time of Draft EA
Middle Eighteen Mile	None	NA	No historic properties affected
Canyon Creek Boundary	Historic ranch site	Eligible historic property	Adverse effect[3]
Little Sawmill Culvert	None	NA	No adverse effect[2]

[1] Letters from ID SHPO regarding these conclusions are on file at BPA headquarters, Portland, OR
[2] Survey and SHPO consultation was for a larger area for a prior project where resources found were not in area of current project and the "no adverse effect" concurrence by SHPO was for the larger area of prior project.
[3] Section 106 Memorandum of Agreement being prepared at time of Draft EA

3.11.2 Environmental Consequences for Cultural Resources – Proposed Action

Each project has been surveyed by an archaeologist meeting standards for a professional in archaeology (Secretary of the Interior's Professional Qualification Standards); and consultation with the Idaho State Historic Preservation Office and the affected tribes (Shoshone-Bannock Tribes, Nez Perce Tribe, and the Confederated Salish and Kootenai Tribes) has been conducted in compliance with Section 106 of the National Historic Preservation Act.

The table above includes the conclusions from the Idaho State Preservation Office (ID SHPO) concerning the effects of project activities on the cultural resources found at each project site. At the time of the draft EA, all but three actions had completed consultations with ID SHPO and consulting parties, and of those completed consultations, all but one would not adversely impact the identified cultural resources. In the case of the Canyon Creek Boundary project, the impact of the project would be from the construction of an irrigation ditch and fish screen through the site of an historical homestead. While no features (buildings, corrals, etc.) of that homestead would be impacted, the site itself would be affected by the presence of the new ditch and fish screen. A Memorandum of Agreement is being negotiated between BPA, IDSHPO and the private landowner on which the homestead and proposed irrigation ditch reside is being prepared as required by Section 106 of the National Historic Preservation Act to reduce adverse impacts to the cultural resources.

Construction actions on all sites would include digging and the moving of soil which could reveal cultural resources not found during the cultural field surveys. If cultural resources were discovered in the course of project activities, mitigation measures in Section 2.3 "*Mitigation Measures*" would guide protection and consultation actions concerning the resource found.

The effect on cultural resources from the Proposed Action would be low because eligible archeological or historic sites would either be avoided by project construction or appropriately mitigated through the NHPA Section 106 consultation process.

3.11.3 Environmental Consequences for Cultural Resources – No Action

There would be no ground disturbance with the No Action Alternative, and there would therefore be no potential to affect cultural resources.

3.12 Socioeconomics and Environmental Justice

3.12.1 Affected Environment

3.12.1.1 Socioeconomic Characteristics

As of the 2010 United States Census, there were just fewer than 8,000 people in Lemhi County (a population density of 1.7 people per square mile). The population is 96.4% white with 2.3% Latino and 0.7% American Indian. The median family income was $49,119, with 13% of families and 20% of the population below the national poverty level.

The total population of the Lemhi Valley is about 6,000. The area's largest communities are Salmon (population 3,300) and Leadore (population 103). During summer months, the county experiences a noticeable population increase. Summer homes, seasonal government jobs, and tourism creates a large influx of people during the summer months. Hunting and fishing are significant economic generators for this Valley, supporting local vendors (gas, food, and lodging) and suppliers, making Salmon, Idaho the #2 best hunting and fishing town in the United States according to Outdoor Life (2012).

Agriculture and agriculture-related industries (primarily livestock grazing and hay production) provide the base for the local economy. Summer-season and hunting-season recreational activities such as hunting, fishing, camping, river floating, and off-road vehicle use have increased their contribution to local economy measurably over the past two decades.

3.12.1.2 Environmental Justice Populations

Executive Order 12898 directs federal agencies to take the appropriate and necessary steps to address disproportionately high and adverse human health or environmental effects of federal actions on the health or environment of minority populations and low-income populations (the environmental justice populations). Guidelines provided by the CEQ (1997) and EPA (1998) indicate that a minority community may be defined where either 1) the minority population comprises more than 50 percent of the total population, or 2) the minority population of the affected area is meaningfully greater than the minority population in the general population of an appropriate benchmark region used for comparison.

In the Lemhi Valley, there is no community that meets the definitions of a minority population as defined by CEQ and EPA, above. Therefore, Environmental Justice Populations will not be addressed further.

3.12.2 Environmental Consequences for Socioeconomics – Proposed Action

Implementation of the restoration actions would likely create short-term beneficial economic effects for local businesses through purchases of food, fuel, lodging, and materials associated with construction and restoration actions. Materials necessary to build projects may also be sourced locally (e.g., logs, gravel), and lodging, food, and other services would be required to support construction workers traveling from outside of the immediate area. When practicable, local companies would be utilized for restoration project activities which could provide a shot term increase in jobs. Although beneficial, the positive impact from construction of restoration projects would be small and temporary when compared to the larger local economy. Therefore, the construction-related impacts to socioeconomics are considered low due to the minimal amount of goods and services that are expected to be required during these site-specific projects.

The restoration actions may also improve fish populations and natural scenery leading to long-term benefits for fishing and tourism within the communities.

Land use conversions in restored riparian areas from agriculture to natural habitats may require changes in grazing practices or some land uses, but no action is anticipated to impact agricultural productivity or revenue sufficient to change land uses, decrease ranching- or farming-related jobs, or lead to a decrease in agricultural support services.

Effects to the socioeconomics of the Valley as a whole with the implementation of the Proposed Action would be low due to the small scale and dispersed nature of the projects.

3.12.3 Environmental Consequences for Socioeconomics – No Action

The No Action Alternative would not induce any environmental or economic change to the Lemhi Valley. There would be no adverse effect, short- or long-term, on communities within the Valley. However, there would also be no potential for long-term beneficial effects of restored fish runs and improved riparian areas and floodplains that might otherwise contribute to improved conditions for recreational fishing or for recreational and tourism economic benefits.

3.13 Climate Change

3.13.1 Affected Environment

Greenhouse gases (GHGs) are chemical compounds in the earth's atmosphere that absorb and trap infrared radiation (heat) that is reflected or emitted from the surface of the earth. The trapping and subsequent buildup of heat in the atmosphere creates a greenhouse-like effect that maintains a global temperature warm enough to sustain life. Some forms of GHGs can be produced either by natural processes or as a result of human activities. However, the current scientific consensus is that human-made sources are increasing atmospheric GHG concentrations to levels that would raise the earth's average temperature. The United States Global Climate Research Program (USGCRP) found that since the 1970s, average U.S. temperatures and sea levels have risen and precipitation patterns have changed (USGCRP 2009). The Intergovernmental Panel on Climate Change found similar patterns on a global climate scale (IPCC 2007).

Ongoing global climate change has implications for the current and likely future status of salmon, but particularly so in the Pacific northwest, where snow melt into the Columbia River Basin has significant influence on regional hydrology. Recent studies, particularly by the Independent Scientific Advisory Board (ISAB), describe the potential impacts of climate change in the Columbia Basin, including the Lemhi River Valley. These effects may decrease snowfall, increase early-year runoff, decrease summer and fall flow, and generally increase water temperatures. The ISAB (2007) identified the following list of likely effects of projected climate changes on salmon species:

- Water temperature increase resulting in loss of cold-water habitat (temperatures exceed upper thermal limits for a species). Projected salmon habitat loss would be most severe in Oregon and Idaho, possibly higher than 40% of 2007 by 2090. However, this assumes a high rate of greenhouse gas emissions and used a climate model that projected a 5º C in global temperatures by 2090, a value that is higher than the scenarios considered most likely (ISAB 2007). Although a liberal estimate of change, this does not account for changes to hydrology that could further imbalance salmon habitat.
- Variations in rainfall intensity may alter seasonal hydrography. With reduced snowpack and greater rainfall, the timing of stream flow would likely change, reducing spring and summer stream flow and increasing peak river flows (ISAB 2007). This reduction in stream flow may impact the quality and quantity of tributary rearing habitat, greatly affecting spring and summer salmon and steelhead runs. In addition, the Pacific Northwest's low late-summer and early-fall stream flows are likely to be further reduced, which would limit juvenile fall Chinook and chum salmon shallow mainstem rearing habitat.
- Considering both the water temperature and hydrologic effects of climate change, abundance of Snake River spring/summer Chinook populations would be substantially decreased (20-50% decline from simulated average abundance based on historical 1915-2002 climate; (Crozier et al. 2008). This significantly increases extinction risks in the long term.
- Eggs of fall and winter spawning fish, including Chinook and sockeye salmon, may suffer higher levels of mortality when exposed to increased flood flows.
- Increases in seasonal mainstem Snake and Columbia River water temperature would accelerate the rate of egg development of fall Chinook that spawn in the mainstem of the Snake and Columbia rivers and lead to earlier (smaller size) hatching. Potential effects of increased water temperatures on adult salmon include delay in dam passage, failure to

enter fish ladders, increased fallback, and loss of energy reserves due to elevated metabolic demand. Thermal stress may also lead to increased risk of parasitism and disease.

3.13.2 Environmental Consequences for Climate Change – Proposed Action

Greenhouse gas emissions associated with the projects (primarily carbon dioxide, methane, and nitrous oxide) would be localized and temporary. They would be generated by the short-term emissions from construction equipment, off-road vehicles, on-road vehicles (including worker commuting and material delivery), and dust from ground disturbing activities. Given the short construction duration, low number of vehicles and equipment, and estimate of emissions well below the EPA's reporting threshold[30], the impact from greenhouse gas emissions would be low and therefore the potential for the Proposed Action to accelerate climate change would be low.

The Proposed Action would, however, contribute to the amelioration of global climate change and its adverse warming effects. The restoration of functional riparian, wetland, and floodplain habitats would expand the amount of wetland soils in which atmospheric carbon would be sequestered (Nahlik and Fennessy 2016). Wetlands can accumulate large carbon stores, making them an important sink for atmospheric carbon dioxide and holding up to, or in some cases, even more than 40% soil carbon (Vepraskas and Craft 2016), which is substantially greater than the 0.5–2% carbon commonly found in agricultural soils (Lal *et al* 1995). By increasing stored carbon through the increase of wetland soils, the Proposed Action would help mitigate for the release of greenhouse gases.

The Proposed Action would also provide for an increase of long term water table inputs through restoring floodplain function and increasing connectivity of streams and rivers to their floodplains. It would also increase riparian shading of streams and rivers (see Section 3.2.2.2.2, "*Temperature*"). Both of these results from the Proposed Action would help lower water temperatures, thereby ameliorating the effects of climate change on aquatic species.

3.13.3 Environmental Consequences for Climate Change – No Action

The No Action Alternative would neither contribute to the accumulation of greenhouse gasses (because there would be no use of fossil-fuel powered vehicles) nor contribute to the amelioration of such greenhouse gas accumulation by increasing wetland soils that could otherwise sequester those gasses. The No Action Alternative would have no effect on climate change.

3.14 Cumulative Effects

Cumulative effects are the incremental effects of a project or program when added to effects of other past, present, and reasonably foreseeable future actions. Sections 3.1 through 3.13 of this chapter present information about current environmental conditions and the environmental and socioeconomic consequences of implementing the Proposed Action.

Past actions of cumulative environmental consequence in the Valley include agriculture (with water withdrawals), road construction, dam construction (since removed), rural development, grazing, timber cutting, mining, suppression of natural fire regimes, harvests of fish and wildlife, and fish and wildlife habitat restoration and enhancement.

[30] On October 30, 2009, the U.S. Environmental Protection Agency published a rule (40 CFR Part 98) for the mandatory reporting of 25,000 metric tons or more of carbon dioxide equivalent per year of greenhouse gases from large GHG emissions sources in the United States.

Present (ongoing) actions include the use and maintenance of roads and highways; ongoing land uses and management actions such as agriculture (with continued water withdrawals), grazing, forest management, wildfire suppression and prescribed fire use; the management and harvest of fish and wildlife populations; and additional aquatic and upland restoration and resource preservation actions by public and private entities in the Valley.

Reasonably foreseeable future actions include the continuance of the ongoing actions listed above, with some increases in land use pressures and those ongoing actions as populations increase.

Short-Term Cumulative Effects

The Proposed Action is restoration projects, the purpose of which is to address the cumulative adverse effects of past actions with adverse effects on rivers and floodplains in the Lemhi Valley. While these actions may create short term (weeks to months) adverse impacts, the sites of those impacts would be quickly restored and improved for the long term; and many of those would be implemented on properties protected by conservation easements where continued long-term benefit from the restoration action is reasonably ensured. From a cumulative effects standpoint, therefore, these projects would not be adding to the long-term cumulative effects of past or ongoing environmentally consumptive or impactful actions. There would, however, be short-term adverse impacts, and those may have the potential to add cumulatively to preexisting, ongoing, adverse effects from past actions of cumulative environmental consequence in the Lemhi Valley, the geographic area of consideration for all short-term affects assessments discussed in the resource sections below.

Long-Term Cumulative Effects

The long-term cumulative effect of the Proposed Action would be a cumulative contribution of improved environmental conditions to those of ongoing restoration actions of the past few decades. These restoration actions, albeit small in scale compared to the cumulative adverse environmental impacts from agricultural development and grazing in the Valley, are beginning to reshape the Valley's natural resources. Both public and private entities are engaged in projects across the Valley to restore natural hydrologic form and processes in the rivers and floodplains where such actions can be taken in concert with protection of developed infrastructure and authorized water uses. Concerted effort by Federal land management agencies is being applied to restore more historically-sustainable and near-natural forest and range vegetative conditions and ecological processes on the lands they manage.

This Proposed Action would contribute cumulatively to the ongoing restoration of tributary and floodplain hydrology; and riparian and floodplain habitats in the Valley. The Proposed Action is almost exclusively on private lands, not benefitting from the restoration focus of management on federal public and National Forest System lands, where monitoring and research suggest their goals of maintaining or restoring aquatic and riparian habitats and key ecological processes at watershed and larger scales is being achieved (USFS 2018). They would, however, be on lands of generally higher resource productivity than those managed by the BLM and USFS, and would help fill a gap in natural resource restoration in the Valley by funding such actions in highly productive aquatic, riparian, and wetland habitats at lower elevations.

3.14.1 Land Use and Recreation –Cumulative Effects

For each of the project areas, there would be changes to land use, simply because current land uses could not continue while the project is under construction or post construction where agricultural activities would not occur on some of the project sites. There would thus be a loss of grazing and agricultural activity on these sites. There are however, no other stoppages of agriculture or grazing activity anticipated in the Lemhi Valley beyond the normal rotation or cycle of these activities to which these short-term stoppages would contribute further to a cumulative loss of agricultural land uses.

There may be delays to recreational traffic during the culvert installation on highway 28, of by movement of construction equipment for all projects, but there are no other road construction activities planned for the Lemhi Valley in 2020 or 2021 to which these delays would add cumulatively.[31] Thus, the incremental effects of the Proposed Action on land use and recreation when added to effects of other past, present, and reasonably foreseeable future actions would be low.

3.14.2 Water Resources –Cumulative Effects

There would be no impacts to water quantity from the Proposed Action since no water would be withdrawn from the Lemhi River or its tributaries.

There would be impacts to water quality from the sedimentation anticipated at each construction site. Though there may be cumulative turbidity effects from nearby agricultural activities or cattle grazing, this would only be of short-term cumulative concern for Eighteenmile Creek, where a TMDL has been established (See Section 3.2.1.2, "*Water Quality*") for sedimentation. However, environmental design features and mitigation measures described in Section 2.3, *"Mitigation Measures*", would ensure that project impacts on water resources would be low, and would have a low, temporary contribution to the cumulative water quality degradation when combined with other past, present and reasonably foreseeable future actions.

3.14.3 Fish and Aquatic Species –Cumulative Effects

There would be short-term adverse effects on fish and aquatic species and habitat during construction activities even though numerous mitigations are in place to minimize them as much as possible. This would temporarily add to the adverse effects of poor habitat conditions the local aquatic species would be experiencing at and near these construction sites. By design, the habitats as described in the "*River and Floodplain Restoration Projects",* Section 2.1.1.1, would be essentially rebuilt. The short-term effects to fish and their habitat by the projects would not, however, extend beyond the areas where construction is occurring (with the exception of turbidity effects, discussed in Section 3.14.2 above, which may affect habitat moderately downstream during construction activities). These adverse project effects would also be short-term only, followed by long-term increases in aquatic-species' habitat condition, diversity, and carrying capacity.

This Proposed Action would contribute cumulatively to the ongoing restoration of tributary and floodplain hydrology; and riparian and floodplain habitats in the Valley. The incremental beneficial effects of the Proposed Action's restoration of fish and aquatic species' habitat when added to the beneficial effects of other past, present, and reasonably foreseeable future restoration actions would be moderate.

3.14.4 Vegetation –Cumulative Effects

Vegetation at many project sites has been impacted by human activities and animal uses, and the proposed construction actions would cumulatively degrade those conditions in the short term. As in the discussion on Section 3.14.3 "*Fish and Aquatic Species*", above, the construction effects would be cumulative to the adverse effects of poor vegetative conditions already in place at many of the

[31] According to the Office of Federal Lands Highways website https://flh.fhwa.dot.gov/projects/id/ and the Idaho Department of Transportation website https://itd.idaho.gov/d6/

construction sites and in the Valley. The effects would be high in the short term as vegetation is disturbed by construction, and for some sites, the effect would be destructive in the short term. And, as above, that short-term adverse effect would be quickly replaced by a more robust, native vegetative condition for the long term. The incremental effects of the Proposed Action's improvements of native riparian vegetative communities when added to the effects of other past, present, and reasonably foreseeable restoration actions would be moderate and beneficial.

3.14.5 Wetlands and Floodplains – Cumulative Effects

The discussion of short-term cumulative effects on wetlands and floodplains follows closely with that of "*Vegetation*" and "*Fish and Aquatic species*", above. The existing condition is degraded from past and present activities. Adding heavy equipment operations and the redesign of hydrologic systems to those poor existing conditions would temporarily cause wetland and floodplain function disturbance in the project areas. But those effects would be only temporary during construction, and more importantly, would not extend into the high-flow or potential flooding periods of the winter and spring following the late summer or fall construction activities. Even for the Eagle Valley and Lemhi Headwaters projects that would likely be implemented over two to three years, each construction season would wrap up with implemented mitigation measures (see Section 2.3, "*Mitigation Measures*") to maintain a functional floodplain and protect wetlands. As above, in the short-term this temporary floodplain and wetland disturbance would be quickly replaced by a more effective and well-connected floodplain and wetland system for the long term. The long-term incremental effects of the Proposed Action's localized restoration of wetland and floodplain condition and function when added to effects of other past, present, and reasonably foreseeable restoration actions would be moderate and beneficial.

3.14.6 Wildlife – Cumulative Effects

Wildlife habitats have been degraded and populations have been reduced by human development and constant activity in the Lemhi Valley. The Proposed Action's construction disturbance and vegetation (habitat) removal would add to these effects in the short term, as most wildlife would likely be temporarily displaced, not destroyed. As with "Fish and Aquatic Species", these short-term adverse effects would be replaced by long-term improvements in habitat amounts, diversity, and carrying capacity. The incremental effects of the Proposed Action's improvements of wildlife habitats when added to the effects of other past, present, and reasonably foreseeable restoration actions would be moderate and beneficial.

3.14.7 Geology and Soils – Cumulative Effects

The past, present, and reasonably foreseeable future actions that could cumulatively affect soils and geology during the short-term construction actions are these habitat restoration actions and continued land-disturbing operations such as grazing and agriculture. The projects would have temporary effects on soils and geology because project earthwork would occur during the dry late summer and early fall months and environmental design features and mitigation measures would limit long-term project-related impacts to soils and geology. The temporary soil-related effects from the projects would add to ongoing disturbance in the Valley from agriculture and grazing, but overall, the temporary nature and the project minimization measures would ensure that the cumulative impacts on geology and soils from the Proposed Action when added to effects of other past, present, and reasonably foreseeable land-disturbing actions would be low.

3.14.8 Transportation –Cumulative Effects

The main sources of traffic in this area are agricultural/ranching, residential, and recreational; and these sources would continue as the proposed construction activities commence. The Proposed Action would add additional construction traffic to the rural roads in the valley, but this addition would be minimal and the pre-existing traffic is also very light. Traffic delays would be added to this minimally increased traffic on Highway 28 where the Little Sawmill Culvert is proposed to be installed. But there are no other road construction actions planned for the valley[32] during the proposed construction period, and the effects would be mitigated through safety and mitigation measures aimed at reducing the impacts from traffic delays. No additional permanent roads are included in this Proposed Action and the short term effects are low, thus the cumulative effect of these projects on transportation when added to the existing transportation network and traffic amounts would be low.

3.14.9 Visual Resources – Cumulative Effects

The Proposed Action would introduce large construction equipment and construction activities into the rural landscape for one or two seasons (generally mid- to late-summer and early fall). The actions would generally not be visible in the foreground of any major highway (exceptions would be the Little Sawmill Culvert, and L-63) for any project, nor would they be visually inconsistent from the routine agricultural activities common throughout the valley either during their operations or in their ultimate visual results. The cumulative effect on visual resources, when considering the existing visual character and past, present, and likely foreseeable activities in the Valley, would be low.

3.14.10 Air, Noise, and Public Health and Safety –Cumulative Effects

Vehicular traffic and agricultural activities in the project area have all contributed to air quality impacts, though the air quality in the Valley remains high. These ongoing emission sources would continue, and the low combustion emissions and dust generation added by the proposed projects are expected to have a low, temporary and localized cumulative air quality impact.

Within the project area, the predominant sources of noise are rural living, agricultural activities, recreationists, and vehicular traffic. These noise sources would continue to generate the sounds of the Lemhi Valley and the Proposed Action would temporarily add construction noise to it. The proposed construction projects are expected to have a low cumulative noise impacts since the impact would be low when combined with other noise sources, are not near residences (with the exception of L-63, and would cease after construction ended.

The cumulative effect on public health and safety would be low. The projects would not hinder the effective function of any public emergency or health service and would not add to any known health or safety risk in the Valley.

3.14.11 Cultural Resources –Cumulative Effects

It is likely that cultural resources in the project areas have been affected by past agricultural transportation and rural development activities, and would continue to be affected by such future actions on private lands.

The proposed projects would likely have a low cumulative impact on historic properties because, although no historic properties or archaeological resources would be adversely affected, other than

[32] According to Idaho Transportation Department website, https://itd.idaho.gov/d6/ accessed 4/15/2020.

in the Canyon Creek Boundary Project, where appropriate mitigation is being developed, there may be unknown cultural resources that are discovered during construction. Implementation of the measures described in Section 2.3, "*Mitigation Measures*", would reduce the potential for construction activities to cumulatively impact unknown cultural resources in the area. The incremental effects of the Proposed Action on cultural resources when added to the effects of past, present, and reasonably foreseeable agricultural and other land management actions in the Valley would be moderate.

3.14.12 Socioeconomics and Environmental Justice – Cumulative Effects

Socioeconomic benefits (jobs and contracting opportunities) of the Proposed Action, when combined with other fish and wildlife mitigation projects, including other BPA-funded projects, could combine for cumulative positive socioeconomic benefits. The projects would not directly add permanent jobs to the Valley, so there would be no incremental cumulative effect on local population and income, and thus no need to change infrastructure and service s to accommodate new residents.

Forecasts of future returns of anadromous salmonids are not possible, so expenditures and income associated with their potential contribution to future recreation cannot be predicted. But increased returns of salmon and steelhead to the Valley are reasonably expected to positively affect the local and regional economy, which is already profiting from recreational fishing by tourists.

The cumulative impacts from the proposed projects on socioeconomics, when considering past and present economic activities and likely foreseeable developments would be low.

The Proposed Action would not disproportionately affect environmental justice populations, and would thus generate no cumulative effect on environmental justice populations.

3.14.13 Climate Change –Cumulative Effects

The Proposed Action would have a cumulative effect on climate change by adding greenhouse gasses to the atmosphere. Local vehicular traffic, ranching, agriculture, forestry management, and residential activities all contributed to past GHG accumulations. These sources of GHG emissions would continue, and any addition, when considered globally, would contribute incrementally to long-term atmospheric conditions for climate change. The Proposed Action would contribute such incremental additions of greenhouse gases through restoration actions that require construction activities using heavy equipment, though these contributions. The effect of the Proposed Action's incremental contribution of greenhouse gasses to the atmosphe re when added to the effects of other past, present, and reasonably foreseeable contributions from agricultural and other activities in the Valley, would be low.

4 Environmental Consultation, Review, and Permit Requirements

This chapter addresses statutes, implementing regulations, and executive orders applicable to the Proposed Action.

4.1 Environmental Review and Coordination

In conducting the actions described in this EA, BPA would comply with applicable Federal laws, regulations, and executive orders. The following sections describe how the Proposed Action is in compliance with the various environmental laws and other relevant Federal executive orders.

4.1.1 National Environmental Policy Act

This EA was prepared pursuant to regulations implementing NEPA (42 U.S.C. 4321 *et seq.*), which requires federal agencies to assess the impacts that their actions may have on the environment. NEPA requires preparation of an EIS for major federal actions significantly affecting the quality of the human environment. BPA has prepared this EA pursuant to regulations implementing NEPA, which requires federal agencies to assess, consider, and disclose the impacts that their actions may have on the environment before major federal actions are taken.

In this EA, BPA evaluated two alternatives to meet the purpose and need as described in Chapter 2: the Proposed Action and the No Action Alternative. The Proposed Action would implement various aquatic and upland restoration actions in the Lemhi Valley that vary in scale and impact.

4.2 Fish and Wildlife

4.2.1 Endangered Species Act

The ESA and its amendments (16 U.S.C. 1531 *et seq.*) require federal agencies to ensure that the actions they authorize, fund, and carry out do not jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. The effects on species listed under the ESA are discussed in Chapter 3 of this EA, specifically in Section 3.3, "*Fish and Aquatic Species*"; and Section 3.6 "*Wildlife*". No ESA listed plant species are located within or near the project areas.

The actions assessed in this EA have been consulted on under the ESA with NMFS and USFWS in BPA's Habitat Improvement Program (HIP) consultation (2003- present), now in its fourth iteration (HIP IV[33]). As part of that consultation, all actions were designed and reviewed with NMFS and UFWS personnel through the HIP project review process to ensure consistency with the prescribed design criteria and conservation measures. Project notifications, also part of that consultation process at the completion of design reviews, were provided to both NMFS and USFWS for each action.

4.2.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act, as amended, implements various treaties and conventions between the U.S. and other countries, including Canada, Japan, Mexico, and Russia, for the protection of migratory birds (16 USC 703-712). Under this Act, taking, killing, or possessing migratory birds, or

[33] NMFS Biological Opinion reference No. 2013.9724; USFWS Biological Opinion 01EOFW00-2013-F-01199

their eggs or nests, is unlawful. The act classifies most species of birds as migratory, except for upland and nonnative birds.

Executive Order 13186, issued in January 2001, directs each federal agency undertaking actions that may negatively impact migratory bird population to work with USFWS to develop an agreement to conserve those birds. The protocols developed by this consultation are intended to guide future agency regulatory actions and policy decisions; renewal of permits, contracts, or other agreements; and the creation of or revisions to land management plans. This order also requires that the environmental analysis process include effects of federal actions on migratory birds. On August 26, 2013, USFWS and the U.S. Department of Energy signed a Memorandum of Understanding to complement the Executive Order. This Memorandum of Understanding addresses how BPA and USFWS work cooperatively to address migratory bird conservation and is in the process of being renewed.

This Proposed Action includes ground-disturbing activities that could impact migratory birds as discussed in Chapter 3. The construction actions here would be implemented primarily in mid to late summer, outside of the nesting season for migratory birds, as directed by mitigation measures in Section 2.3, "*Mitigation Measures*". Shrubby riparian areas (key migratory bird nesting areas) would not be impacted in the spring (key migratory bird nesting period) by heavy equipment actions, though hand work such as fencing and planting would occur then. The impact to migratory birds would be negligible, though likely from unintentional disturbance rather than destruction of nest sites.

4.2.3 Fish and Wildlife Conservation Act and Fish and Wildlife Coordination Act

The Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901 *et seq.*) encourages federal agencies to conserve and promote conservation of non-game fish and wildlife and their habitats. The Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq.*) requires federal agencies with projects affecting water resources to consult with USFWS and the state agency responsible for fish and wildlife resources. The USFWS and IDFG were contacted as part of the scoping process. The USFWS is also party to the HIP design reviews for these actions and reviews the design details for the most complex of these projects. Both agencies are engaged in the local watershed technical team review process where each action is proposed, reviewed, and prioritized prior to submission to the Council and BPA for funding.

4.2.4 Magnuson-Stevens Fishery Conservation and Management Act of 1976

The National Marine Fisheries Service is responsible for ensuring compliance with the Magnuson-Stevens Fishery Conservation and Management Act of 1975. Public Law 104–297, the Sustainable Fisheries Act of 1996, amended the Magnuson-Stevens Fishery Conservation and Management Act to establish new requirements for evaluating and consulting on adverse effects to essential fish habitat (EFH), for which the Lemhi River has been designated. Under Section 305(b) (4) of the act, BPA is required to consult with NMFS for actions that adversely affect EFH; in turn, NMFS is required to provide EFH conservation and enhancement recommendations. As discussed in Section 3.3, "*Fish and Aquatic Species*", the Proposed Action would result in net improvement to instream fish habitat after producing short-term impacts.

4.2.5 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d) addresses taking or possessing of and commerce in bald and golden eagles, with limited exceptions. The Act only covers intentional acts or acts in "wanton disregard" of the safety of bald or golden eagles.

The Proposed Action includes the potential to disturb nesting bald eagles in the Eagle Valley project, for which specific measures controlling disturbance distance and timing from the nest site, and protection of nest and roost trees, are included to ensure protection of the nesting birds and compliance with this Act (Section 2.3, "*Mitigation Measures*"). Other projects have no known potential to disturb bald or golden eagles, or their nest or roost sites. Overall, bald eagles could benefit in the long term from an increased source of food in the form of increased anadromous fish runs.

4.3 Wetlands, Floodplains, and Water Resources

4.3.1 Wetlands and Floodplains: Executive Orders 11988 and 11990

As part of the NEPA review, U.S. Department of Energy NEPA regulations require that impacts on floodplains and wetlands be assessed and alternatives for protection of these resources be evaluated in accordance with Compliance with Floodplain/Wetlands Environmental Review Requirements (10 CFR 1022.12), Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands. These Executive Orders require federal agencies to evaluate and avoid, to the extent possible, potential long and short-term adverse impacts of their actions in 100-year flood hazard zones[34] as shown on Federal Emergency Management Agency (FEMA) flood insurance rate maps. Their objectives were to curtail development actions that might decrease floodplain function. In the actions proposed here, however, BPA would be funding restoration actions designed to reverse pre-existing adverse conditions these Executive Orders were intended to prevent. BPA-funded projects would restore floodplain function where possible without placing human infrastructure at risk, and would not result in long-term adverse impacts to wetlands or floodplains.

4.3.2 Water Resources

Wetland and waterway management, regulation, and protection are addressed in several sections of the Clean Water Act, including Sections 401, 402, and 404. IDEQ would review each project's permit applications for compliance with Idaho's water quality standards and grant certification if the permits comply with these standards.

4.3.2.1 Clean Water Act Section 401

A federal permit to conduct an activity that causes discharges into navigable waters is issued only after Idaho State certifies that existing water quality standards would not be violated if the permit were issued. IDEQ has reviewed the Corps' Section 404 Nationwide Permit 33 ("*Temporary Constructions, Access, and Dewatering*") that would be required for the Proposed Action for compliance with Idaho water quality standards and granted 401 certification in 2017.

4.3.2.2 Clean Water Act Section 402

This section authorizes National Pollutant Discharge Elimination System (NPDES) permits for the discharge of pollutants, such as stormwater or hatchery effluent discharges. Project implementers would issue a Notice of Intent to obtain coverage under this general permit, and would prepare a Stormwater Pollution Prevention Plan to address stabilization practices, structural practices, stormwater management, and other controls.

[34] The 100-year floodplain areas are designated on these maps as areas with a one percent or greater chance of flooding during a given year.

No actions proposed in this Proposed Action would construct a facility for which a Section 402 NPDES permit would be required.

4.3.2.3 Clean Water Act Section 404

Authorization from the US Army Corps of Engineers (Corps) is required in accordance with the provisions of Section 404 of the Clean Water Act when dredged or fill material is discharged into waters of the United States. Sponsors for the project actions with construction actions proposed here (projects 1 through 11) would be acquiring this authorization from the Corps prior to implementation. The Corps' nationwide permit process (NWP 33, "*Temporary Constructions, Access, and Dewatering*") would be used for these actions.

4.4 Heritage Conservation and Cultural Resources Protection

Laws and regulations governing the management of cultural resources include:

- Antiquities Act of 1906 (16 U.S.C. 431–433),
- Historic Sites Act of 1935 (16 U.S.C. 461–467),
- Section 106 of the NHPA (54 U.S.C. 306108), as amended,
- Archaeological Data Preservation Act of 1974 (16 U.S.C. 469 a–c),
- Archaeological Resources Protection Act of 1979 (16 U.S.C. 470 et seq.), as amended,
- Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 et seq.),
- Executive Order 13007 Indian Sacred Sites, and
- American Indian Religious Freedom Act of 1978 (PL 95-341, 92 Stat. 469, 42 U.S.C. 1996, 1996a).

Each project has been surveyed and consulted on in compliance with Section 106 of the NHPA to ensure compliance with that act. All actions would avoid damaging cultural and historic resources and would comply with applicable cultural resource preservation laws.

4.5 Air Quality, Noise and Public Health and Safety

The Federal Clean Air Act, as amended (42 U.S.C. 7401 *et seq.*), requires the EPA and individual states to carry out a wide range of regulatory programs intended to assure attainment of the NAAQS. Air quality impacts from this action would include limited temporary fugitive dust and vehicle emissions from construction, and negligible effects from operation, as discussed in Section 3.10, "*Air Quality, Noise, and Public Safety*".

The Federal Noise Control Act of 1972 (42 U.S.C. 4901 et seq.) sets forth a broad goal of protecting all people from noise that jeopardizes their health or welfare. The act further states that federal agencies are authorized and directed, to the fullest extent consistent with their authority under federal laws administered by them, to carry out the programs within their control in such a manner as to further this policy. The analysis in Section 3.10, "*Air, Noise, and Public Health and Safety*", of this EA indicates that the Proposed Action would have low potential for temporary noise impacts during construction, and would meet applicable noise requirements.

4.6 Executive Order on Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations was signed by President Clinton on February 11, 1994. This Executive Order directs Federal agencies to take the appropriate and necessary steps to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of Federal programs, policies, and activities on the health or environment of minority populations and low-income populations (collectively, the environmental justice populations) to the greatest extent practicable and permitted by law.

As discussed in Section 3.12.1.2 "*Environmental Justice*", there would be no effects to environmental justice populations.

4.7 Climate Change

Executive Orders 13423 and 13514 require federal agencies to measure, manage, and reduce GHG emissions by agency-defined target amounts and dates. Proposed Action activities that would produce GHG emissions include "soil carbon" emissions produced through the removal and/or disturbance of natural vegetation and soils during construction; and the use of gasoline and diesel powered vehicles and equipment during construction. These activities would make minimal contributions to the GHG emissions associated with climate change, as discussed in Section 3.13, "*Climate Change*", of this EA.

4.8 Farmland Protection Policy Act

The Farmland Protection Policy Act (7 U.S.C. 4201 *et seq.*) directs federal agencies to identify and quantify adverse impacts of federal programs on farmlands. The purpose of this Act is to minimize the number of federal programs that contribute to the unnecessary and irreversible conversion of agricultural land to non-agricultural uses. Three types of farmland are recognized by the Act: prime farmlands, unique farmlands, and farmland of statewide or local importance. None of these three types of farmland are designated on the soil types underlying any of the proposed projects.

Farmland would be impacted in this Proposed Action, but the activities proposed in the Proposed Action would not irreversibly convert agricultural lands to non-agricultural uses. Though agricultural lands may be converted to wetland or riparian habitats, those would not be irreversible, and could more properly be referred to as "reversions" than "conversions", since the land would revert to a condition more like its original condition prior to conversion to agricultural uses.

4.9 Resource Conservation and Recovery Act, Toxic Substances Control Act, and Federal Insecticide, Fungicide and Rodenticide Act

The Resource Conservation and Recovery Act (42 U.S.C. 6901 *et seq.*) regulates the disposal of hazardous wastes. The Toxic Substances Control Act (15 U.S.C. 2601-2692) gives authority to the Environmental Protection Agency to regulate substances that present unreasonable risks to public health and the environment. The Federal Insecticide, Fungicide and Rodenticide Act (7 U.S.C. 136(a-y)) authorizes the Environmental Protection Agency to prescribe conditions for use of pesticides.

The requirements of this act would be met. Only EPA-approved herbicides would be used in the Proposed Action, and only according to manufacturer's label directions. All label instructions pertaining to disposal would be followed. Herbicides would not be stored on the treatment area and would be applied by licensed applicators only.

4.10 Comprehensive Environmental Response, Compensation, and Liability Act

Under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 U.S.C. 9601 *et seq.*), BPA has determined that the proposed project areas are not on the EPA's National Priority List.

4.11 Distribution and Availability

BPA mailed letters to landowners, tribes, government agencies, and other potentially affected or concerned citizens and interest groups announcing the availability of the Draft and Final EAs. The EA is available for review on the BPA website: (*www.bpa.gov/goto/LemhiRestoration)*. A copy of the EA is available on request from BPA by calling the toll-free document request line at 1-800-622-4520.

5 Agency Coordination and Public Involvement

Residents and landowners surrounding the project sites were notified of this proposal during the public scoping effort described in Section 1.5, "*Public Involvement*", and were kept informed as this assessment progressed based on their expressed level of interest. BPA also contacted elected officials at the county, state, and Federal levels; and conservation organizations and individuals from county, state, and federal entities engaged in restoration projects in the Upper Salmon River Basin (of which the Valley and this Proposed Action's projects is a part).

5.1 Federal Government

5.1.1 Elected Officials

US Senator, Idaho, Michael Crapo

US Senator, Idaho, James Risch

US Representative, Idaho, 1st Congressional District, Russ Fulcher

US Representative, Idaho, 2nd Congressional District, Mike Simpson

5.1.2 Federal Agencies

USFWS - Idaho Fish and Wildlife Office

NOAA Fisheries

NOAA Fisheries

NOAA Fisheries

Bureau of Land Management, Idaho State Office

U.S. Forest Service, Intermountain Region

U.S. Environmental Protection Agency, Region 10

U.S. Army Corps of Engineers, Walla Walla District

5.2 Tribal Governments

Confederated Salish and Kootenai Tribes, Cultural Resources; Mike Durglo, Tribal Historic Preservation Officer

Confederated Salish and Kootenai Tribes, Natural Resources Director Rich Janssen, Jr.

Confederated Salish and Kootenai Tribes, Fish and Wildlife Director Tom McDonald

Confederated Salish and Kootenai Tribes, Kyle Felsman, Tribal Historic Preservation Officer

Nez Perce Tribe of Idaho, Natural Resources Director, Aaron Miles

Nez Perce Tribe of Idaho, Cultural Resources, Nakia Williamson

Nez Perce Tribe of Idaho, Patrick Baird, Tribal Historic Preservation Officer

Shoshone Bannock Tribes of the Fort Hall Reservation, Fish and Wildlife Director, Chad Colter

Shoshone Bannock Tribes of the Fort Hall Reservation, Cultural Resources, Louise Dixey

Shoshone Bannock Tribes of the Fort Hall Reservation, Natural Resources Director, Travis Stone

5.3 Idaho State Government

5.3.1 Elected Official

Governor, Brad Little

5.3.2 State Agencies

Idaho Transportation Department, State Office

Idaho Department of Environmental Quality, State Office

Idaho Department of Fish and Game, State Office

Idaho State Department of Agriculture Plants and Insects

5.4 Lemhi County

Lemhi County Extension

Lemhi County Commissioners

5.5 Public Libraries

Idaho State University Library

University of Idaho Library

Moscow Public Library

5.6 Organizations

Advocates for the West

American Rivers

Association of Northwest Steelheaders

Conservation Angler

Idaho Conservation League

Idaho Rivers United

Institute for Fisheries Resources

Native Fish Society

Nature Conservancy Idaho

Pacific Rivers

Save Our Wild Salmon Coalition

Snake River Salmon Solutions

Trout Unlimited

Upper Snake River Tribes Foundation

Western Rivers Conservancy

Western Watersheds Project

Wild Fish Conservancy

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Appendix A – Design Criteria for Project Features

The design criteria conservation measures in this section are those from BPA's ESA consultation with NMFS and the USFWS in BPA's Habitat Improvement Program (HIP) consultation (2003 - present), now in its fourth iteration (HIP IV). The measures in this Appendix are those applicable to the types of actions included in the Proposed Action. The design criteria and methodologies prescribed here are integral to the project descriptions in Chapter 2.

Conservation Measures and Design Criteria for Fish Passage Restoration Actions

Consolidate or Replace Existing Irrigation Diversions
(L-58C, L-63, and Canyon Creek Boundary Projects)

1. Show the profile of the stream channel thalweg in the design plan when removing channel spanning diversion structures greater than three feet in height to provide enough information to clearly demonstrate the action's impacts to the stream channel, and the potential for channel degradation for a minimum for ten upstream and ten downstream channel widths of the upstream and downstream boundaries of the action.
2. Design all diversion structures to meet the National Marine Fisheries Service (NMFS) Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011 or more recent version) and Guidelines for incorporating adult Pacific lamprey passage at fishways (PLTW 2017).
3. Avoid the use of wire cloth in order to reduce entrainment of larval lamprey. Use perforated plate, vertical bar or interlocking bar screens instead (Rose and Mesa 2012).
4. Follow criteria outlined in the Headcut and Grade Stabilization activity when placing rock structures or engineered riffles.
5. Include the installation of a totalizing flow meter in the project design for all diversions for which installation of this device is possible. For all other diversions, use a staff gauge or other device capable of measuring instantaneous flow.
6. Consolidate multiple existing diversions into one diversion if the consolidated diversion is located at the most downstream existing diversion point unless sufficient water is available to support unimpeded passage at low flows elsewhere. Clearly identify in the design the low flow conditions within the stream reach relative to the cumulative diverted water right. Diversion consolidation may occur upstream of the lowest original structure if instream flow conditions are proven favorable for fish passage and habitat use.
7. Design diversions to incorporate Point of Diversion (POD) flow restrictions to limit the diverted flow to satisfy the irrigator's water right at the 95% exceedance stream flow stage. Provide hydraulic calculations and a stage rating curve to support diversion flow restrictions, regardless of the restriction is accomplished. POD flow restriction may be accomplished by:
    a. Incorporation of a restricted orifice plate or screen at the POD that provides at a maximum, the required area to pass the irrigator's water right;
    b. Mechanically restricting the opening of a variable head gate to the maximum area required to pass the irrigator's water right; or
    c. Any other method that would satisfy the intent of the diversion flow governance requirement that can be justified by the design documents.

8. Use no treated wood and copper- or zinc-plated hardware in the construction of irrigation diversions. Cure/dry all concrete sufficiently (48-72 hours, depending on temperature) allowing it to contact stream flows.
9. Design or replace irrigation diversion intake and return points to prevent fish and other aquatic organisms of all life stages from swimming or being entrained in the irrigation system. Submit designs for NMFS review and approval of all fish screens for surface water that is diverted by gravity or by pumping at a rate that exceeds 3 cfs.
10. Ensure that diversions equipped with a fish screen that utilizes an automated cleaning device have a minimum effective surface area of 2.5 square feet per cfs, and a nominal maximum approach velocity of 0.4 feet per second (fps).
11. Ensure that screens with no automated cleaning device have a minimum effective surface area of five square foot per cfs, and a nominal maximum approach rate of 0.2 fps; and a round or square screen mesh that is no larger than 2.38 mm (0.094 inch) in the narrow dimension, or any other shape that is no larger than 1.75 mm (0.069 inch) in the narrow dimension.

Low Flow Consolidation

12. Design fish passage to the design benchmarks set forth in NMFS 2011 (or most recent version)[35] and, where appropriate, guidelines set forth in Pacific Lamprey Technical Workgroup 2017.[36]
13. Remove all temporary material placed in the stream to aid low-flow fish passage when stream flow increases, prior to anticipated high flows that could wash consolidation measures away or cause flow to go around them.

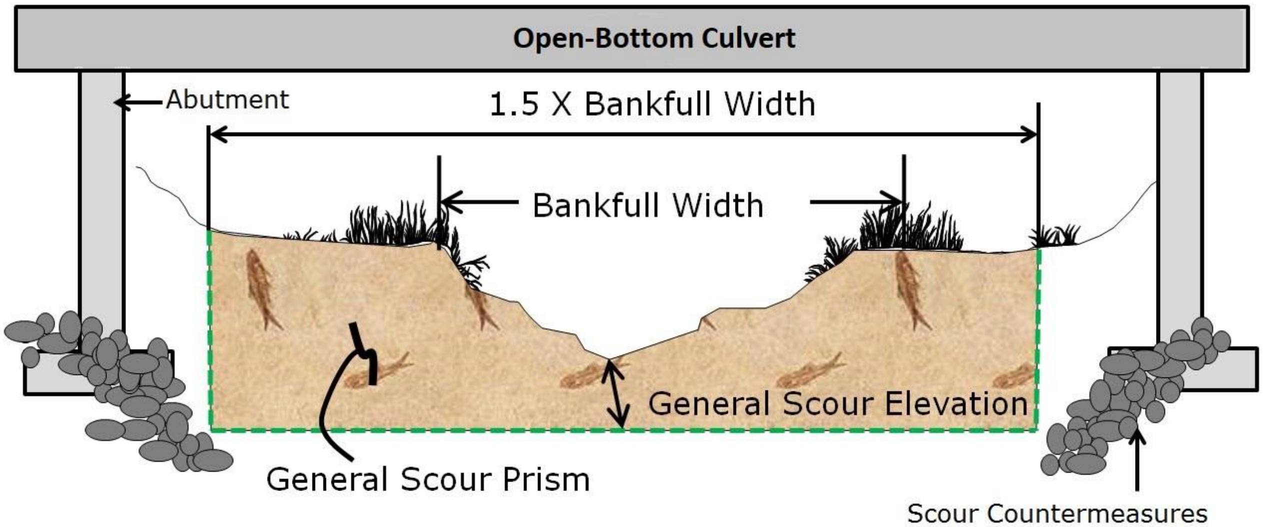
Culvert Removal or Replacement (Little Sawmill Culvert project)

14. Design the open bottom culvert so it is wide enough to maintain a clear, unobstructed opening during events that approximate a two-year flood-recurrence interval. For stream simulation culverts, maintain a clear and unobstructed opening 1.5 times the bankfull width or greater as shown in the Figure below.

35 NMFS. 2011. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon. Available at: http://www.westcoast.fisheries.noaa.gov/publications/hydropower/fish_passage_design_criteria.pdf

36 Practical guidelines for incorporating adult Pacific lamprey passage at fishways (Pacific Lamprey Technical Workgroup 2017) (https://www.fws.gov/pacificlamprey/mainpage.cfm)

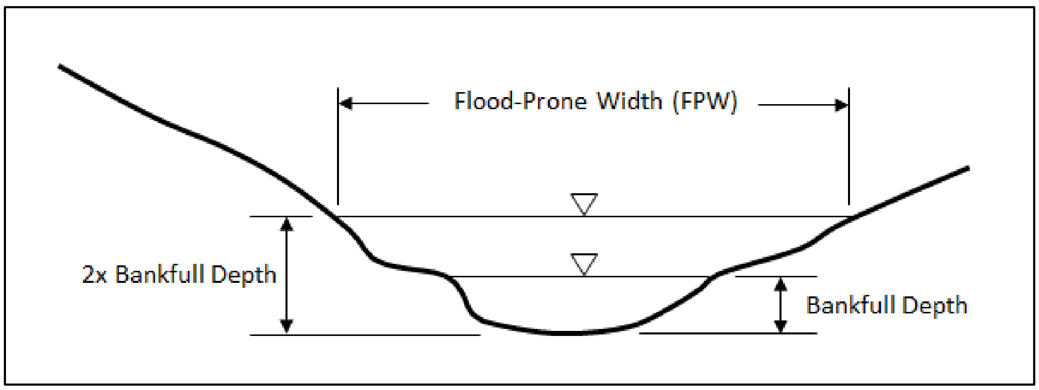
Open-bottom culvert scour prism illustration



15. Do not apply scour countermeasures within the general scour prism (the brown shaded area in Figure above) and calculate general scour according to Mitigation Measure # 35.
16. Design relief conduits (if they are necessary) to pass through existing fill.
17. Reshape streambanks in a manner that does not create a velocity that differs from upstream and downstream conditions.
18. Use streambed simulation (continuous streambed that simulates natural channel width, depth, and slope connects the reaches up and downstream of the crossing).
19. Ensure closed bottom culverts are a minimum of nine feet in diameter to accommodate:
    a) A channel <u>vertical clearance</u> (the minimum vertical clearance between the culvert bed and ceiling) greater than six feet.
    b) An <u>embedment</u> (the burial depth of the bottom of a culvert) into the streambed not less than 30% at the outlet, not more than 50% at the inlet of the culvert height, and to a minimum depth of three feet.
20. Ensure that the channel slope (the slope of the reconstructed streambed within the culvert) approximates the average slope of the adjacent stream from approximately ten channel widths upstream and downstream of the site in which it is being placed, or approximates the average slope of an appropriate reference reach that represents natural conditions outside the zone of the road crossing influence.
21. Ensure that the length of culvert (maximum length of road crossing) utilizing the streambed simulation method does not exceed 150 feet.
22. Ensure that fill materials are comprised of materials of similar size, composition, and mobility to natural bed materials in an appropriate reference reach. Use no angular rock unless the natural material is angular (*e.g.* basalt lithology).
23. Include a construction note requirement in the design plans to wash fines to seal the streambed properly and prevent flows from going subsurface.
24. Ensure that structure material is concrete, metal, or untreated wood, and that concrete is sufficiently cured or dried[21] before coming into contact with stream flow. Use no treated wood.

25. Ensure that the culvert width for stream simulation is at least 1.5 times the bankfull width.
26. Include suitable grade controls to prevent culvert failure caused by changes in stream elevation. Construct grade-control structures to prevent headcutting above or below the culvert using rock or wood as outlined in BPA's HIP 4 Handbook (BPA 2019).
27. Use the following guidelines for calculating entrenchment ratios:
    a. Calculate the entrenchment ratio (ER) per Rosgen (1994).
        i. ER = flood-prone width (FPW) / bankfull width (BFW)
        ii. FPW is defined as the water surface width at a height of twice the bankfull depth above the bed (Figure below). The BFW would be determined at an appropriate reference location not impacted by an existing bridge or culvert.
        iii. If ER is greater than 1.5, a minimum opening of 1.5x BFW is required.
        iv. If ER is less than 1.5, the minimum opening would be equal to the ER, but not less than 1.2x BFW.

Flood Prone Width and Bankfull Width



28. Use the following guidelines for calculating general scour elevations:

    General scour is a lowering of the streambed across the stream or waterway at the crossing. This lowering may be uniform across the bed or non-uniform, that is, the depth of scour may be deeper in some parts of the cross section. The following method would be the minimum analyses required to determine general scour elevation and, in combination with the 1.5 times bankfull top width, used to establish the general scour prism as presented in the "Open-bottom culvert scour prism illustration" above.

    Equation #1 is used to determine the flow velocity (Vc) needed to move the streambed material. The bankfull depth (y) is determined from hydraulic model results for the 2-year flood. The computed bankfull depth should be compared against the field measured bankfull depth with the larger of the two values used for (y) in Equation #1. The D50 particle size should be defined from the project-reach-specific pebble count.

Equation 1

$$V_c = 11.17y^{1/6}D_{50}^{1/3}$$

V_c = Critical velocity above which bed material of size D and smaller will be transported (ft)
y = Bankfull depth within the proposed culvert or bridge (ft)
D_{50} = Particle for which 50% is finer (ft)

Equation #2 is used to determine the scour depth (ds) below the streambed elevation. The bankfull depth (y) and the critical velocity (Vc) are taken from Equation #1 above. The mean velocity (Vm) is determined from hydraulic model results for the 2-year flood.

Equation 2

$$d_s = y\left(\frac{V_m}{V_c} - 1\right)$$

d_s = Scour depth below streambed at thalweg (ft)
y = Bankfull depth within the proposed culvert or bridge (ft)
V_c = Critical velocity above which bed material of size D and smaller will be transported (ft)
V_m = Mean velocity within the proposed culvert or bridge (ft)

Results from the scour depth calculation should be compared against observed scour holes or pools within or adjacent to the project reach. Consideration should be also given to evaluating the stream bed mobility upstream and downstream of the proposed crossing. The general scour prism and the proposed stream crossing would be presented relative to a surveyed cross section of the stream channel and floodplain.

For additional guidance on engineering calculations for all components of culvert scour analysis, the designer is directed to Evaluating Scour at Bridges, Fifth Edition, Hydraulic Engineering Circular No. 18, April 2012, Publication No. FHWA-HIF-12-003, U.S. Department of Transportation Federal Highway Administration.

Conservation Measures for River, Stream, Floodplain, and Wetland Restoration Actions

(Lemhi Headwaters, Narrows Reach, Eagle Valley, Lemhi/Big Springs, Canyon Creek Confluence, Hayden Creek, and Middle Eighteenmile projects)

The construct actions associated with the River and Floodplain restoration projects (Section 2.1.1, "*Construction Actions*") all have activities that would be guided by the mitigation measures here, or design elements that would be shaped by the design criteria specified in this section.

Improve Secondary Channel and Floodplain Interactions

29. Demonstrate in the designs that the project would be self-sustaining over time or promote the recovery of natural habitat-forming processes. "Self-sustaining" means the restored or created habitat would not require major or periodic maintenance, but function naturally within the processes of the floodplain. "Promotion of natural habitat-forming processes" means an early step in the restoration of a process that may take decades or multiple steps to restore.
30. Propose new side channel construction only within the historic floodplain (*e.g.,* 5-year recurrence interval) and current channel meander migration zone; and design it to minimize excavation needed for construction. Design for the reconnection of historical fragmented habitats whenever possible.
31. Construct perennial side channels to prevent fish stranding by providing a continual positive **overall** grade, or, if the gradient is lower than the main channel, then by providing a year-round water connection.
32. Design intermittent side channels that are activated only at flood stage with sufficient roughness and gradient to create shallow, slow-moving water that would not attract fish.
33. Haul excavated material removed from off- or side-channel habitat to an upland site, or spread it across the adjacent floodplain in a manner that does not restrict floodplain capacity. Hydric soils may be salvaged to provide appropriate substrate and/or seed source for hydrophytic plant community development. Obtain hydric soils only from wetland salvage sites.
34. Excavate only to depths that do not exceed the maximum thalweg depth of the main channel.
35. Conduct all side channel and pool habitat work in isolation from waters occupied by ESA-listed salmonid species until project completion. Upon project completion, a reconnection may be made by either excavation to waters occupied by ESA-listed salmonids or re-watering of these channel units.
36. Take adequate precautions to prevent the creation of fish passage issues or stranding of juvenile or adult fish. Avoid stranding by incorporating floodplain or channel features that create shallow, slow-moving, water during flood stage that would not attract fish.
37. For re-watering stream channels which have been isolated and dewatered during project construction:
    a. Pre-wash reconstructed stream channels into a reach equipped with sediment capture devices, prior to reintroduction of stream flow.
    b. Re-water stream channels slowly to minimize a sudden increase in turbidity. Re-water in stages when appropriate.

Setback or Removal of Existing Berms, Dikes, and Levees

38. To the greatest degree possible, remove non-native fill material originating from outside the floodplain of the action area, from the floodplain and disposed of at an upland site.
39. Design breaches to be equal to or greater than the active channel width to reduce the potential for channel avulsion during flood events.
40. In addition to other breaches, always breach the berm, dike, or levee at the downstream end of the project or at the lowest elevation of the floodplain to ensure that flows would naturally recede back into the main channel, minimizing fish entrapment.
41. When necessary, loosen compacted soils once overburden material is removed.
42. Use overburden or fill material that is native to the project area within the floodplain to create set-back dikes and fill anthropogenic holes provided that this does not impede floodplain function.
43. When a setback is required, prioritize setback locations to the outside of either the meander belt width or the channel meander zone margins.

Protect Streambanks Using Bioengineering Methods

44. Without changing the location of the bank toe, restore damaged streambanks to a slope, pattern, and profile suitable for establishment of permanent woody vegetation. This may include sloping of unconsolidated bank material to a stable angle of repose or the use of benches in consolidated cohesive soils. The purpose of bank shaping is to provide a more stable platform for the establishment of riparian vegetation, while also reducing the depth to the water table, therefore promoting better plant survival.
45. Whenever possible, use plantings and soil bioengineering for bank stabilization, and use large wood for stabilization as a last resort. The goal of bioengineering actions should be long-term stabilization by vegetation.
46. Add large wood to create habitat complexity and interstitial habitats through use of various large wood sizes and configurations of the placements when feasible.
47. Focus the structural placement of large wood on providing channel boundary roughness for energy dissipation versus flow re-direction that may affect the stability of the opposite streambank.
48. Use large wood that is intact, hard, and undecayed to partly decaying with untrimmed root wads to provide functional refugia habitat for fish. Decayed or fragmented wood found lying on the ground may be used for additional roughness and to add complexity to large wood placements, but do not use it for the primary structural components.
49. Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.
50. Use no cable or chain for the anchoring of large wood. Manila, sisal or other biodegradable ropes may be used for lashing connections. If hydraulic conditions warrant use of structural connections, then rebar pinning or bolting may be used. Use structural connections minimally, and only to ensure structural longevity in highly energetic systems (high gradient systems with lateral confinement and a limited floodplain). Demonstrate the need for structural anchorage in the design documentation.
51. Use no rock for streambank stabilization (except as ballast to stabilize large wood) unless it is necessary to prevent scouring or down-cutting of an existing flow control structure (*e.g.*, a culvert, bridge support, headwall, utility lines, or building). In this case,

rock may be used as the primary structural component for construction of vegetated riprap with large wood. Scour holes may be filled with rock to prevent damage to structural foundations but would not extend above the adjacent bed of the river. This does not include scour protection for bridge approach fills.

52. Place rock so as not to impair natural stream flows into or out of secondary channels or riparian wetlands.
53. Install fencing as necessary to prevent access and grazing damage to revegetated sites and riparian buffer strips.
54. Extend riparian buffer strips associated with streambank protection from the bankfull elevation towards the floodplain a minimum distance of 35 feet.

Install Habitat-Forming Instream Structures (Large Wood, Small Wood, and Boulders)

Mitigation Measures for Large Wood Structures

55. Design large wood placements to mimic the process and function of natural accumulations of large wood in the channel and address defined limiting factors.
56. Use large wood that is intact, hard, and undecayed to partly decaying and should preferably include untrimmed root wads when available to provide functional refugia habitat for fish. Large wood includes whole trees with rootwad and limbs attached, pieces of trees with or without rootwads and limbs, and cut logs. Use no decayed or fragmented wood found lying on the ground or partially sunken in the ground as key pieces but may be incorporated to add habitat complexity.
57. Do not use cable or chain for large wood anchoring. Manila, sisal or other biodegradable ropes may be used for lashing connections. Use rebar-pinning[37] or bolting if hydraulic conditions warrant use of structural connections. Use structural connections minimally and only to ensure structural longevity in highly energetic systems (high gradient systems with lateral confinement and limited floodplain). Include rationale and justification in the Basis of Design Report for the use of structural anchorage.
58. If a 100-year flood design criterion is applied to specific structures, then consider stability requirements for the primary large woody debris elements including base, key, and anchorage members (logs larger than 15 feet long and greater than one foot in diameter). These pieces would comprise ~ 50% of the overall structure. Woven, racking, matrix, and recruited material would be transient and would dynamically interact with the fluvial system. If specific stability evaluation of a structure results in criteria more conservative than that presented above, then a risk – benefit analyses would be used to ascertain the appropriateness of the subject structure. This assessment would be used to determine the benefits to fish habitat and may result in modifying or forgoing the specific action.
59. Limit the use of rock to what is needed to anchor the large wood.
60. Use only wood piles for piling needs. Use no steel piling. Drive each piling as follows to minimize the use of force and resulting sound pressure:
    a. Use a vibratory head to drive the piles; an impact hammer shall not be used
    b. Select areas with soft substrate rather than rocky hard substrate; avoid bedrock

[37] If rebar is to be used, the protruding ends should be cut flush with the log or bent in order to prevent impaling fish, people or wildlife.

c. Isolate the work area if possible to minimize acoustic disturbance

Mitigation Measures for Small Wood Structures (Canyon Creek Boundary project)

61. Construct small wood placements for floodplain reconnection in stream systems less than 4% stream gradient.
62. Install structures that would be overtopped to have crest elevations that extend no more than three feet above the stream bed. Cut vertical posts (if utilized) so as not to extend above the proposed crest elevation.
63. For incised channels, apply an adaptive management approach using lower elevation structures that trap sediment and aggrade the channel, with future and subsequent project phases rather than tall structures with excessive drop and increased risk of failure.
64. Drive vertical posts (if utilized) to a depth at least 1.5 times the expected scour depth of the waterway or a ratio of 1:2 for exposed – embedded length whichever is more conservative. Space posts a minimum 1.5 feet apart.
65. Complete all in-stream construction associated with small wood structures by hand or small machinery not to exceed 15,000 lbs operating weight.
66. Use non- treated wood (*e.g.,* fence posts) from a materials source collected outside the riparian area for construction of all primary materials used in small wood placements.
67. Design structures so as to not unreasonably interfere with use of the waterway for navigation, fishing, or recreation.
68. Minimize the placement of inorganic material to the amount necessary to prevent under-scour of structure, and manage pore flow sufficient to ensure adequate over-topping flow and side flow to facilitate fish passage where required.
69. In addition to any other design parameters necessary to meet fish passage requirements, design structures to be porous, and provide for a water surface differential of no more than one-foot at low flows, or otherwise provide a clear path for fish passage over, around, or through the structure during low flows.
70. Use no cabling, wire, mortar or other materials that serves to affix the structure to the bed, banks, or upland.
71. Additional potential effects of these structures may include channel aggradation and associated channel widening, bank erosion, increased channel meandering, and decreased channel depth. Use the Basis of Design Report to demonstrate how these potential impacts would be accommodated.
72. At project completion, grade, seed, and plant all disturbed areas, including staging and access areas, to repair damage and restore the riparian zone.

Riparian and Wetland Vegetation Planting

73. Design vegetation treatments using an experienced silviculturist, botanist, ecologist, or qualified technician.
74. Plant species that are the same as those that naturally occur in the project area.
75. Acquire tree and shrub species as well as sedge and rush mats to be used as transplant material from outside the bankfull width, typically in abandoned floodplains, and where such plants are abundant, or salvaged from areas where excavation is planned.
76. Size and anchor sedge and rush mats to prevent their movement during high flow events.
77. Mimic natural species distribution when planting in riparian and floodplain areas.

Channel Reconstruction

78. Provide detailed construction drawings.
79. Demonstrate in the designs that channel reconstruction would identify, correct (to the extent possible), and account for (in the project development process), the conditions that lead to the degraded condition.
80. Demonstrate in the designs that the proposed action would mimic natural conditions for gradient, width, sinuosity and other hydraulic parameters.
81. Demonstrate in the designs that structural elements shall fit within the geomorphic context of the stream system.
82. Demonstrate in the designs that there is sufficient hydrology and that the action would be self-sustaining over time. Self-sustaining means the restored or created habitat would not require major or periodic maintenance but function naturally within the processes of the floodplain.
83. Demonstrate in the designs that the proposed action would not result in the creation of fish passage issues or post-construction stranding of juvenile or adult fish.

Install Habitat-Forming Materials (Sediment and Gravel)

84. Apply augmentation only in areas where the natural sediment and gravel supply has been eliminated, significantly reduced through anthropogenic disruptions, or used to initiate gravel accumulations or habitat forming processes in conjunction with other actions, such as simulated log jams and debris flows.
85. Use only gravel for stream placement that is of properly sized gradation for that stream and is clean alluvium with similar angularity as the natural bed material. When possible, use gravel of the same lithology as found in the watershed. Imported gravel must be free of invasive species and non-native seeds.
86. Use only sediment that is sized appropriately for the action area based on information gathered from a reference reach, and that is free of invasive species and non-native seeds.
87. Demonstrate in the designs (or basis of design report) that shallow-water habitat is a limiting factor to salmonid production in the action area for placement of finer materials.
88. Use sediment sources only from previously-dredged material. Do not dredge specifically to acquire the material.
89. After placement of gravel or sediment in areas accessible to higher streamflow, allow the stream to naturally sort and distribute the material.
90. Do not place gravel directly on bars and riffles that are known spawning areas, which may cause fish to spawn on the unsorted and unstable gravel, thus potentially resulting in redd destruction.
91. Acquire spawning gravel or sediment to be placed instream only from an upland source outside of the channel and riparian area, and that is of properly-sized gradation for that stream, clean, and if possible, non-angular.

Conservation Measures for Invasive Plant Control and Vegetation Management

Every project in the Proposed Action would include treatment for invasive plants, and would be guided by the criteria in this section.

Managing Vegetation Using Physical Control Methods

92. Restrict ground-disturbing mechanical activity in established buffer zones adjacent to streams, lakes, ponds, wetlands and other identified sensitive habitats based on percent slope. For slopes less than 20%, apply a buffer width of 35 feet. Use no ground-disturbing mechanical equipment on slopes greater than 20%.
93. When possible, use manual control (*e.g.*, hand pulling, grubbing, and cutting) in sensitive areas to avoid adverse effects to listed species or water quality.
94. Dispose of all noxious weed material in a manner that would prevent its spread. Bag and burn noxious weeds that have developed seeds.

Managing Vegetation Using Herbicides

Herbicide application practices would be tightly constrained. The mitigation measures for this action are those listed as "Conservation Measures" specified in the Invasive Plant Control section of the most recent iteration of BPA's ESA consultation with NMFS and the U.S. Fish and Wildlife Service (USFWS) in BPA's Habitat Improvement Program (HIP) consultation (2003-present), now in its fourth iteration (HIP IV). The most recent iteration of that consultation is incorporated here by reference, and the relevant portions of it to this section are included in Appendix C, "*Mitigation Measures for Invasive Plant Control",* and constitute the mitigation measures for this type of action.

Mitigation Measures for Installing, Upgrading, or Maintaining Fish Exclusion Devices and Bypass Systems

95. Install, replace, upgrade, remove, and maintain diversion water intake and return points to prevent salmonids of all life stages from swimming into, or being entrained within, the diversion system.
96. Design, construct, install, operate, and maintain all fish screens (including screens installed on temporary and permanent pump intakes) and fish bypass systems according to NMFS fish screen criteria, detailed in *Anadromous Salmonid Passage Facility Design* (NMFS 2011 or most recent version).
97. Acquire NMFS Engineering Review and approval for all fish screens with diverted flow by gravity or pumping at a rate that exceeds three cubic feet per second.
98. In areas where larval lamprey could be entrained, use screening by perforated plate, vertical bar, or interlocking bar screens. Do not use wire screening.

Conservation Measures for Upland Actions

Most of the actions proposed in this EA include planting and fencing, and the modification of riparian and upland habitats to some degree. The mitigation measures in this section would be applied on all projects.

99. Do not allow grazing within riparian-area fenced enclosures without a grazing management plan that uses flash grazing or some comparable method to control invasive species or otherwise promote growth of native riparian vegetation.

100. Plant in areas where the proposed plantings have historically occurred but at present are either scarce or absent.

101. Develop a vegetation/planting plan that is responsive to the biological and physical factors at the site. Include the following in all planting plans:

    a. Require the use of native species and the specify seed/plant source, seed/plant mixes, soil preparation, etc.

    b. Include vegetation management strategies that are consistent with local native succession and disturbance regimes.

Consider the abiotic factors contributing to the sites' succession, i.e., weather and disturbance patterns, nutrient cycling, and hydrologic condition.

Appendix B General Conservation Measures Applicable to All Actions

These measures are those from BPA's ESA consultation with NMFS and the USFWS in BPA's Habitat Improvement Program (HIP) consultation (2003 - present), now in its fourth iteration (HIP IV). These measures would be implemented on all projects that involve in-water or near-water work. The design criteria and methodologies prescribed here are integral to the project descriptions in Chapter 2.

General Conservation Measures

Project Design and Site Preparation

Timing of in-water work

Formal recommendations published by Idaho Department of Fish and Game (IDFG) or informal recommendations from the appropriate state Fishery Biologist in regard to the timing of in-water work, would be followed.

Bull trout - In Bull Trout spawning and rearing areas, eggs, alevin, and fry are present nearly year round. In Bull Trout habitats designated as foraging, migration, and overwintering (FMO) habitats, juvenile and adult bull trout may be present seasonally. Some project locations may not have designated in-water work windows for bull trout, or if they do, they may differ from the in-water work windows for salmon and steelhead. If this is the case, the project sponsor would contact the appropriate USFWS field office to ensure that all reasonable implementation measures are considered and an appropriate in-water work window is used to minimize project effects.

Exceptions to IDFG in-water work windows would be requested by BPA through the Variance Process.

Contaminants

The project sponsor would complete a site assessment with the following elements to identify the type, quantity, and extent of any potential contamination for any action that involves excavation of more than 20 cubic yards of material:

1) A review of available records, such as former site use, building plans, and records of any prior contamination events;
2) A site visit to inspect the areas used for various industrial processes and the condition of the property;
3) Interviews with knowledgeable people, such as site owners, operators, and occupants, neighbors, or local government officials; and
4) A summary, stored with the project file that includes an assessment of the likelihood that contaminants are present at the site, based on items 4(a) through 4(c).

Site layout and flagging

1) Prior to construction, the project area would be clearly flagged to identify the following:
    a) Sensitive resource areas, such as areas below ordinary high water (OHW), spawning areas, springs, and wetlands;
    b) Equipment entry and exit points;
    c) Road and stream crossing alignments;
    d) Staging, storage, and stockpile areas; and

e) No-herbicide-application areas and buffers.

Temporary access roads and paths

1) Existing access roads and paths would be preferentially used whenever possible, and the number and length of temporary access roads and paths through riparian areas and floodplains would be minimized to lessen soil disturbance, soil compaction, and impacts to vegetation.
2) Vehicle use and human activities, including walking in areas occupied by terrestrial ESA- listed species, would be minimized.
3) Temporary access roads and paths would not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure. If slopes are steeper than 30%, the road would be designed by a civil engineer with experience in steep road design.
4) The removal of riparian vegetation during construction of temporary access roads would be minimized. When temporary vegetation removal is required, vegetation would be cut at ground level (not grubbed).
5) At project completion, all temporary access roads and paths would be de-compacted and reshaped to match the original contour; and the soil would be stabilized and revegetated.
6) Helicopter flight patterns would be established in advance, and located to avoid terrestrial ESA- listed species, including their occupied habitat and appropriate buffers, during sensitive life stages (i.e. nesting and critical breeding periods).

Temporary stream crossings

1) Existing stream crossings, fords, or bedrock would be used whenever possible.
2) If an existing stream crossing is not accessible, temporary crossings would be installed. Treated wood shall not be used on temporary bridge crossings or in locations in contact with or over water.
3) For projects that require equipment and vehicles to cross in the wet:
   a) The location and number of all wet crossings must be approved by BPA and clearly indicated on design drawings.
   b) Vehicles and machinery would cross streams at right angles to the main channel wherever possible.
   c) No stream crossings would occur 300 feet upstream or 100-feet downstream of an existing redd or spawning fish.
   d) After completion, temporary stream crossings would be obliterated, and the banks restored.

Staging, storage, and stockpile areas

1) Staging areas (used for construction equipment storage, vehicle storage, fueling, servicing, and hazardous material storage) would be 150 feet or more from any natural waterbody or wetland, or on an adjacent established road area in a location and manner that would preclude erosion into, or contamination of, the stream or floodplain.
2) Natural materials used for implementation of aquatic restoration, such as large wood, gravel, and boulders, may be staged within the 100-year floodplain.

3) Any large wood, topsoil, and native channel material displaced by construction would be stockpiled for use during site restoration at a specifically identified and flagged area.
4) Any material not used in restoration, and not native to the flood plain, would be removed to a location outside of the 100-year floodplain for disposal.

Equipment

Mechanized equipment and vehicles would be selected, operated, and maintained in a manner that minimizes adverse effects on the environment (*e.g.*, minimally-sized, low pressure tires; minimal hard-turn paths for tracked vehicles; temporary mats or plates within wet areas or on sensitive soils). All vehicles and other mechanized equipment would be:

1) Stored, fueled, and maintained in a vehicle staging area located 150 feet or more from any natural water body or wetland, or on an adjacent, established road area;
2) Refueled in a vehicle staging area located 150 feet or more from a natural waterbody or wetland, or in an isolated hard zone, such as a paved parking lot or adjacent, established road (this measure applies only to gas or diesel-powered equipment with tanks larger than five gallons);
3) Biodegradable lubricants and fluids shall be used on equipment operating in the stream channel and live water.
4) Inspected daily for fluid leaks before leaving the vehicle staging area for operation within 150 feet of any natural water body or wetland; and
5) Thoroughly cleaned before operation below ordinary high water (OHW), and as often as necessary during operation, to remain free of grease.

Erosion control

Erosion control best management practices (BMPs) would be prepared and carried out, commensurate with the scope of the action that may include the following:

1) Temporary erosion control BMPs.
    a) Temporary erosion control BMPs shall be in place before any significant alteration of the action site, and shall be appropriately installed downslope of any activity within the riparian buffer area until site rehabilitation is complete.
    b) If there is a potential for eroded sediment to enter the stream, sediment barriers would be installed and maintained for the duration of project implementation.
    c) Temporary erosion control measures may include sedge mats, fiber wattles, silt fences, jute matting, wood fiber mulch with soil binder, or geotextiles and geosynthetic fabric. Biodegradable netting may be used so that they can decompose on site.
    d) Soil stabilization utilizing wood fiber mulch and tackifier (hydro-applied) may be used to reduce erosion of bare soil if the materials are noxious-weed-free and nontoxic to aquatic and terrestrial animals, soil microorganisms, and vegetation.
    e) Sediment would be removed from erosion control BMP once it has reached 0.33 of the exposed height of the BMP.
    f) Once the site is stabilized following construction, temporary erosion control BMPs would be removed.

2) Emergency erosion control BMPs. The following materials for emergency erosion control would be available at the work site:
    a) A supply of sediment control materials; and
    b) An oil-absorbing floating boom whenever surface water is present.

Dust abatement

The project sponsor would determine the appropriate dust control measures by considering soil type, equipment usage, prevailing wind direction, and the effects caused by other erosion and sediment control measures. In addition, the following criteria would be followed:

1) Work would be sequenced and scheduled to reduce exposed bare soil subject to wind erosion.
2) Dust-abatement additives and stabilization chemicals (typically magnesium chloride, calcium chloride salts, or lignin sulfonate) would not be applied within 25 feet of a natural waterbody or wetland and would be applied so as to minimize the likelihood that they would enter streams. Applications of lignin sulfonate would be limited to a maximum rate of 0.5 gallons per square yard of road surface, assuming a 50:50 (lignin sulfonate to water) solution.
3) Application of dust abatement chemicals would be avoided during or just before wet weather and at stream crossings or other areas that could result in unfiltered delivery of the dust abatement chemicals to a waterbody (typically these would be areas within 25 feet of a natural waterbody or wetland; distances may be greater where vegetation is sparse or slopes are steep).
4) Spill containment equipment would be available during application of dust abatement chemicals.
5) Petroleum-based products would not be used for dust abatement.

Spill prevention, control, and counter measures

The following measures would be used to prevent accidental spills of fuel, lubricants, hydraulic fluid, or other contaminants into the riparian zone or directly into the water:

1) A description of hazardous materials that would be used, including inventory, storage, and handling procedures, would be available on-site.
2) Written procedures for notifying environmental response agencies would be posted at the work site.
3) Spill containment kits (including instructions for cleanup and disposal) adequate for the types and quantity of hazardous materials used at the site would be available at the work site.
4) Workers would be trained in spill containment procedures and would be informed of the location of spill containment kits.
5) Any waste liquids generated at the staging areas would be temporarily stored under an impervious cover, such as a tarpaulin, until they can be properly transported to, and disposed of, at a facility that is approved for receipt of hazardous materials.
6) Pumps used adjacent to water shall use spill containment systems.

Invasive species control

The following measures would be followed to avoid introduction of invasive plants and noxious weeds into project areas:

1) Prior to entering the site, all vehicles and equipment would be power-washed, allowed to dry fully, and inspected to make sure no plants, soil, or other organic material adheres to the surface.
2) Watercraft, waders, boots, and any other gear to be used in or near water would be inspected for aquatic invasive species. Wading boots with felt soles are not to be used due to their propensity for aiding in the transfer of invasive species unless decontamination procedures are used.

Work Area Isolation & Fish Salvage

Work Area Isolation

Any work area requiring excavation or mobilization of sediment within the wetted channel would be isolated from the active stream whenever ESA-listed fish are reasonably certain to be present, or if the work area is less than 300-feet upstream from known ESA-listed fish spawning habitats. If the work area isolation practices would cause greater impacts than it would prevent, is located in deep or swiftly flowing water, or if fish can be effectively excluded by nets or screens, then a variance to not isolate the work area may be pursued.

When work area isolation is required, design plans would include all isolation elements, fish release areas, a pump to be used to dewater the isolation area, and, when fish are present, a fish screen that meets NMFS's fish screen criteria (NMFS 2011[38], or most current). Wider mesh screens may be used after all fish have been removed from the isolated area. Work area isolation and fish capture activities take place during periods of the coolest air and water temperatures possible, normally early in the morning versus late in the day, and during conditions appropriate to minimize stress to fish species present.

A fish biologist would determine how to remove ESA-listed fish, with least harm to the fish, before in-water work begins. This would involve either passive movement of fish out of the project's stream reach through slow dewatering, or actively removing the fish from the project reach. Should active removal be warranted, a fish biologist would clear the area of fish before the site is dewatered using one or more of a variety of methods including seining, dipping, or electrofishing, depending on specific site conditions.

Dependent upon site conditions, a fish biologist would conduct or supervise the following:

1) Slowly reduce water from the work area to allow some fish to leave the work area volitionally;
2) Install block nets;
    a) Block nets would be installed at upstream and downstream locations and maintained in a secured position to exclude fish from entering the project area.
    b) Block nets would be secured to the stream channel bed and banks until fish capture and transport activities are complete. Block nets may be left in place for the duration of the project to exclude fish.
    c) If block nets remain in place more than one day, the nets would be monitored at least daily to ensure they are secured to the banks and free of organic accumulation. If the project is within bull trout spawning and rearing habitat, the block nets must be checked every four hours for fish

[38] NMFS. 2011. Anadromous salmonid passage facility design. Northwest Region. Available online at: http://www.habitat.noaa.gov/pdf/salmon_passage_facility_design.pdf

impingement on the net. Less frequent intervals must be approved through a variance request.

   d) Nets would be monitored hourly anytime there is instream disturbance.

3) Capture fish through seining, and relocate to streams;
   a) While dewatering, any remaining fish would be collected by hand or dip nets.
   b) Seines with a mesh size to ensure capture of the residing ESA-listed fish would be used.
   c) Minnow traps may be left in place overnight and used in conjunction with seining.
4) Electrofish to capture and relocate fish not caught during seining, NMFS electrofishing guidelines shall be used. This step is to be used as a last resort; after all passive techniques have been exhausted.
5) Continue to slowly dewater the stream reach;
6) Collect any remaining fish in cold-water buckets and relocate to the stream;
   a) Limit the time fish would be in a transport bucket, and release them as quickly as possible;
   b) The number of fish within a bucket would be limited, and fish would be of relatively comparable size to minimize predation;
   c) Aerators for buckets would be used, or the bucket's water would be frequently changed with cold, clear, water at 15 minute, or more-frequent, intervals.
   d) Buckets would be kept in shaded areas; or if in exposed areas, covered by a canopy.
   e) Dead fish would not be stored in transport buckets but would be left on the streambank to avoid mortality counting errors.

NMFS's Electrofishing Guidelines (NMFS 2000[39])

- Initial Site Surveys and Equipment Settings

   a) In order to avoid contact with spawning adults or active redds, researchers must conduct a careful visual survey of the area to be sampled before beginning electrofishing.
   b) Prior to the start of sampling at a new location, water temperature and conductivity measurements shall be taken to evaluate electrofisher settings and adjustments.
   c) No electrofishing should occur when water temperatures are above 18°C or are expected to rise above this temperature prior to concluding the electrofishing survey.
   d) Whenever possible, a block net should be placed below the area being sampled to capture stunned fish that may drift downstream.
   e) Equipment must be in good working condition and operators should go through the manufacturer's preseason checks, adhere to all provisions, and record major maintenance work in a logbook.
   f) Each electrofishing session must start with all settings (voltage, pulse width, and pulse rate) set to the **minimums** needed to capture fish. These settings should be gradually increased only to the point where fish are immobilized

[39] http://www.westcoast.fisheries.noaa.gov/publications/reference_documents/esa_refs/section4d/electro2000.pdf

and captured, and generally not allowed to exceed conductivity-based maxima

Electrofishing Guidelines for ESA-listed Salmonids

	Initial settings	Maximum settings	
Voltage		Conductivity	Max Voltage
	100V	<100	1100 V
		100-300	800 V
		>300	400 V
Pulse Width	500 µS	5 mS	
Pulse Rate	30 Hz	70 Hz	

- Electrofishing Technique
    a) Sampling should begin using straight DC. The power needs to remain on until the fish is netted when using straight DC. If fish capture is unsuccessful with initial low voltage, gradually increase voltage settings with straight DC.
    b) If fish capture is not successful with the use of straight DC, then set the electrofisher to lower voltages with PDC. If fish capture is unsuccessful with low voltages, increase pulse width, voltage, and pulse frequency (duration, amplitude, and frequency).
    c) Electrofishing should be performed in a manner that minimizes harm to the fish. Stream segments should be sampled systematically, moving the anode continuously in a herringbone pattern (where feasible) through the water. Care should be taken when fishing in areas with high fish concentrations, structure (*e.g.*, wood, undercut banks) and in shallow waters where most backpack electrofishing for juvenile salmonids occurs. Voltage gradients may be high when electrodes are in shallow water where boundary layers (water surface and substrate) tend to intensify the electrical field.
    d) Do not electrofish in one location for an extended period (*e.g.*, undercut banks) and regularly check block nets for immobilized fish.
    e) Fish should not make contact with the anode. The zone of potential injury for fish is 0.5 m from the anode.
    f) Electrofishing crews should be generally observant of the condition of the fish and change or terminate sampling when experiencing problems with fish recovery time, banding, injury, mortality, or other indications of fish stress.
    g) Netters should not allow the fish to remain in the electrical field any longer than necessary by removing stunned fish from the water immediately after netting.
- Sample Processing and Recordkeeping
    a) Fish should be processed as soon as possible after capture to minimize stress. This may require a larger crew size.
    b) All sampling procedures must have a protocol for protecting held fish. Samplers must be aware of the conditions in the containers holding fish; air pumps, water transfers, etc., should be used as necessary to maintain safe

conditions. Also, large fish should be kept separate from smaller prey-sized fish to avoid predation during containment.

c) Fish should be observed for general condition and injuries (*e.g.*, increased recovery time, dark bands, and visually observable spinal injuries). Each fish should be completely revived before releasing at the location of capture. A plan for achieving efficient return to appropriate habitat should be developed before each sampling session. Also, every attempt should be made to process and release ESA-listed specimens first.

d) Pertinent water quality (*e.g.*, conductivity and temperature) and sampling notes (*e.g.*, shocker settings, fish condition/injuries/mortalities) should be recorded in a logbook to improve technique and help train new operators. It is important to note that records of injuries or mortalities pertain to the entire electrofishing survey, including the fish sample work-up.

e) The anode would not intentionally contact fish.

f) Electrofishing should not be conducted when the water conditions are turbid and visibility is poor. For example, when the sampler cannot see the stream bottom in one foot of water.

g) If mortality or obvious injury (defined as dark bands on the body, spinal deformations, de-scaling of 25% or more of body, and torpidity or inability to maintain upright attitude after sufficient recovery time) occurs during electrofishing, operations would be immediately discontinued, machine settings, water temperature, and conductivity checked, and procedures adjusted or electrofishing postponed to reduce mortality.

Dewatering

Dewatering, when necessary, would be conducted over a sufficient period of time to allow species to naturally migrate out of the work area and would be limited to the shortest linear extent practicable.

1) Diversion around the construction site may be accomplished with a cofferdam and a by-pass culvert or pipe, or a lined, non-erodible diversion ditch. Where gravity feed is not possible, a pump may be used, but must be operated in such a way as to avoid repetitive dewatering and re-watering of the site. Impoundment behind the cofferdam must occur slowly through the transition, while constant flow is delivered to the downstream reaches.
2) All pumps would have fish screens to avoid juvenile fish impingement or entrainment, and would be operated in accordance with NMFS's current fish screen criteria (NMFS 2011[40], or most recent version). If the pumping rate exceeds three cubic feet per second (cfs), a NMFS Engineering review would be necessary. If the screen is in an isolated area with no fish (salmonids or larval lamprey), a larger mesh screen may be used.
3) Dissipation of flow energy at the bypass outflow would be provided to prevent damage to riparian vegetation and/or stream channel.
4) Seepage water would be pumped to a temporary storage and treatment site or into upland areas to allow water to percolate through soil or to filter through vegetation prior to reentering the stream channel.

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[40] NMFS. 2011. Anadromous salmonid passage facility design. Northwest Region. Available online at: http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/Fish-Passage-Design.pdf

5) In areas occupied by larval lamprey, to the extent possible, salvage using guidance set forth in USFWS 2010[41] or most recent guidance.
6) In areas occupied by native freshwater mussels, to the extent possible, salvage using guidance developed by the Xerces Society (Blevins et al. 2018)[42].

Bull Trout Electrofishing Mitigation Measures

In areas potentially occupied by bull trout, follow the guidelines in NMFS's Electrofishing Guidelines (NMFS 2000[43]), as described above, with the following additional restrictions:

1) For salvage operations in known bull trout spawning and rearing habitat[44], electrofishing shall only occur from May 1 to July 31. In FMO habitats, electrofishing may occur any time of year.
2) Bull trout are very temperature sensitive and generally should not be electrofished or otherwise handled when temperatures exceed 15°C in spawning and rearing habitats.
3) Salvage/ electrofishing activities should take place during periods of the coolest air and water temperatures possible, normally early in the morning versus late in the day, and during conditions appropriate to minimize stress to fish species present.

Salvage of Native Fish, Lamprey[45] and Mussels[46]

In addition to Conservation Recommendations for salmonids, additional efforts will be employed to salvage other native species. The following guidelines are draft from the U.S. Fish and Wildlife Service, with assistance from the Xerces Society, and will be used as appropriate and to the extent possible.

1) Conduct native mussel and lamprey presence/ absence; approximate numbers for salvage to aid in planning for salvage. Pre-select site where salvaged mussels will be relocated.
2) Suggested drawdown: this order should be adjusted for site-specific conditions and numbers of species and individuals- for example, if you only have a small number of mussels or very limited larval lamprey habitat, it may be most efficient to salvage only during drawdown. If drawdown occurs during cool, wet weather, and the area will be rewatered within 24-48 hours, mussels and larval lamprey may survive in the sediments, and not require salvage. Conversely, if conditions are warm or hot,

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[41] USFWS. 2010. Best management practices to minimize adverse effects to Pacific lamprey. Available online at: http://www.fws.gov/pacific/Fisheries/sphabcon/lamprey/pdf/Best%20Management%20Practices%20for%20Pacific%20Lamprey%20April%202010%20Version.pdf

[42] Blevins et al. 2018. Conserving the Gems of Our Waters: Best Management Practices for Protecting Native Western Freshwater Mussels, available on line at https://xerces.org/wp-content/uploads/2018/01/2018-001_Freshwater_Mussel_BMPs_XercesSociety.pdf

[43] http://www.westcoast.fisheries.noaa.gov/publications/reference_documents/esa_refs/section4d/electro2000.pdf

[44] Bull Trout Spawning and Rearing habitat is not foraging, migrating, and overwintering (FMO) habitats.

[45] For lamprey, see USFWS. 2010. Best management practices to minimize adverse effects to Pacific lamprey or the latest revision: Available online at: http://www.fws.gov/pacific/Fisheries/sphabcon/lamprey/pdf/Best%20Management%20Practices%20for%20Pacific%20Lamprey%20April%202010%20Version.pdf

[46] For mussels, see Blevins et al. 2018. Conserving the Gems of Our Waters: Best Management Practices for Protecting Native Western Freshwater Mussels, and Blevins et al. 2019. Mussel-Friendly Restoration. Both available on line at https://xerces.org/western-freshwater-mussels/

lamprey can expire within a couple of hours. Depending on your site and circumstances, other adjustments may also be necessary. A generalized order prior to drawdown is:

a. Salvage FW mussels by hand, locating by snorkeling or wading. If mussels are numerous (or staff is limited), it may be necessary to do this step in the days before drawdown, as relocation/placement can be time consuming.
b. Salvage larval lamprey by e-fisher under watered conditions with lamprey-specific settings.
c. Salvage bony fish after lamprey with nets or by e-fisher with appropriate settings.
d. If there are sufficient numbers of people and equipment, some people can be dry-shocking dewatered areas, while others are removing remaining mussels, and others are salvaging salmon.

3) Continue salvage larval lamprey and FW mussels by hand during and after drawdown, as water recedes and lamprey continue to emerge from sediments and overlooked mussels become visible. Larval lamprey may emerge hours after dewatering occurs.
4) To encourage larval lamprey emergence, "Dry shock" in areas of fine/sandy deposits that are likely to have high larval lamprey densities.
5) Hold all fish in buckets, fine mesh baskets or tanks with adequate temperatures, space and oxygen. Release all fish throughout the salvage process in appropriate habitats to minimize stress, thermal shock and predation risk. Hold mussels in coolers as described below and relocate mussels in a pre-selected appropriate habitat; placement of each individual is needed to allow mussels to re-establish/burrow into the new habitat.

Electrofishing for Larval Lamprey

(This extensive section of HIP General Conservation Measures not included since the Lemhi Basin is outside the range of Pacific lamprey and lamprey are not present.)

Fish Salvage Notice

Monitoring and recording of fish presence, handling, and mortality must occur for the duration of the isolation, salvage, electrofishing, dewatering, and rewatering operations. Once operations are completed, a salvage report would document procedures used, any fish injuries or deaths (including numbers of fish affected), and causes of any deaths.

Construction and Post-Construction Mitigation Measures

Fish passage

Fish passage would be provided for any adult or juvenile fish likely to be present in the project area during construction, unless passage did not exist before construction, or the stream is naturally impassable at the time of construction. If the provision of temporary fish passage during construction would increase negative effects on ESA-listed species or their habitat, a variance can be requested from the NMFS Branch Chief and the USFWS Field Office Supervisor. Pertinent information, such as the species affected, length of stream reach affected, proposed time for the passage barrier, and alternatives considered would be included in the variance request.

Construction and discharge water

1) Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate.
2) Diversions would not exceed 10% of the available flow.
3) All construction discharge water would be collected and treated using the best available technology suitable for site conditions.
4) Treatments to remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present would be provided.
5) Concrete wash water would be contained and not allowed to enter flowing or standing waters.

Minimize time and extent of disturbance

Earthwork (including drilling, excavation, dredging, filling and compacting) in which mechanized equipment is used in stream channels, riparian areas, and wetlands would be completed as quickly as possible. Mechanized equipment would be used in streams only when BPA specialists agree that such actions are the only reasonable alternative for implementation, or would result in less sediment in the stream channel or damage (short- or long-term) to the overall aquatic and riparian ecosystem relative to other alternatives. To the extent feasible, mechanized equipment would work from the top of the bank, unless work from another location would result in less habitat disturbance.

Operations that could damage or destroy habitat for nesting migratory birds would not be conducted during the springtime nesting season (generally March through June) without surveys to identify and protect nesting sites prior to operations.

Cessation of work

Operations would cease under the following conditions:

1) High flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage
2) When allowable water quality impacts, as defined by the state CWA section 401 water quality certification or turbidity monitoring protocol (Appendix C), have been exceeded

Site restoration

When construction is complete:

1) All streambanks, soils, and vegetation would be cleaned up and restored as necessary using stockpiled large wood, topsoil, and native channel material.
2) All project-related waste would be removed.
3) All temporary access roads, crossings, and staging areas would be de-compacted and re-contoured. When necessary for revegetation and infiltration of water, compacted areas of soil would be loosened.

All disturbed areas would be rehabilitated in a manner that results in similar or improved conditions relative to pre-project conditions. This would be achieved through redistribution of stockpiled materials, seeding, and/or planting with local native seed mixes or plants.

Revegetation

Long-term soil stabilization of disturbed sites would be accomplished with reestablishment of native vegetation using the following criteria:

1) Planting and seeding would occur prior to or at the beginning of the first growing season after construction.

2) Use a mix of species, appropriate to the site that would achieve establishment, shade, and erosion control objectives. These would, preferably be forb, grass, shrub, or tree species native to the project area or region.
3) Vegetation, such as willow, sedge and rush mats, would be salvaged from disturbed or abandoned floodplains, stream channels, or wetlands, and replanted at the site in appropriate locations.
4) Invasive species would not be used.
5) Short-term stabilization measures may include the use of non-native sterile seed mix (when native seeds are not available), weed-free certified straw, jute matting, and other similar techniques.
6) Surface fertilizer would not be applied within 50 feet of any stream channel, waterbody, or wetland.
7) Fencing would be installed as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
8) Re-establishment of vegetation in disturbed areas would achieve at least 70% of pre-project conditions within three years.
9) Invasive plants would be removed or controlled until native plant species are well-established (typically three years post-construction).

Site access

The project sponsor would retain the right of reasonable access to the site in order to monitor the success of the project over its life.

Implementation monitoring

Project sponsor staff or their designated representative would provide implementation monitoring to demonstrate that:

1) General mitigation measures are adequately followed
2) Effects to listed species are not greater than predicted
3) Turbidity monitoring is being conducted in accordance with the turbidity monitoring protocol (Appendix C).

CWA section 401 water quality certification

The project sponsor or designated representative would complete and record water quality observations to ensure that in-water work is not degrading water quality. During construction, CWA section 401 water quality certification provisions provided by the Idaho Department of Environmental Quality would be followed.

Staged Rewatering Plan

When appropriate, the project sponsor shall implement a staged rewatering plan for projects that involve introducing streamflow into recently excavated channels under the 2a) Improve Secondary Channel and Wetland Habitat Activity category or 2f) Channel Reconstruction categories. This plan may be altered according to site specific conditions with coordination and feedback from BPA and the Services.

1) Pre-wash the newly-excavated channel before rewatering[47]. Turbid wash water will be detained and pumped to the floodplain or into a reach with sediment capture devices, rather than discharging into fish-bearing waters.

[47] The contractor may find it useful to have prewashed gravel bags available onsite to control the flow of water.

2) Prepare new channel for water by installing seine nets at the upstream end to prevent fish from moving downstream into the new channel until 0.66 of total streamflow is available in that channel. Starting in the early morning, introduce 0.33 of the flow into the new channel over a period of 1-2 hours.
3) When reintroducing streamflow into a dewatered stream reach, monitor for turbidity:
    a. A sample must be taken to establish background turbidity levels prior to any anticipated turbidity pulses. Take the sample at an undisturbed area approximately 100 feet upstream from the newly excavated channel.
    b. Take a second sample or observation, immediately downstream of the newly excavated channel, approximately:
    c. 50 feet downstream for streams that are less than 30 feet wide;
    d. 100 feet downstream for streams between 30 and 100 feet wide;
    e. 200 feet downstream for streams greater than 100 feet wide; and
    f. 300 feet from the discharge point or nonpoint source for locations subject to tidal or coastal scour.
    g. A sample must then be taken every **2 hours** during rewatering and be compared against the background measurement.
    h. An exceedance occurs whenever **both** of the following conditions are exceeded:
    i. Downstream turbidity exceeds 40 NTU.
    j. Downstream turbidity exceeds 10% above background.
    k. In an exceedance occurs for two consecutive readings (4 hours), stop work immediately and take measures to reduce turbidity before continuing to reintroduce streamflow.
4) Prepare to introduce the second 0.33 of the flow (up to a total of 0.66) to the new channel by installing seine nets at the upstream end of the old channel in order to prevent fish, larval lamprey and freshwater mussels from moving into a partially-dewatered channel. Introduce the second 0.33 of the flow over the next 1-2 hours. Salvage fish from the old channel at this time, so that the old channel is fish-free before dropping below 0.33 of the flow.
5) *Note: the fish will be temporarily blocked from moving downstream into either channel until 0.66 of the flow has been transitioned to the new channel. This blockage to downstream fish passage is expected to persist for roughly 12 to 14 hours, but fish will still be able to volitionally move out of the channel in the downstream direction.* Perform monitoring as in #3 above.
6) After the second 0.33 of flow is introduced over 2 hours, and turbidity is within 10% of the background level, remove seine nets from the new channel, and allow fish to move downstream back into the channel.
7) Introduce the final 0.33 of flow. Once 100% of the flow is in the new channel, install plug to block flow into the old channel and remove seine nets from the old channel. Additional efforts to salvage larval lamprey emerging from fine sediment deposits should be conducted after the flow is gone and possibly for a few hours after flow is gone, as the larvae will continue to emerge.

Turbidity Monitoring Protocol[48]

The Project Sponsor shall complete and record the following water quality observations. If the geomorphology of the project area (*e.g.*, silty or claylike materials) or the nature of the action (*e.g.*, large amounts of bare earth exposure) shall preclude the successful compliance with these triggers, BPA would be notified in advance of the likelihood and seek additional recommendations.

1) Take a background turbidity measurement approximately 100 feet upstream from the project area using a recently-calibrated turbidimeter. Record the observation, location, and time of the background measurement before monitoring at the downstream point, known as the **measurement compliance point**. If the background turbidity is less than 20 NTU, then use visual observations.
2) Take a second sample or observation, immediately after each **measurement compliance point**, approximately:
    a) 50 feet downstream for streams that are less than 30 feet wide;
    b) 100 feet downstream for streams between 30 and 100 feet wide;
    c) 200 feet downstream for streams greater than 100 feet wide; and
    d) 300 feet from the discharge point or nonpoint source for locations subject to tidal or coastal scour.
    e) Record the downstream observation, location, and time.
3) Turbidity shall be measured (steps 1-2) every **four hours** while work is being implemented.
4) An exceedance occurs whenever the both of the following conditions are exceeded:
    a) Downstream turbidity exceeds 40 NTU**,**
    b) Downstream turbidity exceeds 10% above background
5) If an exceedance occurs then adjustments or corrective measures must be taken in order to reduce turbidity. The NMFS staff biologists of the area can provide technical assistance.
6) If exceedances occur for more than **two consecutive monitoring intervals** (after eight hours), the activity must stop until the turbidity level returns to background, and BPA must be notified immediately after the project is concluded. BPA shall document the reasons for the exceedances and **corrective measures** taken.
7) If at any time, monitoring, inspections, or observations/samples show that the turbidity controls are ineffective, immediately mobilize work crews to repair, replace, or reinforce controls as necessary. Document those occurrences in the PCF.

[48] From BPA's HIP ESA consultation

Appendix C Conservation Measures for Invasive Plant Control[49]

1) **Herbicide applicator qualifications.** Herbicides would be applied only by an appropriately licensed applicator using an herbicide specifically targeted for a particular plant species that would cause the least impact to non-target species. The applicator would be responsible for preparing and carrying out the herbicide transportation and safety plan shown below.

2) **Herbicide transportation and safety plan.** The applicator would prepare and carry out an herbicide safety/spill response plan to reduce the likelihood of spills or misapplication, take remedial actions in the event of spills, and fully report the event. At a minimum, the plan would:

    a) Address spill prevention and containment;
    b) Estimate and limit the daily quantity of herbicides to be transported to treatment sites;
    c) Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling;
    d) Require a spill cleanup kit be readily available for herbicide transportation, storage and application;
    e) Outline reporting procedures, including reporting spills to the appropriate regulatory agency;
    f) Require that equipment used in herbicide storage, transportation, and handling are maintained in a leak proof condition;
    g) Address transportation routes so that hazardous conditions are avoided to the extent possible;
    h) Specify mixing and loading locations away from waterbodies so that accidental spills do not contaminate surface waters;
    i) Require that spray tanks be mixed or washed further than 150 feet of surface water;
    j) Ensure safe disposal of herbicide containers;
    k) Identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft; and
    l) Instruct all individuals involved, including any contracted applicators, on the plan.

[49] From BPA's HIP ESA consultation

3) **Herbicides.** BPA proposes to use the herbicides in the table below in the typical application rates for invasive plant control.

Allowable Herbicides

Active ingredient	Typical products	Maximum label application rate (ai/ac)
2,4-D (amine)	Amine 4® Weedar 64® Riverdale AM-40®	4.0 lbs
Aminopyralid	Milestone®	0.375 lb
Chlorsulfuron	Telar XP®	3.0 oz
Clethodim	Select®	0.50 lb
Clopyralid	Transline®	0.5 lb
Dicamba	Banvel® Vanquish®	8.0 lbs
Glyphosate	Rodeo® Glypro® Accord® Aquamaster® Aquaneat® Foresters®	3.75 lbs
Imazapic	Plateau®	0.189 lb
Imazapyr	Habitat® Arsenal® Chopper®	1.5 lbs
Metsulfuron methyl	Escort XP®	4.0 oz
Picloram	Tordon 22K® Tordon K®	1 lb
Sethoxydim	Poast® Vantage®	0.375 lb
Sulfometuron methyl	Oust XP®	2.25 oz
Triclopyr (TEA)	Garlon 3A® Tahoe 3A® Triclopyr 3A® Triclopyr 3SL®	9.0 lbs
Fluroxypyr (upland only)	Vista ®	20 oz (upland only)

a) **2,4-D.** As a result of the national consultation on herbicides[50], this herbicide shall comply with all relevant reasonable and prudent alternatives from the 2011 Biological Opinion (NMFS 2011):

b) Do not apply when wind speeds are below two mph or exceed 10 mph, except when winds in excess of 10 mph would carry drift away from salmonid-bearing waters.

c) Do not apply when a precipitation event, likely to produce direct runoff to salmonid bearing waters from the treated area, is forecasted by NOAA/NWS (National Weather Service) or other similar forecasting service within 48 hours following application.

4) **Adjuvants.** BPA proposes to use the adjuvants in the table below in the typical application rates for invasive plant control.

Allowable Adjuvants

Adjuvant type	Trade name
Colorants	Dynamark™ U.V. (red)
	Aquamark™ Blue
	Dynamark™ U.V. (blu)
	Hi-Light® (blu)
Surfactants	Activator 90®
	Agri-Dex®
	Bond®
	Bronc-Max®
	Competitor®
	Class Act®
	Entry II®
	Hasten®
	LI 700®
	Liberate®
	R-11®
	Super Spread MSO®
	Syl-Tac®
Drift retardants	41-A®
	Valid®
	Compadre®

5) Polyethoxylated tallow amine (POEA) surfactant and herbicides that contain POEA (*e.g.*, Roundup®) are not allowed for use.

[50] On June 30, 2011, NMFS issued a final BiOp, addressing the effects of this herbicide on ESA-listed Pacific salmonids. The BiOp has concluded that EPA's proposed registration of certain uses of 2,4-D, including aquatic uses of 2,4-D BEE are likely to jeopardize the continued existence of the 28 endangered and threatened Pacific salmonids. http://www.nmfs.noaa.gov/pr/consultation/pesticides.htm

6) **Herbicide carriers.** Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil.

7) **Herbicide mixing.** Herbicides would be mixed more than 150 feet from any natural waterbody to minimize the risk of an accidental discharge and no more than three different herbicides may be mixed for any one application.

8) **Herbicide application methods.** Liquid or granular forms of herbicides to be applied by a licensed applicator as follows:

    a) **Broadcast spraying** – hand held nozzles attached to back pack tanks or vehicles, or vehicle-mounted booms;

    b) **Spot spraying** – hand-held nozzles attached to backpack tanks or vehicles, hand-pumped spray, or squirt bottles to spray herbicide directly onto small patches or individual plants;

    c) **Hand/selective** – wicking and wiping, basal bark, fill ("hack and squirt"), stem injection, and cut-stump.

9) **Emergent Knotweed Application.** No aquatic application of chemicals is covered by this consultation except for treating emergent knotweed. Only aquatic labeled glyphosate formulations would be used. The only application methods for emergent knotweed are stem injection (formulation up to 100% for emergent stems greater than 0.75 inches in diameter), wicking or wiping (diluted to 50% formulation), and hand-held spray bottle application of glyphosate (up to the percentage allowed by label instructions when applied to foliage using low-pressure hand-held spot spray applicators).

10) **Water Transportation.** Most knotweed patches are expected to have overland access; however, some sites may be reached only by water travel (*e.g.*, wading, inflatable raft, kayak, etc.). The following measures would be used to reduce the risk of a spill during water transport:

    a) No more than 2.5 gallons of glyphosate would be transported per person or raft, and typically, it would be one gallon or less.

    b) Glyphosate would be carried in one gallon or smaller plastic containers. The containers would be wrapped in plastic bags and then sealed in a dry-bag. If transported by raft, the dry-bag would be secured to the watercraft.

11) **Minimization of herbicide drift and leaching.** Herbicide drift and leaching would be minimized as follows:

    a) Do not spray when wind speeds exceed 10 mph or are less than two mph;

    b) Be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind;

    c) Keep boom or spray as low as possible to reduce wind effects;

    d) Increase spray droplet size whenever possible by decreasing spray pressure, using high flow rate nozzles, using water diluents instead of oil, and adding thickening agents;

    e) Do not apply herbicides during temperature inversions, or when ground temperatures exceed 80 degrees Fahrenheit;

    f) Do not spray when rain, fog or other precipitation is falling or is imminent. Wind and other weather data would be monitored and reported for all broadcast applications. The table below identifies BPA's proposed minimum weather and wind speed restrictions (to be used in the absence of more stringent label instructions and restrictions).

g) During application, applicators would monitor weather conditions hourly at sites where spray methods are being used.

Required Herbicide Buffer Widths (from Bankfull Elevation) and Maximum/Minimum Wind Speeds (Mph)

Active ingredient	Broadcast application[1]		Backpack sprayer/bottle /spot spray foliar/basal[2]		Hand application wicking/ wiping/ injection[3]
	Min buffer (ft.)	Max/ Min wind speed (mph)	Min buffer (ft.)	Max/ Min wind speed (mph)	Min buffer (ft.)
2,4-D (amine)	100	10/2	50	5/2	15
Aminopyralid	100	10/2	15	5/2	0
Chlorsulfuron	100	10/2	15	5/2	0
Clethodim	**Not Allowed**	**Not Allowed**	50	5/2	50
Clopyralid	100	10/2	15	5/2	0
Dicamba	100	10/2	15	5/2	0
Glyphosate (aquatic)	100	10/2	15	5/2	0
Glyphosate	100	10/2	100	5/2	100
Imazapic	100	10/2	15	5/2	0
Imazapyr	100	10/2	15	5/2	0
Metsulfuron	100	10/2	15	5/2	0
Picloram	100	8/2	100	5/2	100
Sethoxydim	100	10/2	50	5/2	50
Sulfometuron	100	10/2	15	5/2	0
Triclopyr (TEA)	**Not Allowed**	**Not Allowed**	50	5/2	0 for cut-stump application; 15 feet for other applications
Fluroxypyr	300	10/2	300	5/2	300
Herbicide Mixtures	100	Most conservative of listed herbicides	15	Most conservative of listed herbicides	Most conservative of listed herbicides

[1] Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms

[2] Spot and localized foliar and basal/stump applications using a hand-pump backpack sprayer or field-mixed or pre-mixed hand-operated spray bottle; Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms.

Active ingredient	Broadcast application[1]	Backpack sprayer/bottle /spot spray foliar/basal[2]	Hand application wicking/ wiping/ injection[3]
[3] Hand applications to a specific portion of the target plant using wicking, wiping, or injection techniques; herbicides do not touch the soil during the application process			

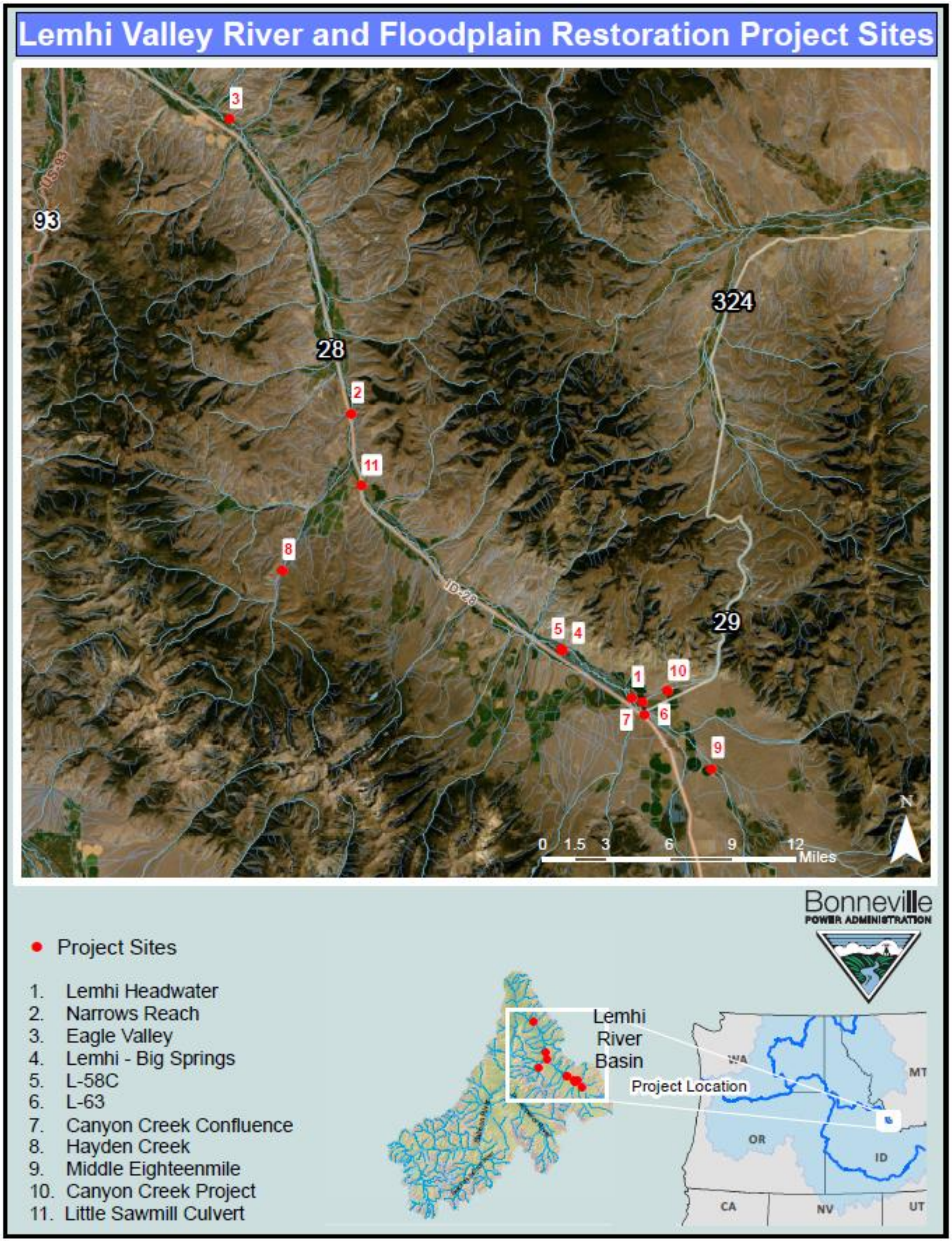
ESA-Listed Terrestrial Species

On sites where ESA-listed **terrestrial wildlife** may occur (within one mile of habitat where ESA-listed terrestrial wildlife occur), herbicide use would be limited to the chemicals and application rates as shown in the table below. Staff would avoid any potential for direct spraying of wildlife, or immediate habitat in use by wildlife for breeding, feeding, or sheltering.

Maximum Application Rates (per discrete application) within one Mile of Habitat where ESA-listed Terrestrial Species Occur (lb./ac)

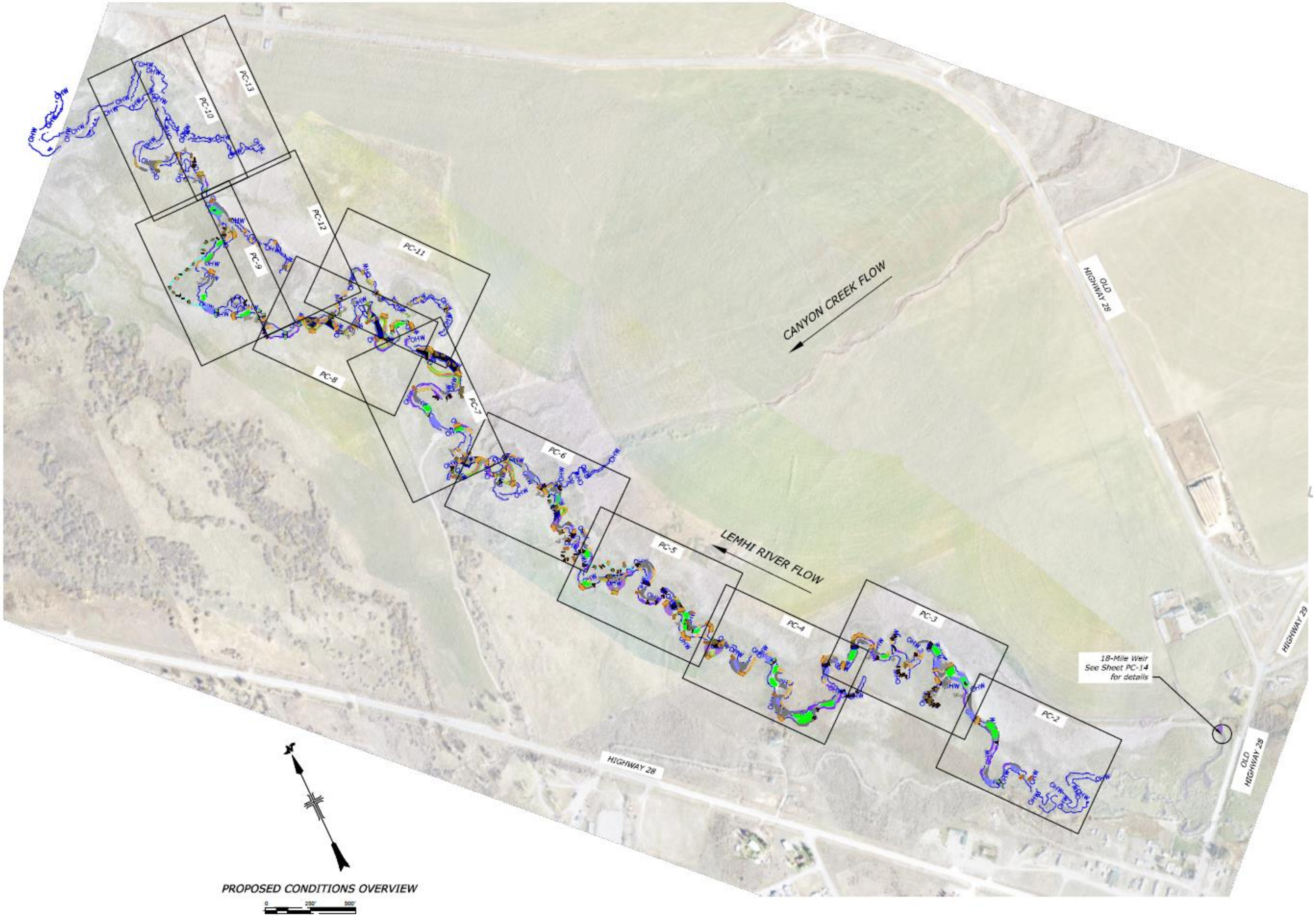
Active Ingredient	Mammals	Birds	Invertebrates
2,4 –D	Not Allowed	Not Allowed	Not Allowed
Aminopyralid	0.22	0.11	Not Allowed
Chlorsulfuron	0.083	0.083	Not Allowed
Clethodim	Not Allowed	Not Allowed	Not Allowed
Clopyralid	0.375	0.375	0.375
Dicamba	Not Allowed	Not Allowed	Not Allowed
Glyphosate	2.0	2.0	2.0
Imazapic	0.189	0.189	Not Allowed
Imazapyr	1.0	1.0	Not Allowed
Metsulfuron	0.125	0.125	Not Allowed
Picloram	Not Allowed	Not Allowed	Not Allowed
Sethoxydim	0.3	0.3	0.3
Sulfometuron	Not Allowed	Not Allowed	Not Allowed
Triclopyr (TEA)	Not Allowed	Not Allowed	Not Allowed

Appendix D - Project Maps and Designs

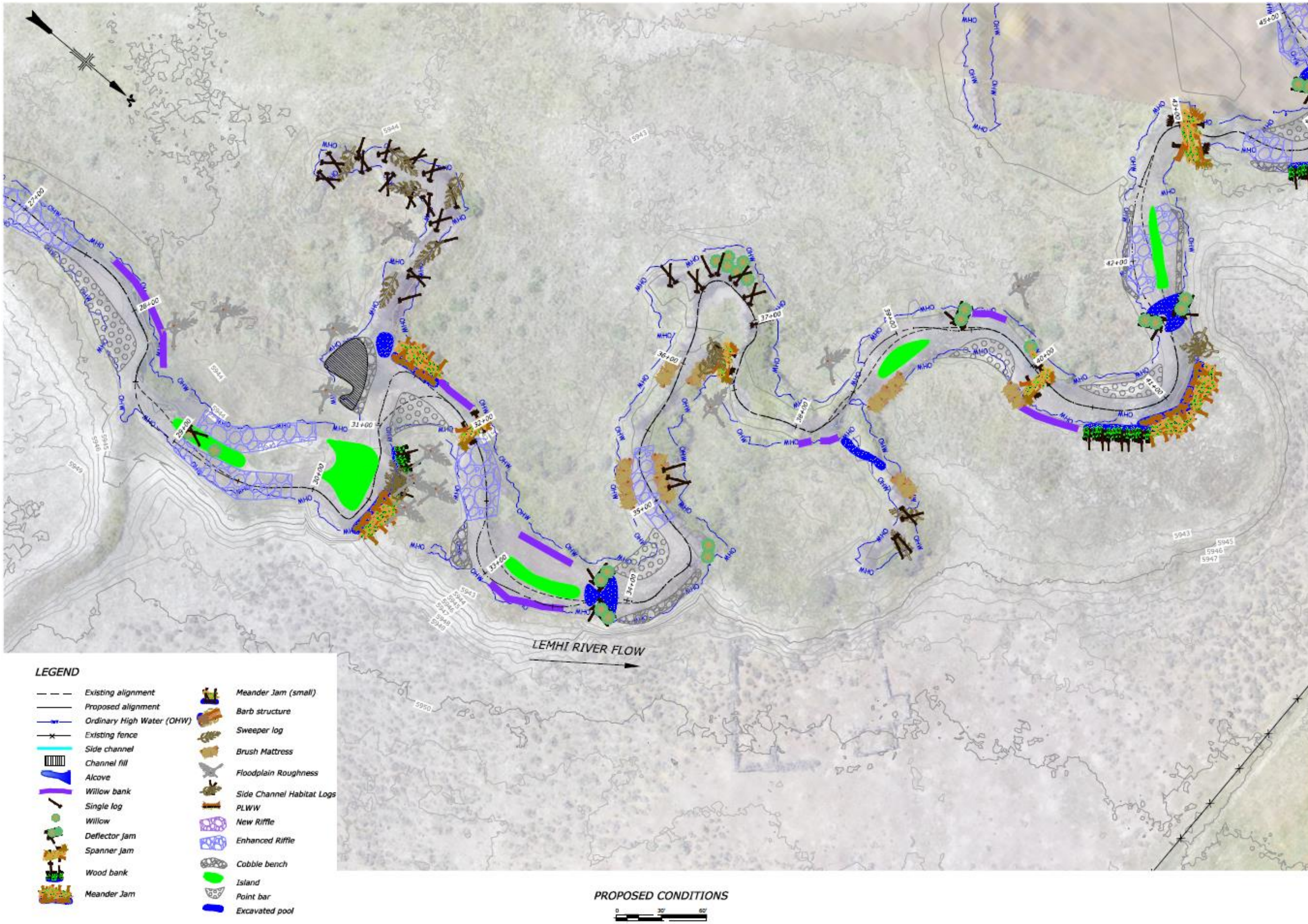


Lemhi Headwaters

Lemhi Headwaters project features overview

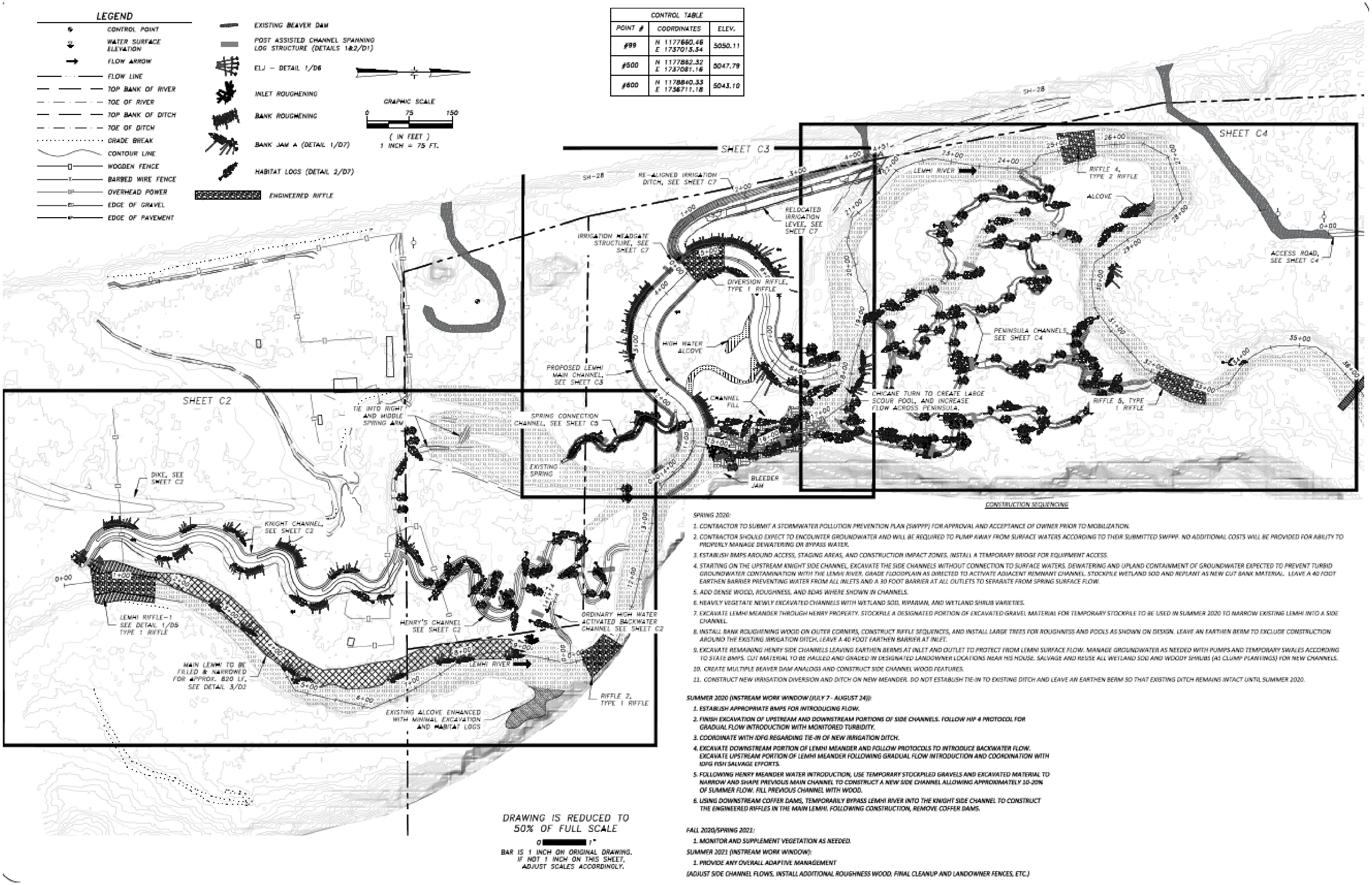


Lemhi Headwaters Project, showing details of one section (second section from right in prior figure – note reversal of orientation)



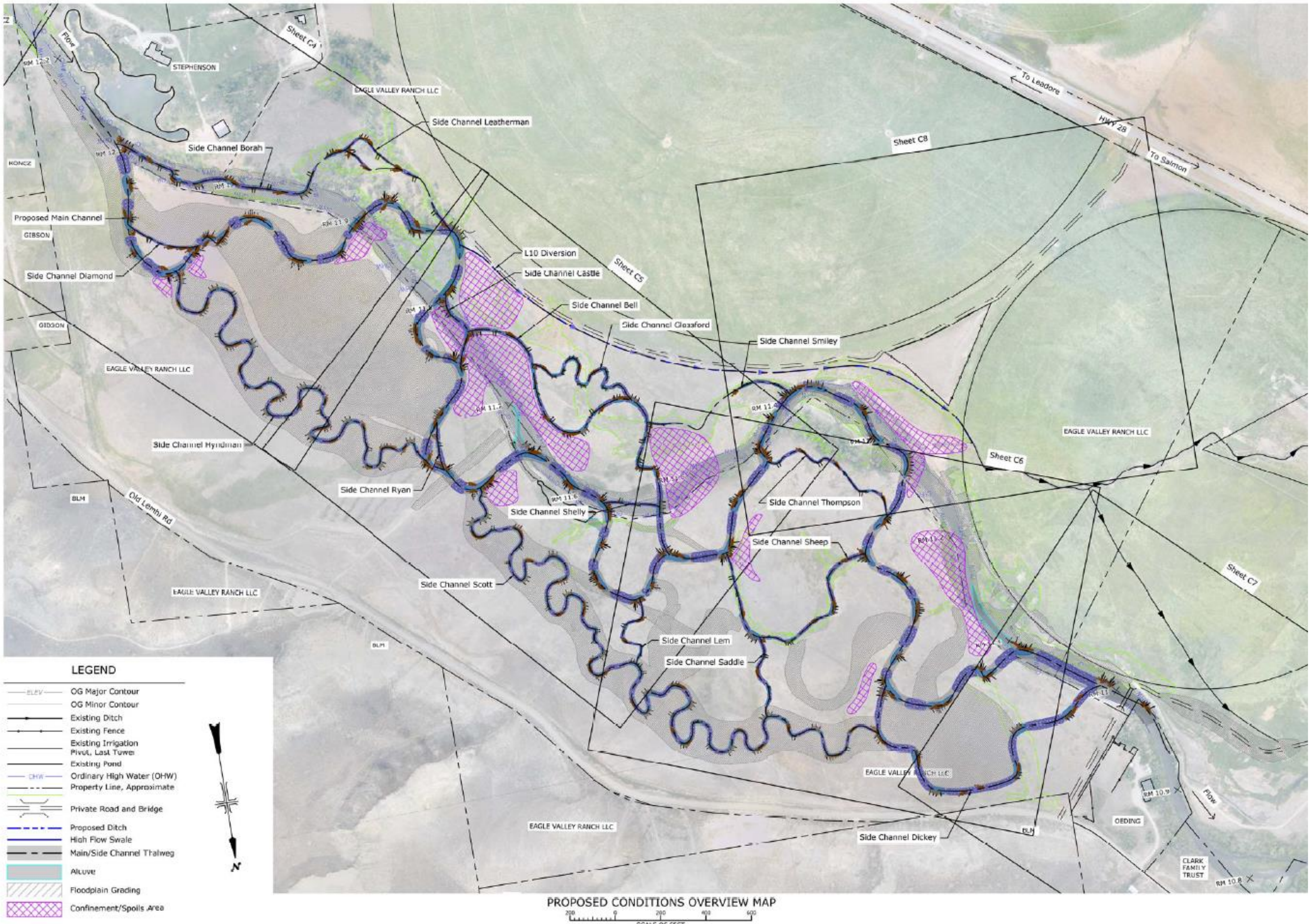
Narrows Reach

Narrows Reach project features



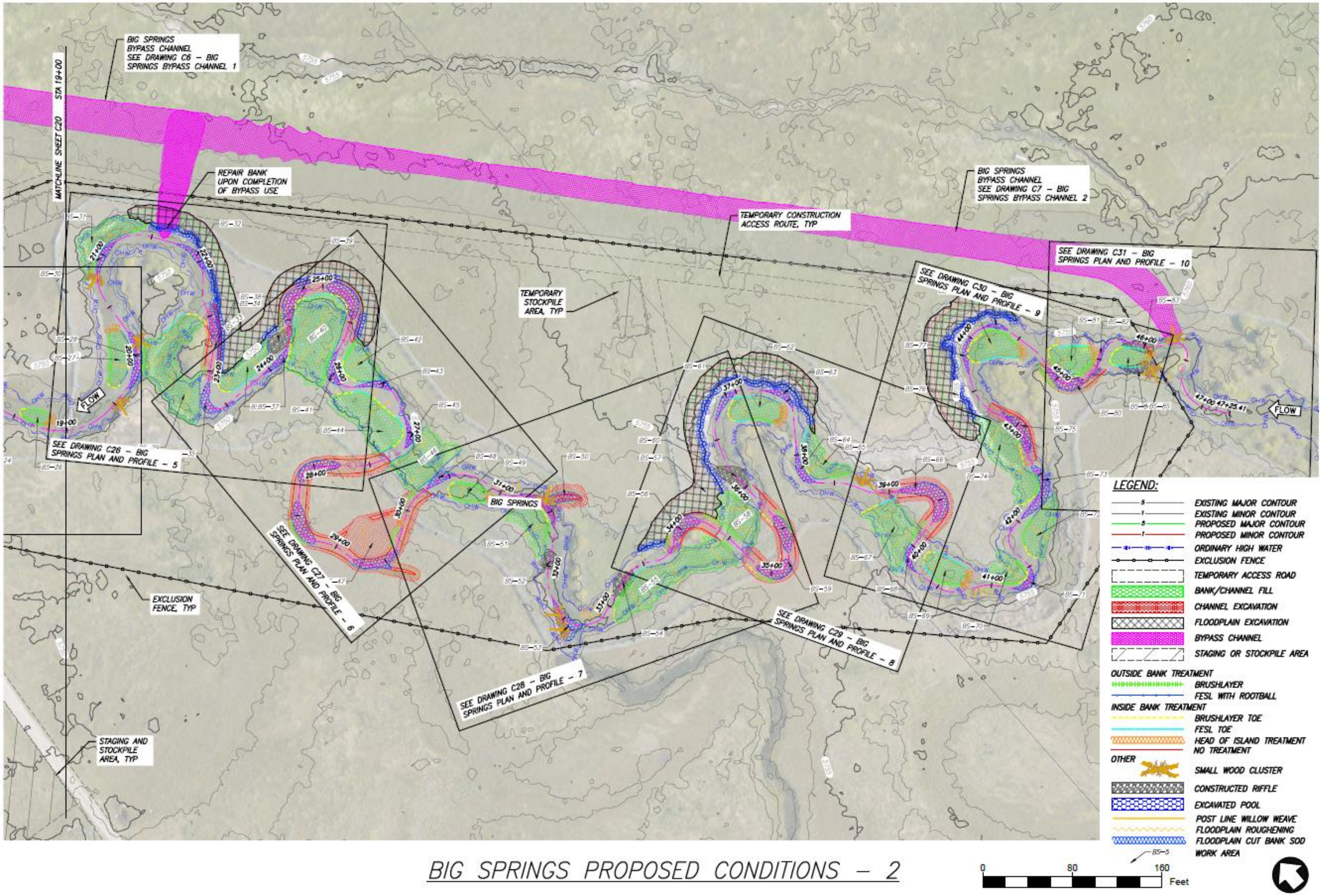
Eagle Valley

Eagle Valley project features

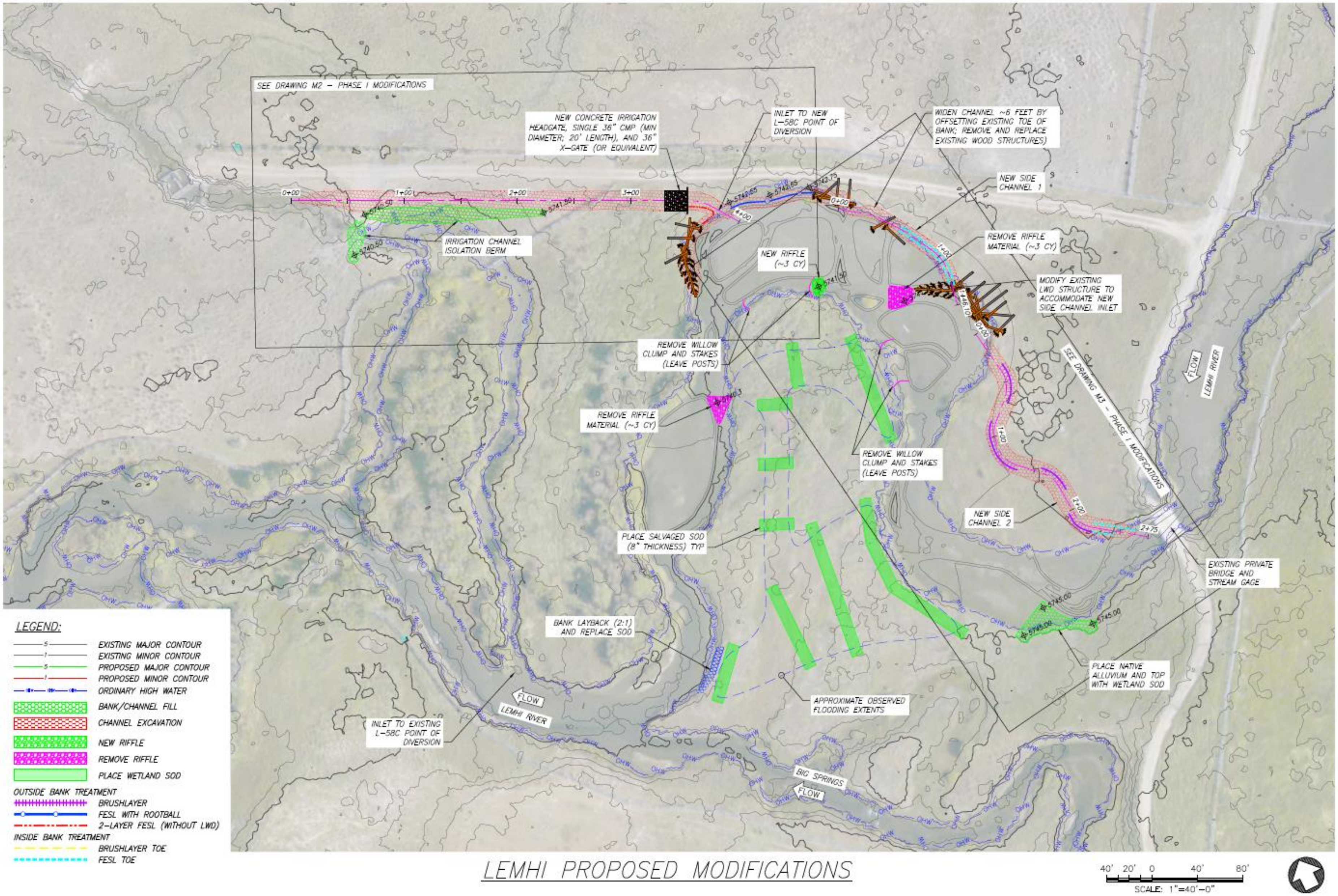


Lemhi/Big Springs

Lemhi/Big Springs project features

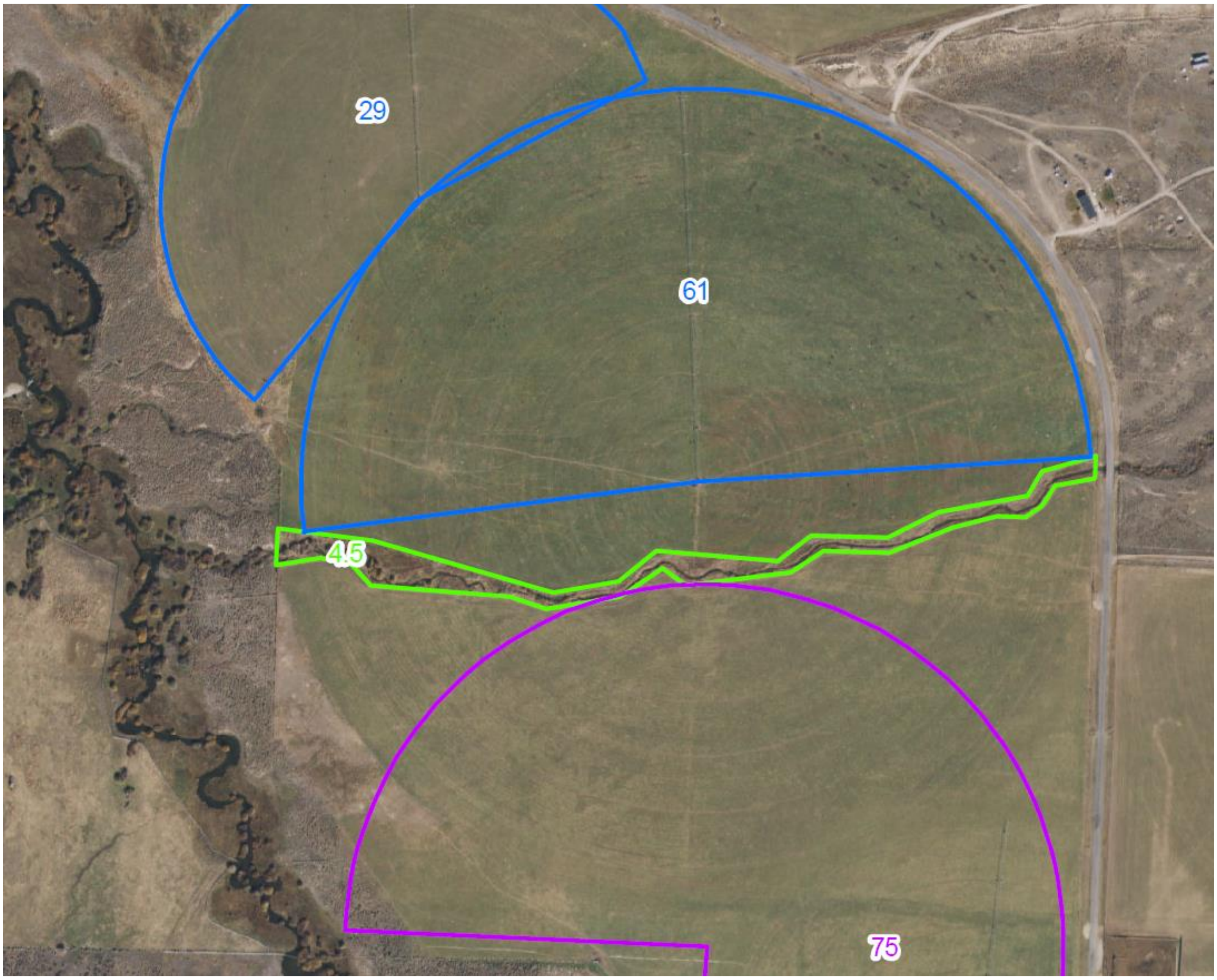


Lemhi/Big Springs, the adaptive management modification features

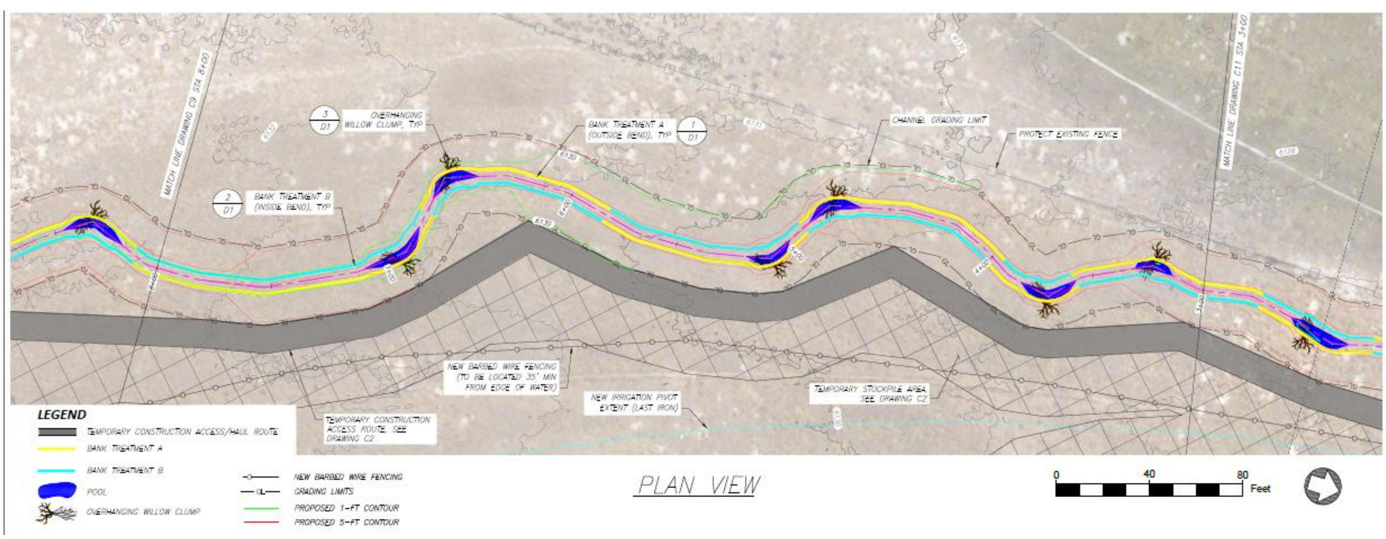


Canyon Creek Confluence

The project is currently in the conceptual design and planning phase. The figure here shows the irrigation system redesigned from one pivot to two, providing opportunity to physically restore the creek. (Numbers are acres)

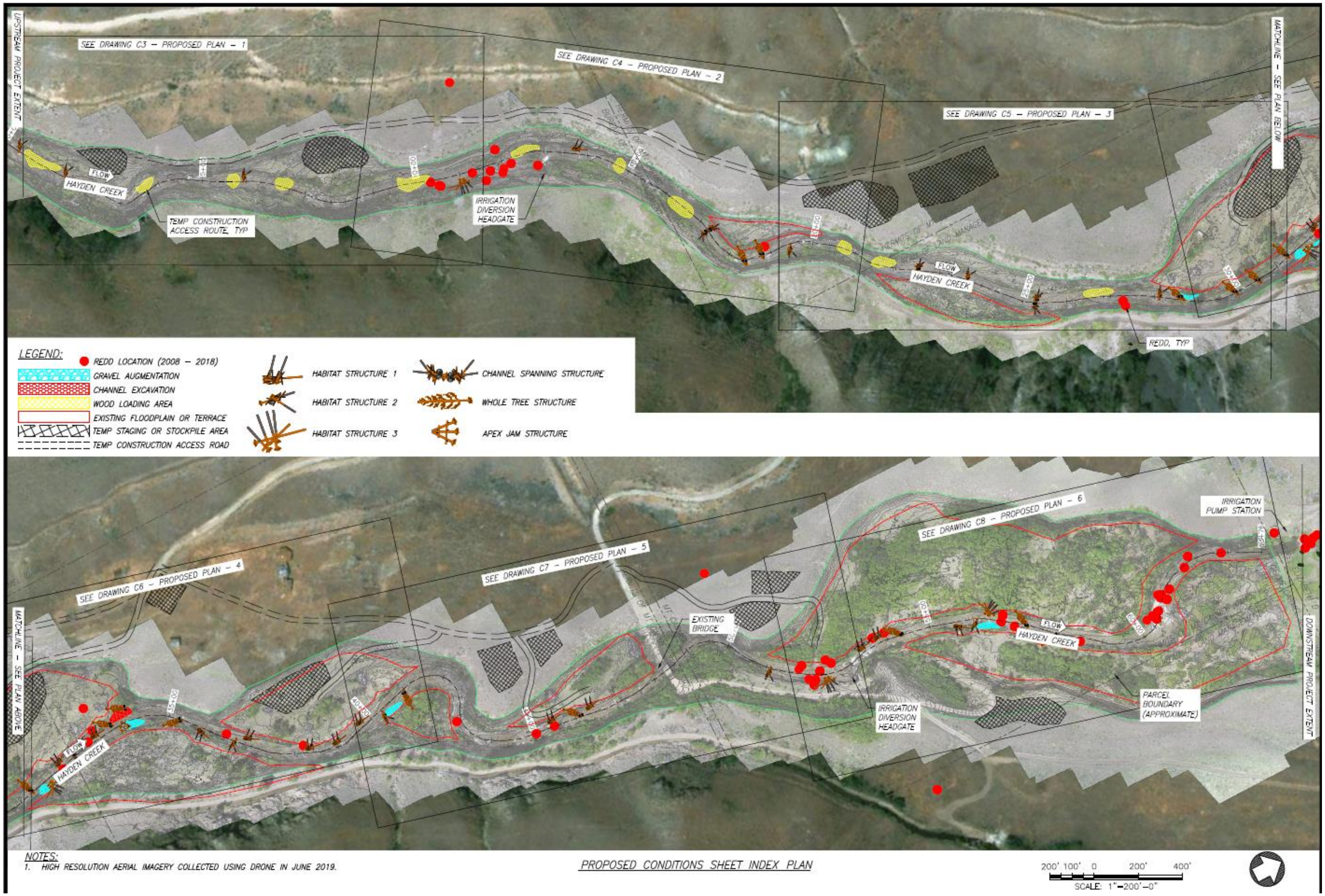


Typical design features to be applied to Canyon Creek. (Example here from similar project implemented in 2019).



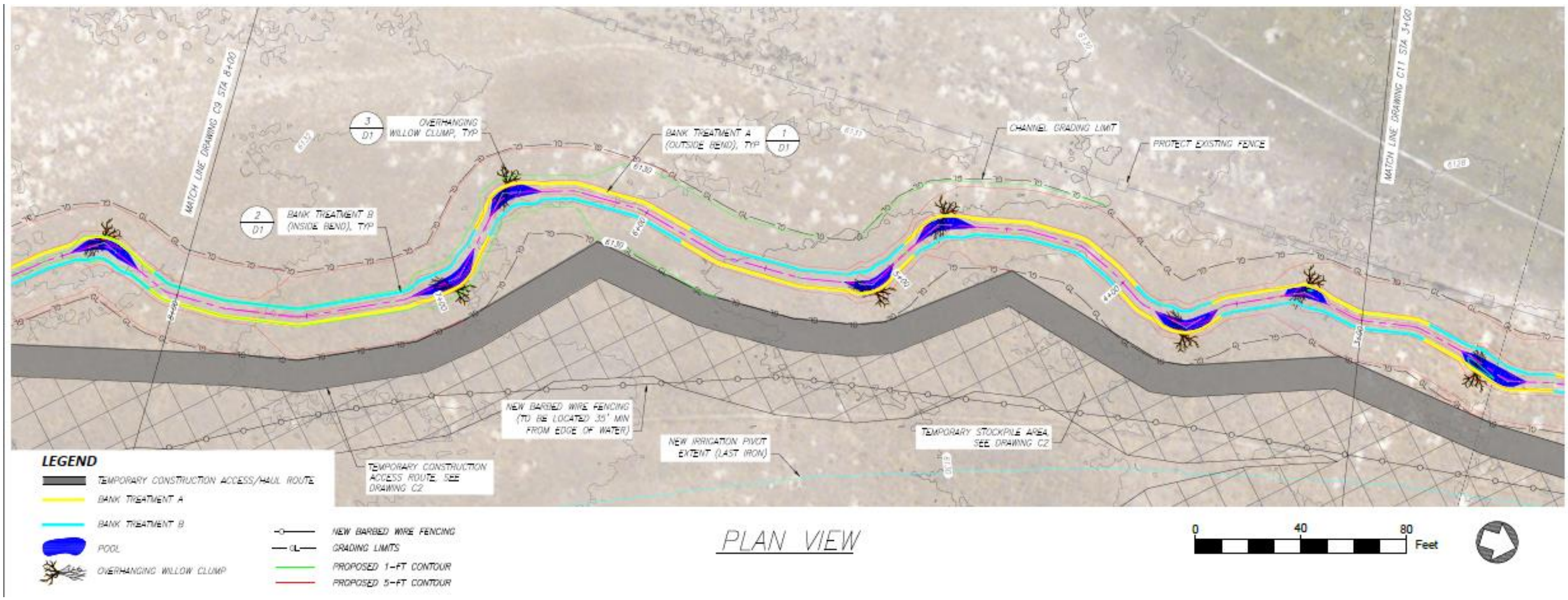
Hayden Creek

Hayden Creek project proposal (downstream section of project is the bottom figure)

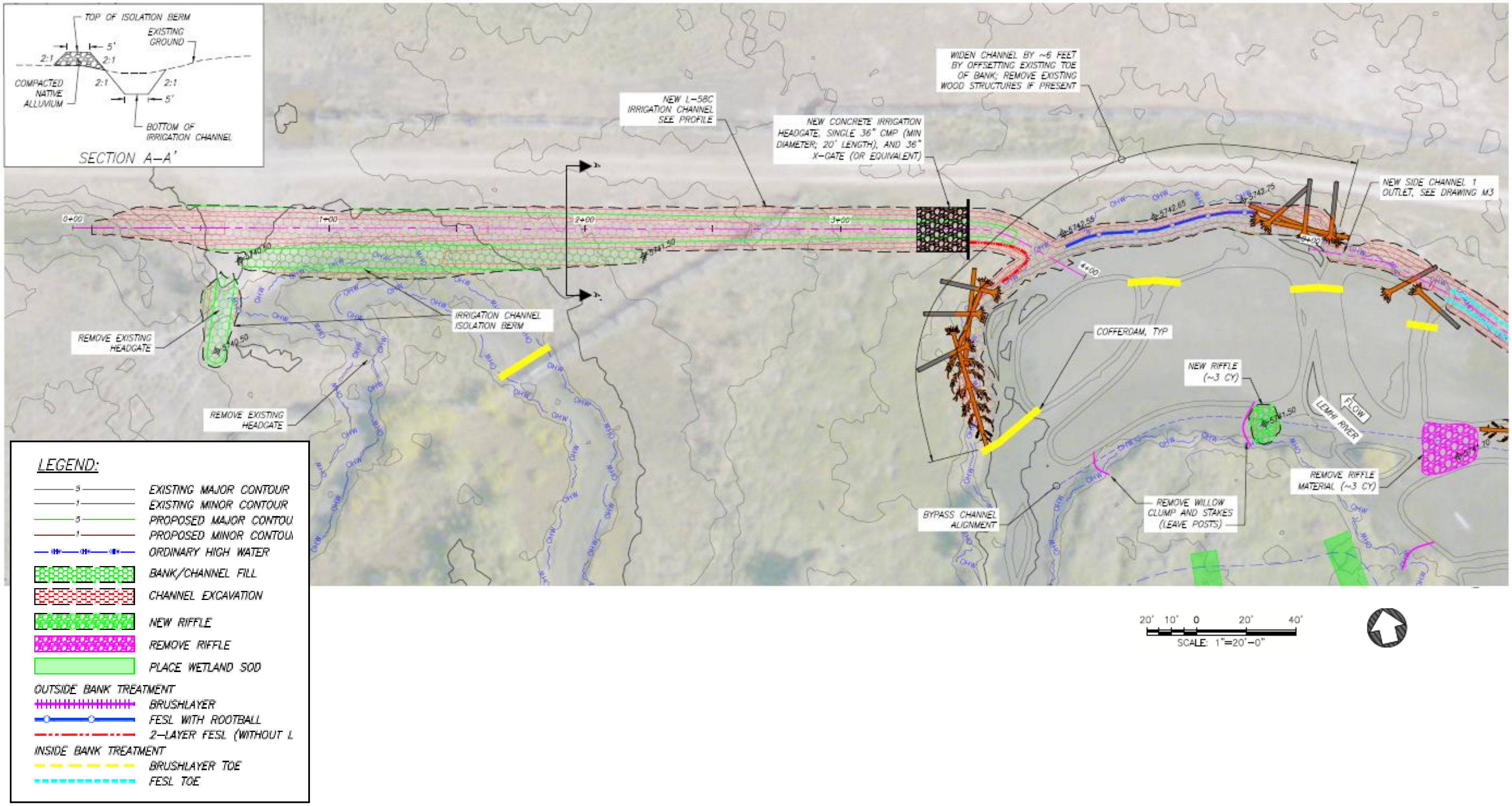


Middle Eighteenmile

The project is currently in the conceptual design and planning phase, thus no detailed plans are yet available. This is a conceptual drawing exemplifying the typical features to be constructed. (Detail here from an essentially identical project immediately upstream implemented in 2019).

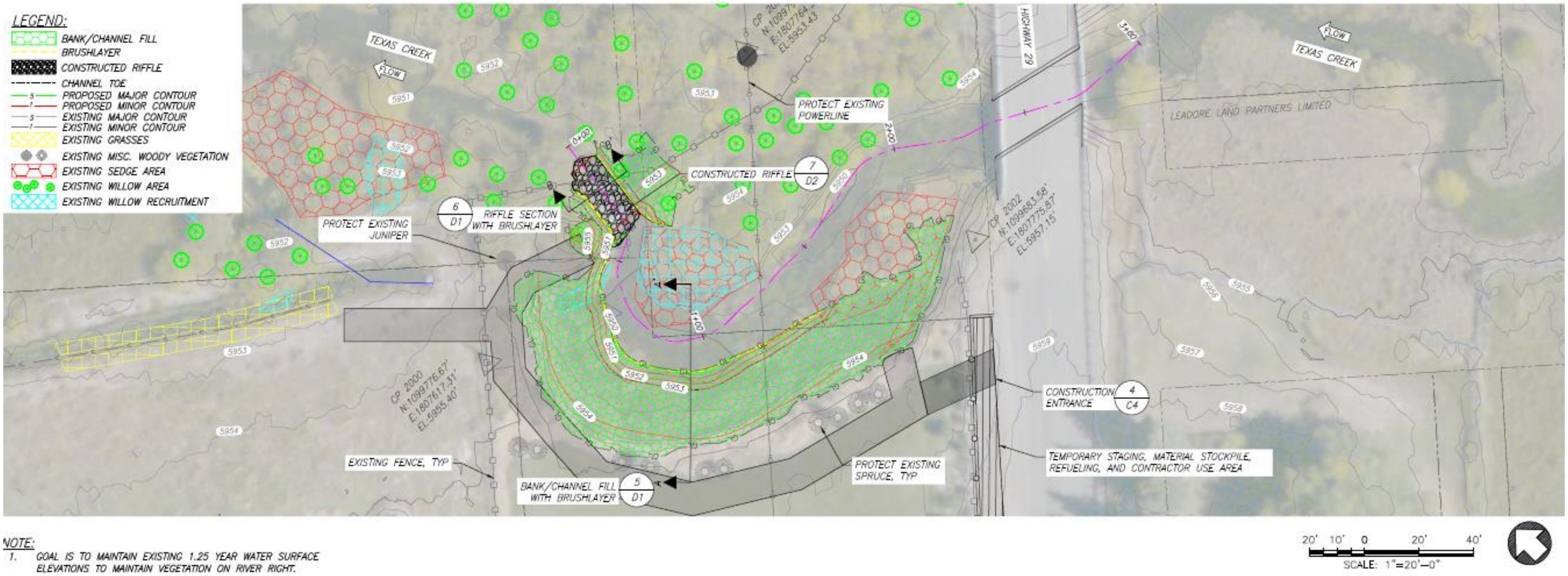


L-58C Diversion Relocation



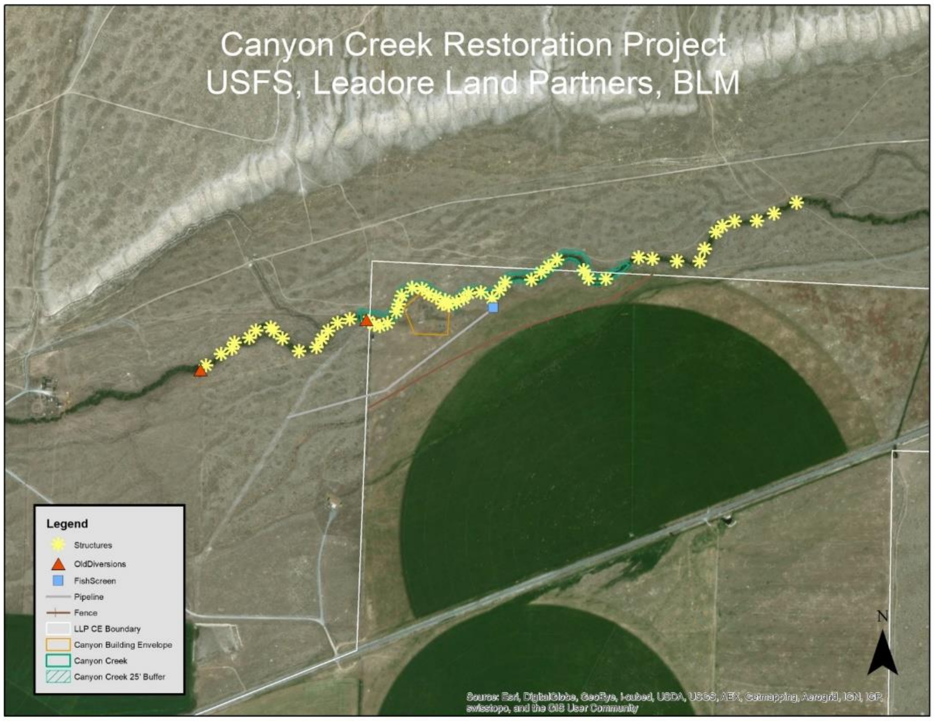
L-63 Weir Removal

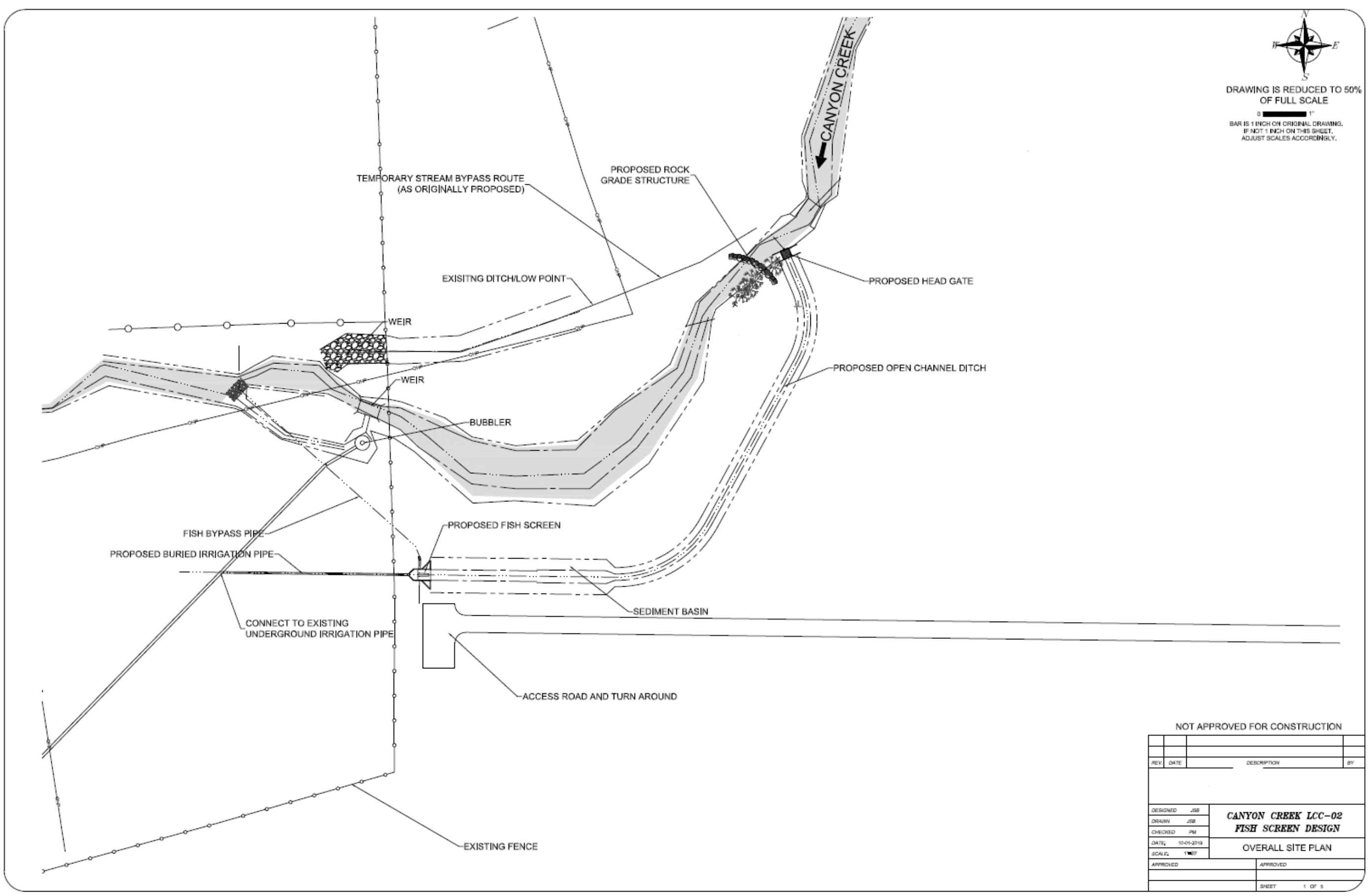
L-63 Weir Removal Project



Canyon Creek Boundary

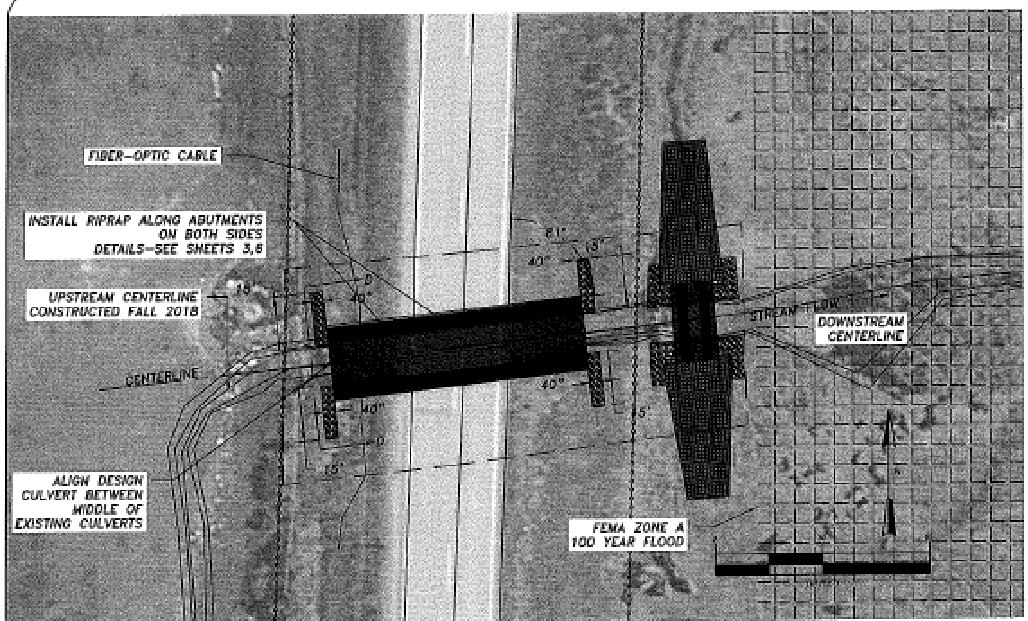
Canyon Creek Diversion Relocation Project





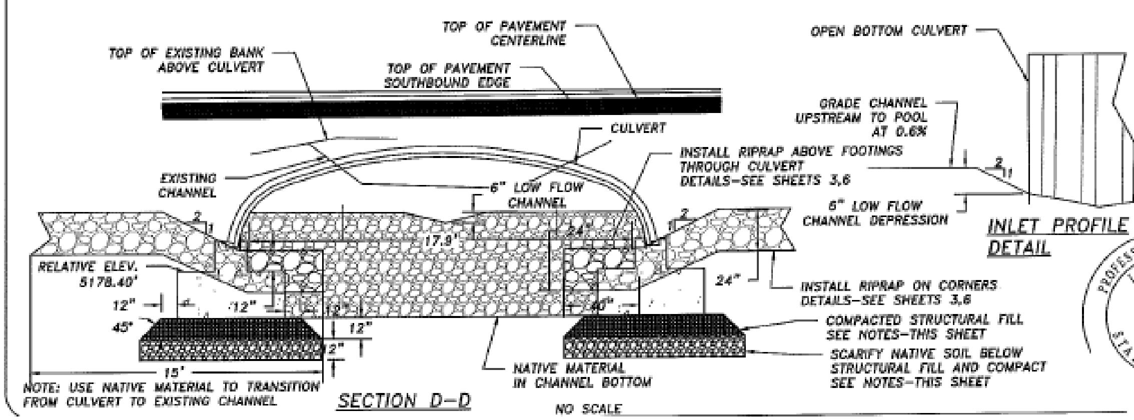
Little Sawmill Culvert

CONSTRUCTION DETAILS 1 –SHEET 6



CONSTRUCTION NOTES

1. CULVERT AND FOOTING INSTALLATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS, ITD 2018 STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION SECTION 508, AND THE AASHTO SPECIFICATIONS FOR HL–93 LOADING.
2. THE AREA SHALL BE CLEARED AND STRIPPED OF ALL BRUSH, ROOTS, SOD, LARGE ROCK, OR OTHER MATERIAL NOT SUITED FOR FOUNDATION MATERIAL FOR THE DESIGNED STREAM CROSSING. ALL UNSUITABLE MATERIALS SHALL BE REMOVED AND DISPOSED OF IN DESIGNATED AREAS (ABOVE THE HIGH WATERLINE OF THE STREAM).
3. CHANNEL BANKS SHALL BE SLOPED AS SHOWN ON THE DRAWINGS.
4. CULVERT AND FOOTING ARE TO FOLLOW STREAM GRADE.
5. SITE PREPARATION FOR CONCRETE ABUTMENTS SHOULD BE ACCOMPLISHED BY COMPACTING THE TOP 12 INCHES OF SUB GRADE (NATIVE GRAVELS) TO 95 PERCENT OF OPTIMUM DRY DENSITY AS DETERMINED BY ASTM D698 AND THEN BEING COVERED BY 12 INCHES OF FINE AGGREGATE BASE MEETING OR EQUAL TO THE ITD STANDARD SPECIFICATIONS, SECTION 703.02 WITH 6% TO 12% PASSING THE NO. 200 SIEVE. ALL SUBGRADE AND BASE LAYERS SHOULD BE COMPACTED TO A MINIMUM OF 95 PERCENT OF OPTIMUM DRY DENSITY AS DETERMINED BY ASTM D698. SOIL SHALL BE COMPACTED TO MEET SOIL BEARING REQUIREMENTS FOR FOOTINGS (3,000 PSF). DIFFERENTIAL SETTLEMENT OF FOOTINGS SHOULD BE WITHIN A HALF INCH AND TOTAL SETTLEMENT SHOULD NOT EXCEED ONE INCH. LIFTS SHALL NOT EXCEED 8 INCHES.
6. EXISTING STREAM BANK VEGETATION SHALL BE PROTECTED EXCEPT WHERE ITS REMOVAL IS ABSOLUTELY NECESSARY FOR THE COMPLETION OF THE CROSSING. DISTURBED AREAS SHALL BE RE–SEEDED.
7. USE RIP RAP TO TRANSITION BETWEEN THE ENDS OF THE CULVERT AND NATURAL CHANNEL. MAXIMUM SLOPE SHALL BE 1.5H:1V.
8. SITE INGRESS AND EGRESS ROUTES SHALL MINIMIZE THE REMOVAL OR DESTRUCTION OF RIPARIAN TREES AND SHRUBS.
9. THE STRUCTURE SHALL BE BACKFILLED USING CLEAN, WELL GRADED GRANULAR MATERIAL THAT MEETS THE REQUIREMENTS OF AASHTO M 145 FOR SOIL CLASSIFICATIONS, A–1, A–2–4, A–2–5, OR A–3 FOR BOX CULVERTS. BACKFILL MUST BE PLACED SYMMETRICALLY ON EACH SIDE OF THE STRUCTURE IN 6–INCH UNCOMPACTED LIFTS. EACH LIFT SHALL BE COMPACTED TO A MINIMUM OF 90 PERCENT DENSITY PER AASHTO T 180.
10. BRING STRUCTURAL BACKFILL UP EVENLY ON ALL SIDES OF THE STRUCTURE AS APPROPRIATE. EXTEND EACH LAYER TO THE LIMITS OF THE EXCAVATION OR TO NATURAL GROUND.
11. ROCK RIP RAP SHALL HAVE A SPECIFIC GRAVITY NO LESS THAN 2.65.
12. FOOTINGS WILL BE SIZED BY CULVERT MANUFACTURER. FOOTINGS SHALL BE CONTINUOUS.
13. SEE CALCULATIONS SHEET AND APPENDIX FOR CALCULATIONS AND ADDITIONAL INFORMATION.
14. DURING THE STREAMBED MATERIAL INSTALLATION, THE FINES SHOULD BE WASHED INTO THE STREAMBED MATERIAL UNTIL WATER POOLS ON THE SURFACE.
15. ALL CONSTRUCTION ACTIVITY SHALL BE IN ACCORDANCE WITH HIP III CONSERVATION MEASURES.
16. NRCS SOIL SURVEY SOILS CLASSIFICATION IS A–1, A–2.
17. CULVERT IS TO HAVE 1.4 FT MINIMUM COVER DEPTH.
18. CONTACT DESIGN ENGINEER FOR ANY DESIGN CHANGES.



Riprap Protection Gradation			
% passing by weight	lower size, in	upper size, in.	average size, in.
100	12	19	16
75	11	17	14
50	10	14	12
20	7	10	8
* utilizing NRCS EFH 16A: Far West States-Lane method			

PROFESSIONAL ENGINEER LICENSED STATE OF IDAHO

9/24/2020

BONNEVILLE POWER ADMINISTRATION

DOE/BP-4955 ▪ May 2020