PROGRAMMATIC BIOLOGICAL ASSESSMENT

For Habitat Restoration Projects in Idaho

Pursuant to:
Section 7 of the Endangered Species Act and
Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act

Submitted by:

National Marine Fisheries Service

In Partnership with
US Army Corps of Engineers
Bureau of Reclamation
Natural Resources Conservation Service
United States Forest Service
Bureau of Land Management

March 2014

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Abbreviations and Acronyms

BLM – Bureau of Land Management
BPA – Bonneville Power Administration
DPS – Distinct Population Segment
EFH – Essential fish habitat
ESA – Endangered Species Act
ESU – Evolutionarily Significant Unit
HIP – Habitat Improvement Program
ICTRT – Interior Columbia Basin Technical Recovery Team
IDFG – Idaho Department of Fish and Game
LWD – large woody debris
MSA – Magnuson-Stevens Fishery Conservation and Management Act
NMFS – National Marine Fisheries Service
NRCS – Natural Resources Conservation Service
OHWM – Ordinary High Water Mark
PCEs – Primary constituent elements
PIT – Passive Integrated Transponder
RM – river mile
USACE – U.S. Army Corps of Engineers
USFS – U.S. Forest Service
FWS – U.S. Fish and Wildlife Service

Glossary of Terms

Action Agency
The action agencies for this consultation are the federal agencies funding or permitting activities covered in this consultation.

Bank Reshaping
Reducing the angle of the bank slope without changing the location of its toe. However, the toe may be reinforced with rootwads or coir logs.

Engineered Log Jams
Engineered log jams are patterned after stable natural log jams and can be either unanchored or anchored in place using rock, wood piles, or mechanical ground anchors (such as pivot or expansion anchors). Engineered log jams create a hydraulic shadow, a low-velocity zone downstream that allows sediment to settle out. Scour holes develop adjacent to the log jam. While providing valuable fish and wildlife habitat, they also redirect flow and can provide stability to a streambank or downstream gravel bar.

Grade Control Structures
Grade control structures are designed to arrest channel downcutting or incision by providing a grade control that retains sediment, lowers stream energy, and increases water elevations to reconnect floodplain habitat and diffuse downstream flood peaks. Grade control structures also serve to protect infrastructure that is exposed by channel incision and to stabilize over-steepened banks. **Boulder weirs** are typically installed for grade control at culverts and in constructed side channels.

Rootwad Toes
Rootwad toes are structural features that prevent erosion at the toe of a streambank. The toe refers to that portion of the steambank that extends from the channel bottom up to the lower limit of vegetation. Rootwad toes can provide the foundation for soft upper-bank treatments such as bank reshaping and soil reinforcement. Rootwad toes provide better fish habitat and have a shorter life span than rock toes.

Soil Reinforcement/Soil Pillows
Soil layers or lifts encapsulated within natural materials. Often the lifts are used to form a series of stepped terraces along the bank which then are planted with woody vegetation.

1.0 Introduction

The National Marine Fisheries Service (NMFS), U.S. Army Corps of Engineers (USACE), Bureau of Reclamation (Reclamation), Natural Resources Conservation Service (NRCS), United States Forest Service (USFS), and the Bureau of Land Management (BLM), collectively called the *action agencies*, are initiating programmatic consultation pursuant to the consultation requirements of Section 7 of the Endangered Species Act (ESA) and Section 305 of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). This programmatic consultation addresses habitat restoration activities funded, permitted, or undertaken by the action agencies within the state of Idaho. Individual projects will each be implemented by a Project Sponsor (usually non-federal), who has applied for funding, technical assistance, or a permit from one or more of the action agencies. In some cases, the Project Sponsor may be the federal action agency itself. For categories of habitat restoration activities for which a federal action agency has an existing programmatic consultation in place with NMFS and FWS (e.g. stream road crossings, weeds treatment), such activities will continue to be covered under the existing programmatic consultation.

This consultation was initiated to programmatically assess routine aquatic habitat restoration projects throughout the anadromous streams of Idaho. NMFS drafted the BA and circulated the first draft to the other action agencies on July 9th, 2013. NMFS then revised the BA in response to suggestions from the other action agencies on how to refine the description of the action and provide appropriate conservation measures and protocols. On October 21st, 2013, NMFS circulated a revised BA to the action agencies. On December 6th, 2013, NMFS met with U.S. Fish and Wildlife Service (FWS) to discuss the proposed action. Between December 2013 and March 2014, NMFS worked with FWS to further refine the proposed action in order to minimize impacts to bull trout and terrestrial ESA-listed species. NMFS submitted the final BA to NMFS and FWS on xxxx.

2.0 Proposed Action

2.1. Action Agencies

The action agencies in this programmatic consultation are the National Marine Fisheries Service (NMFS), U.S. Army Corps of Engineers (USACE), Bureau of Reclamation (Reclamation), Natural Resources Conservation Service (NRCS), United States Forest Service (USFS), and the Bureau of Land Management (BLM). Here we describe the mechanisms through which each agency funds, permits, or implements habitat restoration projects in Idaho.

NMFS

NMFS provides funding for habitat restoration projects through the Pacific Coast Salmon Recovery Fund (PCSRF) and the Mitchell Act:

- The PCSRF was established by Congress in FY 2000 to protect, restore, and conserve Pacific salmon and steelhead populations and their habitats. Under the PCSRF, NMFS manages a program to provide funding to states and tribes of the Pacific Coast region. With this funding states and tribes have undertaken 10,214 projects, resulting in significant changes in salmonid habitat conditions and availability. Approximately 3% of total PCSRF funding has gone to projects in Idaho (NMFS 2011a).

- Congress passed the Mitchell Act in 1938 to provide for the conservation of salmon and steelhead fishery resources of the Columbia River. The program has evolved into three primary components: operation of 17 fish hatcheries; construction, operation, and maintenance of more than 700 fish screens at irrigation diversions to protect juvenile salmon and steelhead in Oregon, Washington, and Idaho; and ongoing operations and maintenance of 90 fishways enhancing adult fish passage to nearly 2,000 miles of stream habitat in all three states. This consultation supplements the existing informal consultation on the Mitchell Act Irrigation Diversions Screening Programs, completed on January 31, 2000 (NMFS 2000). The informal consultation covers the construction, operation, and maintenance of fish screens under the Mitchell Act program, except for projects involving significant instream construction. This programmatic habitat restoration consultation will cover inwater work activities associated with fish screen installations that were not covered in the January 31, 2000, Mitchell Act informal consultation.

USACE

Habitat restoration projects that alter stream channels or streambanks often require a permit from the USACE. The USACE regulates activities in waters of the United States through Section 404 of the Clean Water Act of 1972 and Section 10 of the Rivers and Harbors Act of 1899. Under Section 404 of the Clean Water Act, a Department of the Army permit, issued through the USACE, is required for the discharge of dredged or fill material into all waters of the United States, including special aquatic sites such as wetlands and vegetated shallows. Under Section 10 of the Rivers and Harbors Act, a Department of the Army permit, issued through the USACE, is required for any structure or work that occurs in, above or under navigable waters of the United States or affects the course, location, condition or capacity of such waters. For the State of Idaho, a list of navigable waters is available at the USACE website: http://www.nww.usace.army.mil/html/offices/op/rf/water_regulated.asp

U. S. Bureau of Reclamation

Reclamation works in partnership with local landowners, representatives from states, Tribes, other federal agencies, and conservation groups on habitat projects to improve spawning and rearing habitat for Columbia River Basin salmon and steelhead listed under the Endangered Species Act. Reclamation's Tributary Habitat Program was initiated in 2000 to mitigate for the impacts of the Federal Columbia River Power System on salmonids. The program is focused on providing technical services including project coordination, environmental compliance, permit application, engineering design, and construction monitoring to local project sponsors who obtain federal, state, and private funding to construct the habitat projects. In Idaho, Reclamations's Tributary Habitat Program currently includes the Little Salmon, Upper Salmon, Lemhi, Yankee Fork and Pahsimeroi subbasins, but could expand to other Idaho subbasins in the future. Projects in other subbasins would also be covered under this programmatic consultation.

Reclamation contributions focus on instream habitat projects that:

- increase streamflow through acquisition or lease of water rights, or through improved irrigation efficiency
- remove barriers to improve access to a greater range of spawning and rearing habitat
- replace screens on water diversions to reduce entrainment of fish in water delivery systems
- increase channel complexity
- reconnect side-channels and floodplains to main stream channels

Reclamation currently focuses on the project categories listed above, but could engage in any of the other project categories included in this programmatic consultation.

NRCS

NRCS provides technical and financial assistance to private landowners and others for habitat restoration projects with funding the agency administers under the Federal Farm Bill. NRCS also participates as a partner organization in habitat restoration projects that utilize other funding sources. NRCS contributes technical expertise in an array of disciplines to these projects.

USFS

USFS administers public lands throughout Idaho, covering many miles of stream and riparian habitat. For categories of habitat restoration activities for which the USFS has an existing programmatic consultation in place with NMFS and FWS (e.g. stream road crossings, weeds treatment), such activities will continue to be covered under the existing programmatic consultation—as explained below under descriptions of specific activity categories.

BLM

BLM administers public lands throughout Idaho, covering many miles of stream and riparian habitat. For categories of habitat restoration activities for which BLM has an existing programmatic consultation in place with NMFS and FWS (e.g. stream road crossings, weeds treatment), such activities will continue to be covered under the existing programmatic consultation—as explained below under descriptions of specific activity categories.

BPA (not an action agency in this consultation)

BPA is not an action agency in this programmatic consultation, although BPA funds numerous habitat restoration projects in anadromous streams in Idaho. BPA funds habitat restoration projects in the Columbia River Basin as part of a program to mitigate the impacts of the Federal Columbia River Power System on fish and wildlife. These projects in Idaho are covered under BPA's Habitat Improvement Program. NMFS issued a programmatic opinion and EFH consultation for the third iteration of BPA's Habitat Improvement Program (HIP III, NMFS Reference No. 2013/9274) on March 22, 2013. The categories of habitat restoration actions, conservation measures, and reporting protocols for this Idaho programmatic consultation are similar to those of the BPA's Habitat Improvement Program consultation with NMFS.

2.2. Action Area

The restoration activities described in this biological assessment will occur within the 18 subbasins in the state of Idaho that contain ESA-listed anadromous fishes (Figure 1, Table 1).

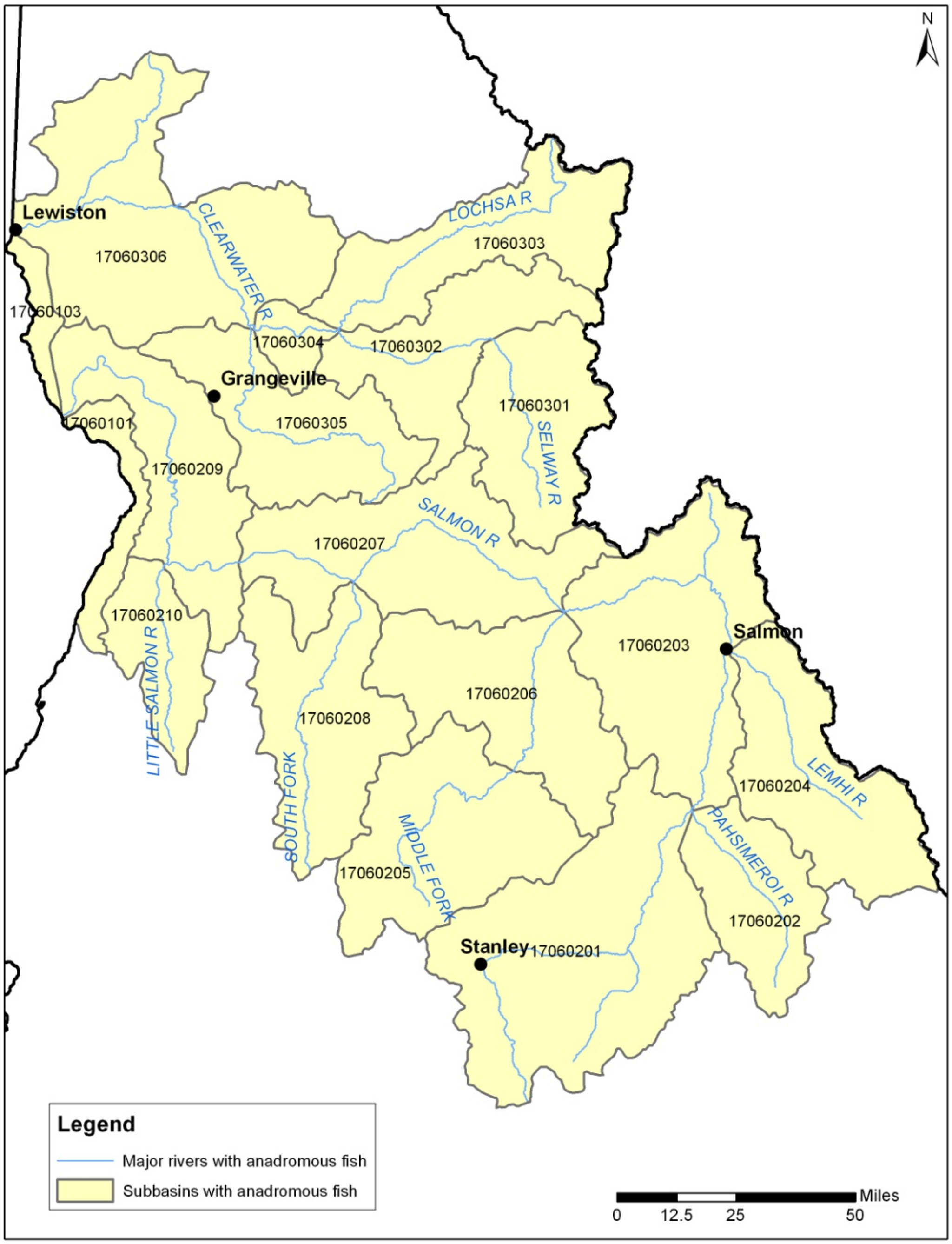

Figure 1. Subbasins in Idaho occupied by ESA-listed anadromous fish species.

Table 1. Subbasins in Idaho with ESA-listed anadromous fish. Bull trout also occupy each of these subbasins.

4th-field HUC	HUC Name
17060101	Hells Canyon
17060103	Lower Snake-Asotin
17060201	Upper Salmon
17060202	Pashimeroi
17060203	Middle Salmon-Panther
17060204	Lemhi
17060205	Upper Middle Fork Salmon
17060206	Lower Middle Fork Salmon
17060207	Middle Salmon-Chamberlain
17060208	South Fork Salmon
17060209	Lower Salmon
17060210	Little Salmon
17060301	Upper Selway
17060302	Lower Selway
17060303	Lochsa
17060304	Middle Fork Clearwater
17060305	South Fork Clearwater
17060306	Clearwater

2.3. Listed Species and Critical Habitat

This BA describes potential effects of the programmatic actions on ESA-listed Snake River fall Chinook salmon, Snake River spring/summer Chinook salmon, Snake River steelhead, and Snake River sockeye salmon, which are under the jurisdiction of NMFS (Table 2). This BA also describes potential effects of the programmatic actions on ESA-listed bull trout, Canada lynx, Northern Idaho ground squirrel, Macfarlane's four-o'clock, Spalding's catchfly, and water howelia; and proposed threatened species yellow-billed cuckoo; which are all under the jurisdiction of FWS (Table 3).

Table 2. ESA-listed fish.

Species	Status; Listing Date; Reference	Designated Critical Habitat
Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened; April 22, 1992; 57 FR 14653	December 28, 1993; 58 FR 68543

Snake River fall		
Chinook salmon (*O. tshawytscha*) Snake River spring/summer	Threatened; June 28, 2005; 70 FR 37160	October 25, 1999; 64 FR 57399
Snake River sockeye salmon (*O. nerka*)	Endangered; Nov. 20, 1991; 6 FR 58619	December 28, 1993; 58 FR 68543
Snake River steelhead (*O. mykiss*)	Threatened; Jan 05, 2006; 71 FR 834	September 02, 2005; 70 FR 52630
Bull trout (*Salvelinus confluentus*)	Threatened; June 10, 1998; 64 FR 58909	October 18, 2010; 75 FR 63898

Table 3. ESA-listed wildlife and plants.

Species	**Status; Listing Date**
Canada lynx *(Lynx canadensis)*	Threatened; March 24, 2000; 65 FR 16052
Northern Idaho ground squirrel *(Spermophilus brunneus brunneus)*	Threatened; April 5, 2000; 65 FR 17779
Yellow-billed cuckoo *(Coccyzus americanus)*	Proposed Threatened; October 30, 2001; 66 FR 54807
Macfarlane's four-o'clock *(Mirabilis macfarlanei)*	Threatened; March 15, 1996; 61 FR 10692
Spalding's catchfly *(Silene spaldingii)*	Threatened; October 10, 2001; 66 FR 51598
Water howellia *(Howellia aquatilis)*	Threatened; July 14, 1994; 59 FR 35860

2.4. Program Implementation Procedures

A habitat restoration project conducted under this consultation may involve multiple parties: one or more federal agencies, a Project Sponsor, a private landowner, and contractors. This BA refers to the Project Sponsor as the entity planning and implementing an individual project. The Project Sponsor will most often be non-federal (e.g. Trout Unlimited or the Nez Perce Tribe) but could in some cases be the federal action agency itself (e.g. USFS). If there are multiple action agencies involved in an individual project, the action agencies will choose one agency to be the lead action agency for the project. The lead action agency will ensure that the Project Sponsor follows all applicable conservation measures and submits all applicable pre- and post-project reports to NMFS and FWS. A federal action agency may also choose to complete project documentation for the Project Sponsor (e.g. NRCS or USACE working with a private landowner).

If one or more action agency intends to fund, permit, or carry out an individual project under this programmatic consultation, the lead action agency will first briefly confirm, via a phone call or email to the local NMFS biologist or NMFS Snake Basin Office in Boise, that the project is likely to fit under this programmatic. The lead action agency will then provide the Project Sponsor with a Project Information Form (Appendix A). The Project Information Form will specify the lead action agency for the project. The lead action agency will ensure that the Project Sponsor completes and submits the Project Information Form to NMFS and FWS (and simultaneously to all other action agencies involved in the project) at least 60 days before initiating the project (or 90 days in some cases, as explained below). NMFS and FWS will review the project information and determine whether additional information or a site visit is necessary. If NMFS or FWS determines that a site visit is necessary, the Project Sponsor and lead action agency will coordinate a site visit for NMFS and/or FWS staff at least 30 days prior to the planned project start date. NMFS and FWS will verify, through reviewing the Project Information Form and additional information provided by the Project Sponsor, or a site visit, that the project falls under this programmatic consultation. Before the project begins, a NMFS biologist will email the Project Sponsor (and all action agencies involved in the project) to confirm that the project fits under this programmatic consultation for listed anadromous species; and a FWS biologist will email the Project Sponsor (and all action agencies involved in the project) to confirm that the project fits under this programmatic consultation for all other listed species. For complex projects with engineering plans, the Project Sponsor will contact NMFS as early as possible in the project development phase to allow sufficient time for a NMFS and/or FWS site visit and discussion of applicable project design and conservation measures.

In the Project Information Form, the Project Sponsor may request minor deviations from the project criteria and conservation measures described in this assessment. If NMFS and FWS determine that the effects of the project will be within the range of the effects analyzed in this assessment, then NMFS and FWS may email their approval to the lead action agency and the Project Sponsor. The Project Sponsor must receive this electronic approval of the variance prior to the work proceeding. If requesting a variance, the Project Sponsor will submit the Project Information Form to NMFS and FWS as early as possible to allow NMFS and FWS sufficient time to assess whether or not the variance would cause additional effects to listed species not previously considered.

If, during implementation of a restoration project, NMFS, FWS, or the Project Sponsor becomes aware of new information or unforeseen circumstances such that the project cannot be completed according to the scope of effects or terms and conditions of the biological opinions, then NMFS and FWS will require that the Project Sponsor stop all project operations, except for efforts to avoid or minimize resource damage, pending completion of individual consultation on the project.

The Project Sponsor will email the Project Information Form (Appendix A) to NMFS (SnakeBasin@noaa.gov), FWS, and to all other action agencies included in the project. The Project Sponsor will submit the Project Completion Form (Appendix B) to NMFS and FWS within 90 days of project completion, to the same email addresses as above. If the project required dewatering for instream work, the Project Completion Form will describe all fish handling. The Project Sponsor will also list on the form any herbicides used. Landowners will allow reasonable access to the project site in order for the Project Sponsor to complete a post-project assessment. Reasonable land access for post-project monitoring will be a condition required for any permits covered under this programmatic.

Some projects will require additional review and approval by NMFS engineering staff. These include fish screens, fish passage facilities at dams, new diversion structures, installation of grade control structures greater than 3 feet height aggregate, and channel reconstruction projects. At least 3 months before the planned project start date, the Project Sponsor will contact NMFS engineering and provide all requested information on the project. A checklist of information to provide to NMFS engineering staff is included in this BA for screens (Appendix D). For the other types of projects, the Project Sponsor would submit all design plans and engineering calculations to NMFS engineering staff. The Project Sponsor may need to adjust the project plans in response to NMFS engineering review. For any action requiring NMFS engineering review, the Project Sponsor will attach to the Project Information Form a copy of all comments or recommendations received from NMFS engineering staff. NMFS engineering staff can be reached at:

Jeff Brown, Hydraulic Engineer
National Marine Fisheries Service, Hydropower Division
Northwest Regional Office
1201 NE Lloyd Blvd., Suite 1100
Portland, OR 97232

503-230-5448
jeffrey.brown@noaa.gov

Or: NMFS West Coast Region, Environmental Service Branch
503-230-5431

Each action agency in this consultation will submit an annual report to NMFS and FWS by April 1 each year, listing all projects completed under the programmatic consultation for the previous year. A representative from each action agency will attend an annual meeting (or phone call) at the NMFS Boise Office to discuss the implementation of the program, how to improve conservation under the program, and how to make the program more efficient or more accountable.

2.5. Categories of Habitat Restoration Activities

The proposed action consists of nine categories of restoration activities: (1) Fish Screening, (2) Fish Passage, (3) Instream Flow, (4) Instream Structures, (5) Side Channels and Floodplain Function, (6) Channel Reconstruction, (7) Riparian Habitat, (8) Road and Trail Erosion Control, Maintenance, and Decommissioning, and (9) Surveying and Monitoring. Table 4 lists these action categories and identifies specific action types included under each category. Each of the action categories are then described in more detail in Section 3.3, *Description of Action Categories and Associated Conservation Measures*. Some restoration projects may involve multiple categories.

Table 4. Categories of activities under the proposed action.

Action Category	Specific Actions Included in This BA
• **Fish Screening**	• Install, upgrade, or maintain fish screens *(NMFS engineering review required for installation or upgrading of screens)*

Action Category	Specific Actions Included in This BA
• **Fish Passage**	• Install or improve fish passage facilities (e.g. fish ladders or other fishways) at diversion structures and other passage barriers *(NMFS engineering review required)* • Remove or modify water control structures (e.g. irrigation diversion structures) • Replace culverts and bridges to provide fish passage and/or to reduce risk of culvert failure and chronic sedimentation, using the stream simulation methods from NMFS (2011).
• **Instream Flow**	• Lease or purchase water rights to improve instream flows • Change or consolidate points of diversion *(NMFS engineering review required for new diversion structures)* • Increase efficiency of irrigation practices (e.g. convert open ditches to pipes, or convert surface water diversions to ground water wells)

• **Instream Structures**	• Provide grade control with boulder weirs or roughened channels *(NMFS engineering review required for installation of structures with greater than 3 feet height)*
	• Install instream habitat structures including
	  • Rootwads, large woody debris (LWD), and log jams
	  • Boulders
	  • Spawning gravels

• **Side Channels and Floodplain Function**	• Reconnect and restore historic side channels • Modify or remove levees, dikes, and berms
• **Channel Reconstruction**	• Reconstruction of existing stream channels into historic or newly constructed channels *(NMFS engineering review required).*

Action Category	Specific Actions Included in This BA

• **Riparian Habitat**	• Plant riparian vegetation
	• Reduce riparian impacts from livestock:
	  • Install fencing
	  • Develop livestock watering facilities away from streams
	  • Install livestock stream crossings (culverts, bridges, or hardened fords)
	• Control invasive weeds through physical removal or with herbicides
	• Stabilize stream banks through bioengineering

• **Road and Trail Erosion Control, Maintenance, and Decommissioning**	• Decommission or obliterate unneeded roads
	• Relocate portions of roads and trails away from riparian buffer areas
	• When part of a larger restoration project, reduce sediment from existing roads:
	  • Improve and maintain road drainage features
	  • Reduce road access and usage through gates, fences, boulders, logs, tank traps, and signs
	  • Remove or stabilize pre-existing cut and fill or slide material

• **Surveying and Monitoring**	• Survey project sites:
	  o Take physical measurements
	  o Install recording devices
	  o Determine fish presence (*electroshocking for research purposes is not included under this consultation*)
	• Monitor project site and stream habitat after project completion
	• Install PIT tag detection arrays

2.6. Description of Action Categories and Associated Conservation Measures

The activities covered under this consultation will be aimed at protecting or restoring fish and wildlife habitat, with long-term benefits for ESA-listed species. However, project construction activities may adversely affect ESA-listed species in the short-term. In order to minimize these adverse effects, the proposed action includes a general set of conservation measures applicable to all projects, as well a set of conservation measures specific to each category of activity. This BA first lists the general conservation measures, and then provides a detailed description of each action category, along with specific conservation measures for each category.

2.6.1. General Conservation Measures

In order to minimize the magnitude and duration of short-term adverse effects on ESA-listed species and critical habitat—and to avoid a chance of long-term adverse effects—all projects under this programmatic consultation will comply with the following set of conservation measures.

Pre-construction and Project Design Conservation Measures

- Timing of in-water work. In-water work will occur only within the preferred work windows listed in Appendix C. For the Upper Salmon River Basin, the work windows are from Upper Salmon Basin Watershed Project Technical Team (2005). If the Upper Salmon Basin Watershed Technical Team updates this list, project sponsors will follow the most recent recommendations.

- Fish screens. All water intakes in which fish could be entrained and injured, including pumps used to isolate an in-water work area, will have a fish screen installed, operated, and maintained according to the criteria in NMFS (2011b or most current version).

- Site assessment for contaminants. If an action involves excavation of more than 20 yards of material in an area with past mining impacts or other land uses known to cause chemical contamination, then the Project Sponsor will complete a site assessment for contaminants. Excavation could be for side-channel habitat restoration or set-back or removal of an existing berm, dike or levee. The site assessment will include the following elements to identify the type, quantity, and extent of any potential contamination: (a) A review of readily available records, such as former site use, building plans, records of any prior contamination events; (b) a site visit to observe the areas used for various industrial processes and the condition of the property; (c) interviews with knowledgeable people, such as site owners, operators, and occupants; neighbors; local government officials; and (d) a report that includes an assessment of the likelihood that contaminants are present at the site. If the site assessment finds potential for chemical contamination, NMFS will review the site assessment and other project plans to determine whether additional conservation measures are needed and whether or not the project can be implemented under this programmatic consultation.

- Site layout and flagging. Prior to construction, the action area will be flagged to identify the following: (1) sensitive resource areas, such as areas below ordinary high water, spawning areas, springs, and wetlands; (2) equipment entry and exit points; (3) road and stream crossing alignments; (4) staging, storage, and stockpile areas; and (4) no-spray areas and buffers for herbicides.

- Temporary erosion controls. Temporary erosion controls will be in place before any significant alteration of the action site, and will be appropriately installed down slope of project activity within the riparian buffer area until site rehabilitation is complete. Once the site is stabilized, temporary erosion control measures must be removed.

- Emergency erosion and chemical spill controls. The Project Sponsor will ensure that the following materials for emergency control of erosion and chemical spill control are onsite: (a) A supply of sediment control materials (e.g., silt fence, straw bales[1]), and (b) an oil-absorbing floating boom and absorbent pads whenever surface water is present.

- Temporary access roads.

1. Do not build temporary roads mid-slope or on slopes steeper than 30%. If a project requires heavy equipment to cross a slope greater than 30%, the Project Sponsor will contact NMFS to determine appropriate conservation measures and whether or not the project fits under this programmatic consultation.

2. Minimize the removal of riparian vegetation when creating temporary access roads. The Project Sponsor will estimate the amount of vegetation to be removed in the Project Information Form.

3. Minimize the number and length of temporary access roads, and design roads to avoid erosion and compaction.

4. Minimize soil disturbance and compaction whenever a new temporary road is necessary within 150 feet of a stream, waterbody, or wetland by clearing vegetation to ground level and placing clean gravel over geotextile fabric, unless otherwise approved in writing (email) by NMFS. This conservation measure applies when more than a single trip into the riparian area is necessary.

5. At temporary stream crossings, equipment will cross the stream in the wet only under the following conditions:
    a. No stream crossing may occur at active spawning sites, when holding adult listed fish are present, or when eggs or alevins are in the gravel.
    b. Do not place temporary crossings in areas that may increase the risk of channel re-routing or avulsion, or in potential spawning habitat, *e.g.*, pools and pool tailouts.
    c. Minimize the number of temporary stream crossings and trips across; use existing stream crossings whenever reasonable. In habitat occupied by ESA-listed fish species, limit stream crossings in the wet to no more than two round trips, unless otherwise approved by a NMFS and FWS biologist.
    d. Equipment and vehicles may cross the stream in the wet only where the streambed is bedrock and where the streambed is naturally stable, or where mats or off-site logs are placed in the stream and used as a crossing. Vehicles and machinery will cross streams at right angles to the main channel wherever possible.

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[1] When available, certified weed-free straw or hay bales will be used to prevent introduction of noxious weeds.

   e. Where necessary to minimize impacts to the stream, install temporary bridges and culverts to allow for equipment and vehicle crossing over perennial streams to access construction areas.

6. When the project is completed, all temporary access roads will be obliterated, and the soil will be stabilized and revegetated. Road obliteration refers to the most comprehensive degree of road decommissioning and involves decompacting the road surface and ditch, pulling the fill material onto the running surface, and reshaping the roadbed to match the hillside contour. The Project Sponsor will obliterate temporary roads in wet areas or areas prone to flooding as soon as possible after project completion and before the start of fall rains.

- <u>Choice and use of equipment.</u> Heavy equipment will be selected (when possible) and operated in a manner that minimizes adverse effects to the environment (e.g., minimally-sized, low pressure tires, minimal hard turn paths for tracked vehicles, temporary mats or plates within wet areas or sensitive soils).

- <u>Vehicle Staging.</u> All equipment shall be cleaned and leaks repaired at least 150 feet from any natural waterbody or wetland prior to entering the project area. The Project Sponsor will remove external oil and grease prior to arriving on site. Thereafter, equipment will be inspected daily for leaks or accumulations of grease, and any identified problems fixed before operation within 150 feet of any natural waterbody or wetland.

- <u>Invasive species</u>. Inspect and, if necessary, wash vehicles and equipment to prevent introducing terrestrial invasive species prior to bringing equipment on the work site. Inspect and sanitize water craft, waders, boots, and any other gear to be used in or near water to prevent the spread of invasive species or whirling diseases.

- <u>Erosion and Sediment Control.</u> Erosion and sediment control are paramount considerations for all ground-disturbing construction activities, particularly when activities occur in or near waterways. The Project Sponsor will describe all temporary and permanent erosion and sediment control measures to be used during the project on the Project Information Form (for large-scale projects, the Project Sponsor will describe these measures in an attached Erosion Control Plan). Erosion control measures will be appropriate for site and weather conditions. The following conservation measures are designed to prevent soil erosion or to collect, retain, and treat storm water runoff and pollutant discharges during all phases of construction:

    1. A supply of emergency erosion control materials will be on hand and temporary erosion controls will be installed and maintained in place until site restoration is complete. Temporary erosion control measures may include fiber wattles, silt fences, jute matting, wood fiber much and soil binder, or geotextiles and geosynthetic fabric.

    2. Ground disturbance will not occur during wet conditions (i.e., during or immediately following rain events).

3. Sequence or schedule work to reduce exposed bare soil subject to wind erosion. Water may be used to control dust.

4. Vegetation may be grubbed only from areas where permanent ground alteration will occur. Vegetation is to be cut at ground level and root wads retained where temporary clearing occurs.

5. Wood fiber mulch and tackifier (hydro-applied) may be used to reduce erosion of bare soil if the Project Sponsor provides certification from the manufacturer that the materials are noxious weed free and nontoxic to aquatic and terrestrial animals, soil microorganisms, and vegetation. This certification will be available for inspection upon request by NMFS and FWS. See the Idaho Sate Noxious Weed List found in IDAPA 02.06.22 for a list of 64 different species of weeds which are designated noxious by state law.

6. Permanent soil stabilization outside the OHWM is best accomplished with reestablishment of native vegetation where possible. The Project Sponsor will begin site restoration immediately following completion of ground disturbing activities. Temporary soil stabilization measures, e.g. jute matting, are required until permanent measures are established and functioning properly. Guidance on selecting and planting native seed or plant materials, including plant densities and species composition, will be provided by technical experts familiar with local site conditions. See the following reports for detailed information on planting appropriate riparian vegetation: *How to plant willows and cottonwoods for riparian restoration* (Hoag 2007), *Native shrubs and trees for riparian areas in the intermountain west* (Tilley et al. 2012), *Description, propagation, and establishment of wetland-riparian grass and grass-like species in the intermountain west* (Hoag et al. 2011)—all available at http://www.nrcs.usda.gov/wps/portal/nrcs/detail/id/technical/?cid=nrcs144p2_047763#aberdeen

7. For all projects, sediment will be removed from erosion controls once the sediment has reached one-third of the exposed height of the control. If inspections show that the pollution controls are ineffective, the Project Sponsor will immediately mobilize work crews to repair, replace, or reinforce controls as necessary.

8. Rewatering stream channels. For stream channels which have been isolated and detwatered during project construction: (1) Reconstructed stream channels will be "pre-washed" into a reach equipped with sediment capture devices, prior to reintroduction of flow to the stream; (2) Stream channels will be re-watered slowly to minimize a sudden increase in turbidity.

9. When reintroducing streamflow to a dewatered stream reach, the Project Sponsor will monitor the stream for turbidity. An appropriate and regularly calibrated turbidity meter, measuring NTUs, is required. A sample must be taken prior to expected turbidity pulses at a relatively undisturbed area approximately 100 feet upstream from inwater disturbance to establish background turbidity levels. A sample must then be

taken every 30 minutes and approximately 600 feet downstream from the point of discharge, or most appropriate downstream site, during sediment pulses and be compared against the background measurement. If turbidity levels exceed 50 NTUs over background levels for three consecutive readings (90 minutes), the Project Sponsor must cease work immediately and take measures to reduce turbidity before continueing to reintroduce streamflow.

- <u>Prevention of chemical contamination from construction equipment and materials</u>. The use of heavy machinery increases the risk for accidental spills of fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone, or directly into the water, where they could adversely affect habitat, injure or kill aquatic food organisms, or directly impact ESA-listed species. In order to minimize the potential for introducing hazardous materials to the aquatic system, the Project Sponsor will adhere to following measures:

    1. No uncured concrete or form materials will be allowed to enter the active stream channel.

    2. All vehicle staging, fueling, storage and washout areas will be located at least 150 feet away from aquatic areas and adequately buffered such that runoff is incapable of being delivered to surface waters or wetlands.

    3. Any waste liquids generated at the staging areas will be temporarily stored under cover on an impervious surface such as tarpaulins until such time they can be properly transported to and treated at an approved facility for treatment of hazardous materials.

    4. Spill containment kits adequate for the types and quantity of hazardous materials stored at the site are required.

    5. All vehicles will be thoroughly cleaned before use at the site.

    6. Hydraulic fluids used in any vehicle that will be operated in live water will be non-toxic to salmonids[2].

- <u>Stockpile Materials.</u> Any large wood, topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration.

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[2] The following criteria should be met to determine if a hydraulic fluid is nontoxic to salmonids during acute exposure: (a) The test species used should be a salmonid (most often this will be rainbow trout, but occasionally Chinook salmon or coho salmon are tested); (b) The test duration should be 96 hours; (c) The test should be conducted using the water accommodated fraction (WAF) (the WAF is used in testing hydrophobic materials to provide a "worst case scenario" for exposure to aquatic organisms); and (d) The value of the LC50 should be >1000 mg/L. Several products on the market meet these specifications.

Construction Conservation Measures

- Work area isolation. Any work area within the wetted channel will be isolated from the active stream whenever ESA-listed fish are reasonably certain to be present, or if the work area is 300 feet or 10 times bankfull channel width (whichever is less) upstream from spawning habitats—unless NMFS and FWS agree in writing (email) that the work can be done with less potential risk to listed fish without isolating and dewatering the work area (e.g. placing LWD). When work area isolation is required, engineering design plans will include all isolation elements, fish release areas, and, when a pump is used to dewater the isolation area and fish could be present, a fish screen that meets NMFS's fish screen criteria (NMFS 2011, or most current).

- Removing fish from instream work areas. When work area isolation is required, a fish biologist will determine how to remove ESA-listed fish, with least harm to the fish, before project construction begins. This will involve either passive movement of fish out of the project reach through slow dewatering, or actively removing the fish from the project reach. Should active removal be warranted, a fish biologist will 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. A fish biologist will conduct or supervise the following activities: install blocknets; capture fish through seining and relocate to streams; electrofish to capture and relocate fish not caught during seining; slowly dewater stream reach; collect any remaining fish in cold-water buckets and relocate to the stream. Use aerators or replace the water in the buckets at least every 15 minutes with cold clear water. While block nets are set, inspect them regularly for fish and remove any living to an area far enough away to avoid additional impingement risk. All of these activities will be completed on the same day. All handling of fish, using any method, will be conducted by or under the direction of a fish biologist, using methods directed by the following: *National Marine Fisheries Service (NMFS) Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act* (http://www.nwr.noaa.gov/publications/reference_documents/esa_refs/section4d/electro2000.pdf)For each project, the Project Sponsor will report the number of fish handled to NMFS and FWS in the Project Completion Form (Appendix B).

- Fish passage. Fish passage will be provided for any adult or juvenile ESA-listed fish likely to be present in the action area during construction, unless passage did not exist before construction, stream isolation and dewatering is required during project implementation, or the stream is naturally impassable at the time of construction. After construction, adult and juvenile passage that meets NMFS' fish passage criteria (NMFS 2011) will be provided for the life of the action.

- Earthwork. Complete earthwork (including drilling, excavation, dredging, filling and compacting) as quickly as possible. During excavation, stockpile native streambed materials above the bankfull elevation, where it cannot reenter the stream, for later use.

- Rock. Riprap may be used to protect culvert inlet/outlets within the road prism when culvert upgrades or installation are a component of the restoration project. Rock for in-stream structures will not be mined from the stream.

- Construction water. Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate. Diversions for construction water will not exceed 10% of the available flow and will have the appropriate State of Idaho permiting (i.e., temporary water right).

- Discharge water. Design, build, and maintain facilities to collect and treat all construction discharge water using the best available technology applicable to site conditions. Provide treatment to remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present.

- Stationary power equipment. Generators, cranes, and any other stationary equipment operated within 150 feet of any natural waterbody or wetland will be maintained as necessary to prevent leaks and spills from entering the water.

- Power equipment. Gas-powered equipment with tanks larger than 5 gallons will be refueled in a vehicle staging area placed 150 feet or more from a natural waterbody or wetland.

- Work from top of bank. To the extent feasible, heavy equipment will work from the top of the bank, unless work from another location would result in less habitat disturbance.

- High flows. Project operations will cease under high flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage.

Post-construction Conservation Measures

- Site restoration. When construction is finished, all streambanks, soils, and vegetation will be cleaned and restored as necessary using stockpiled large wood, topsoil, slash, and native channel material to renew ecosystem processes that form and maintain productive fish habitats.

- Revegetation. Replant each area requiring revegetation prior to or at the beginning of the first growing season following construction. Achieve re-establishment of vegetation in disturbed areas to at least 70% of pre-disturbance levels (monitor vegetation survival the following year and re-plant if necessary to achieve this goal). Use an appropriate mix of species that will achieve establishment and erosion control objectives, preferably forb, grass, shrub, or tree species native to the project area or region and appropriate to the site. Fencing will be installed as necessary to protect the vegetation.

- Site access. The Project Sponsor and lead Action Agency will retain the right of reasonable access to the site of actions funded, permitted, or carried out using this Opinion, such that the Project Sponsor can monitor the success of the project.

- Obliteration. When the project is completed, obliterate all temporary access roads, stabilize the soil, and revegetate the site.

Conservation Measures for Wildlife and Plants

- Canada Lynx**.** Activities will not be located within 270 yards of known active lynx dens (based on sight distance and attenuation of sound in forested environments).

- Northern Idaho Ground Squirrel**.** Any squirrel activity sites, den or burrows encountered at a work site will be flagged and avoided during site preparation, staging, or construction and earthmoving activities. Squirrel activity within 200 feet of work sites will be reported to FWS, which will recommended a course of action, which could include initiation of site-specific consultation or emergency consultation. Do not apply herbicides where ground squirrels are known to be present.

- Yellow-Billed Cuckoo**.** Activities will avoid fragmentation, degradation, or destruction of riparian habitat known to support yellow-billed cuckoos.

- Plants**.** If one or more listed plant species are present and may be affected by the project, the project may require protective measures and the appropriate level of consultation. Due to soil disturbance that will occur, and use of heavy equipment that could carry seeds and plant parts into project areas, all appropriate measures will be incorporated into contract or equipment rental agreements to avoid introduction of invasive plants and noxious weeds into project areas. Do not apply herbicides where listed plant species are known to be present.

2.6.2. Action Categories and Specific Conservation Measures

2.6.2.1. Fish Screening

Purpose: To prevent fish from entering and becoming entrained in unscreened or inadequately screened diversions.

Description: This category includes installing, replacing, upgrading, or maintaining off-channel screens (and fish bypass systems where applicable) to prevent fish entrapment in irrigation canals or other surface water diversions, for existing legal water diversions. Diversion water intake and return points will be designed, modified or replaced to prevent salmonids of all life stages from swimming or being entrained into the irrigation system. Intake pipes for all purposes will be screened with mesh sizes small enough to prevent fish from entering the pipes. Salmonids will be prevented from becoming entrained or impinged by improperly designed screens. This category also covers periodic maintenance of fish screens.

All fish screens will be built to NMFS criteria, detailed in *Anadromous Salmonid Passage Facility Design* (NMFS 2011b). Most fish screens will be installed a short distance downstream from the headgate, but some may be as much as 0.1 mile below the point of diversion. Installation of a fish screen typically involves excavation, installation of bedding material, construction of forms for pouring concrete, installation of the drum screen and paddle wheel, and backfilling of bedding and other material. For smaller diversions, a modular screen may be used that does not require concrete. Estimated total area of disturbance, depending on the size of screen, may be as large as 50 feet of ditch length with a disturbance width of 25 feet. A plastic fish bypass pipe will also be installed, directing approximately 0.8 CFS of diverted flow back to the stream. Bypass pipes are usually 8 inches to one foot in diameter and are buried below the ground surface by a backhoe. Pipe distances will vary from tens to hundreds of feet. Fish bypass structures will be designed and located to facilitate safe reentry of fish into the stream channel.

Since 2000, the Idaho Department of Fish and Game Screen Shop (Screen Shop) has installed fish screens on pump diversions and within irrigation ditches, under an informal consultation on Mitchell Act funded projects. That informal consultation for ESA-listed salmon and steelhead remains in place for actions funded by the Mitchell Act that are not likely to adversely affect listed fish. This programmatic consultation provides coverage for activities that are not covered by the Mitchell Act informal consultation (e.g. screen installations involving in-stream work). Because the Screen Shop has extensive experience with design and installation of fish screens and has successfully implemented Mitchell Act funded projects for more than a decade, the Screen Shop will continue to design and install fish screens without individual review of the designs by NMFS. In lieu of individual review of screening projects, the Screen Shop may submit semi-annual progress reports listing, and briefly describing, all covered projects in the Planning/Design (Phase I), Implementation (Phase II), and Operation and Maintenance (Phase III) stages.

For fish screen projects that are not implemented by the Screen Shop, NMFS (or an individual trained by NMFS to certify that fish screen designs meet NMFS criteria) will approve screen design plans prior to screen installation. During the conceptual design stage (generally three months to two years prior to construction), the Project Sponsor will complete and submit to NMFS engineering staff the "Fish Screen Design Plans Checklist" (Appendix E). A NMFS engineer will review this checklist and may: (1) give approval to move forward with the design; (2) remain engaged with the design process if the project is of sufficient scale to warrant this; or (3) waive engineering involvement (if a small scale project). If the engineer does not waive NMFS' involvement in the design process, the Project Sponsor will submit the final design to NMFS for review at least 90 days prior to construction (or 60 days for small projects requiring less than two weeks construction time). The Project Sponsor will obtain final approval from the engineer via email or by letter prior to initiating construction. The Project Sponsor will note in the Project Information Form whether: (1) engineering involvement for the action has been waived, or (2) the final design is approved.

The owner or operator of the screen is responsible for seeing that debris is periodically removed from screens within irrigation ditches, thus ensuring that structures continue to function properly and do not increase the risk of erosion by blocking ditch flow.

Conservation Measures

- All fish screens, including screens installed in temporary and permanent pump intakes, will be designed to meet the criteria in NMFS' *Anadromous Salmonid Passage Facility Design* (NMFS 2011b, or most recent version). Irrigation diversion intake and return points will be designed (to the greatest degree possible) to prevent all native fish life stages from swimming or being entrained into the irrigation system.

- All fish screens will be sized to accommodate the current documented diversion rate or the maximum instantaneous diversion rate associated with the legal water right, whichever is less. "Accommodate" means that screens will not be overtopped and will remain effective over the entire range of expected water diversion.

2.6.2.2. Fish Passage

Purpose: Restore or maintain fish passage at man-made barriers, particularly at diversion structures and at road stream crossings. The objective of this category is to allow all life stages of salmonids access to historical habitats from which they have been excluded by non-functioning structures, or by instream profile discontinuities resulting from insufficient depth or excessive jump heights and velocities. Additionally, at road stream crossings, prevent streambank and roadbed erosion, facilitate natural sediment and wood movement, and eliminate or reduce excess sediment loading.

Fish passage improvement projects covered under this consultation include (1) installing or improving fish passage facilities at existing barriers; (2) removing or modifying artificial barriers (e.g. diversion structures) to create passage; and (3) replacing culverts or bridges at stream road crossings. For projects covered under this consultation, the proposed action also includes periodic maintenance of fish passage or fish collection facilities to ensure proper functioning, such as cleaning debris buildup or replacing parts.

<u>Fish Passage Facilities</u>

Description: The Project Sponsor may propose to (1) re-engineer improperly designed fish passage or fish collection facilities; (2) complete periodic maintenance of fish passage or fish collection facilities to ensure proper functioning, *e.g*., cleaning debris buildup, replacement of parts; or (3) install a fish ladder at an existing facility. A NMFS engineer must review plans for installing or modifying fish ladders. During the conceptual design stage (generally eight months to two years prior to construction), the Project Sponsor will contact NMFS engineering. After reviewing the plans, the NMFS engineer may: (1) give approval to move forward with the design; (2) remain engaged with the design process if the project is of sufficient scale to warrant this; or (3) waive engineering involvement (if a small scale project). If the engineer does not waive NMFS' involvement in the design process, the Project Sponsor will submit the final design to NMFS for review at least 90 days prior to construction (or 60 days for small projects requiring less than two weeks construction time). The Project Sponsor will obtain final approval from the engineer via email or by letter prior to initiating construction. The Project Sponsor will note in the Project Information Form whether: (1) engineering involvement for the action has been waived, or (2) the final design is approved. All projects will follow the criteria in NMFS' *Anadromous Salmonid Passage Facility Design* (NMFS 2011b). For periodic maintenance of fish passage facilities, any heavy equipment needed will work from the streambank.

Conservation Measures

- Construction of fish passage facilities is limited to existing dams. The installation of fish passage facilities at new dams or new diversion structures is not included under the proposed action.

- A completed or modified fish passage facility will be available for inspection by NMFS staff to verify the structure was built or modified and is operating consistent with design criteria.

- For all passage projects at diversion structures, the diversion must be screened to NMFS criteria (NMFS 2011b) and have a measuring device, which will be a totalizing flow meter where possible, and an adjustable headgate.

Removal or Modification of Water Control Structures (e.g. Diversion Structures)

This action includes removal of water control structures, such as channel-spanning weirs, diversion structures, and other similar structures. Structures retaining contaminated sediments are not proposed.

Conservation Measures

- If a project involves the removal of multiple barriers on one stream or in one watershed over the course of a work season, the Project Sponsor will remove the most upstream barrier first if possible. This way, work at the upstream sites can be completed without listed anadromous fish in the project area.

- Modified diversion structures will be sized to accommodate current documented water use or the instantaneous maximum diversion rate allowed by state law; must be screened to NMFS criteria (NMFS 2011b); and must have a measuring device, which will be a totalizing flow meter where possible, and an adjustable headgate.

Bridge and Culvert Replacement or Removal

Description. For unimpaired fish passage, it is desirable to have a crossing that is a larger than the channel bankfull width, allows for a functional floodplain, allows for a natural variation in bed elevation, and provides bed and bank roughness similar to the upstream and downstream channel. Projects covered under this consultation will use the Streambed Simulation Design Method in NMFS's *Anadromous Salmonid Passage Facility Design* document (NMFS 2011b). The structures for this design method are typically open-bottomed arches or boxes but could have buried floors in some cases. Bridges that span the stream channel are also appropriate. This method utilizes streambed materials that are similar to the adjacent stream channel. In general, streambed simulation should provide sufficient channel complexity to provide passage conditions similar to that which exists in the adjacent natural stream, including sufficient depth, velocity and resting areas. The designers will be skilled in engineering, hydrology/fluvial geomorphology, and fisheries biology. Design plans will be included with the Project Information Form, describing how the project meets the conservation measures listed below, but these projects will not require individual review by NMFS engineering staff. Construction times for such projects will depend on the complexity of the project and could take multiple weeks.

Restoration activities at stream crossings undertaken by USFS and BLM on federal land in Idaho are covered under a separate NMFS and FWS programmatic consultation (NMFS 2012), and are therefore not covered under this consultation.

Conservation Measures

- Stream crossings shall be designed to the standards in NMFS (2011b, or more recent version)[3] and will use the Streambed Simulation Design Method.

- **Channel Width.** In addition, culverts and bridges will provide a clear, unobstructed opening that is at least as wide as 1.5 times the active channel width for un-incised channels.[4] If a stream is entrenched (entrenchment ratio[5] of less than 1.4), the crossing width will accommodate the floodprone width. Floodprone width is the channel width measured at twice the maximum bankfull depth (Rosgen 1996).

- **Channel Vertical Clearance:** The minimum vertical clearance between the culvert bed and ceiling should be more than 6 feet, to allow access for debris removal. Smaller vertical clearances may be used if a sufficient inspection and maintenance plan is provided with the design that ensures that the culvert will be free of debris during the passage season.

- **Channel Slope:** The slope of the reconstructed streambed within the culvert should approximate 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 in a stream reach that represents natural conditions outside the zone of the road crossing influence. For purposes of maintaining streambed integrity within the road crossing, the maximum slope of streambed simulation where closed bottom culverts are used should not exceed 6%. Design detail and/or a long term maintenance plan should be included that reflects how the streambed within the culvert will be maintained in its design condition over time.

- **Embedment:** If a culvert is used, the bottom of the culvert should be buried into the streambed not less than 30% and not more than 50% of the culvert height, and a minimum of 3 feet. For

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[3] NMFS (National Marine Fisheries Service). 2011. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon. Available at: http://www.nwr.noaa.gov/Publications/Reference-Documents/Passage-Refs.cfm.

[4] Active channel width means the stream width measured perpendicular to stream flow between the ordinary high water lines, or at the channel bankfull elevation if the ordinary high water lines are indeterminate. This width includes the cumulative active channel width of all individual side- and off-channel components of channels with braided and meandering forms, and measure outside the area influence of any existing stream crossing, e.g., five to seven channel widths upstream and downstream.

[5] The entrenchment ratio is determined by dividing the width of the flood prone area by the bankful width.

bottomless culverts the footings or foundation must be designed for the largest anticipated scour depth. The ability to maintain the engineered streambed in the design configuration over the life of the project must be demonstrated by the design (such as by using size analysis of streambed material in the adjacent stream reaches).

- **Maximum Length of Road Crossing:** The length for streambed simulation should be less than 150 feet. If the length is greater than 150 feet, a bridge should be considered.

- **Fill Materials:** Fill materials should be comprised of materials of similar size composition to natural bed materials that form the natural stream channels adjacent to the road crossing. The design must demonstrate long term stability of the passage corridor, through assessment of hydraulic conditions through the passage corridor over the fish passage design flow range, and through assessment of the ability of the stream to deliver sufficient transported bed material to maintain the integrity of the streambed over time. Larger material may be used to assist in grade retention and to provide resting areas for migratory fish.

- **Water Depth and Velocity:** Water depth and velocity must closely resemble those that exist in the adjacent stream. To provide resting zones, special care should be used to provide areas of greater than average depth and lower than average velocity throughout the length of the streambed simulation, reasonably replicating those found in the adjacent stream. Hydraulic controls to maintain depth at low flows may be required.

- Bridge replacements must be single-span structures (*i.e.*, no bents, piers, or other support structures below the ordinary high water mark).

- For replacement of an existing culvert or bridge with a new bridge, the Project Sponsor will remove all other artificial constrictions within the functional floodplain of the project area as follows: (1) remove existing roadway fill, embankment fill, approach fill, or other fills; (2) install relief conduits through existing fill; (3) remove vacant bridge supports below total scour depth, unless the vacant support is part of the rehabilitated or replacement stream crossing; and (4) reshape exposed floodplains and streambanks to match upstream and downstream conditions.

- Hard bank stabilization (e.g. riprap) at crossing structures will be limited to the width of the existing road fill prism.

- Grade control structures to prevent head-cutting above or below the culvert or bridge being replaced or upgraded may be built using rock or wood. Grade control structures typically consist of boulder and/or wood structures that are keyed into the banks, span the channel, and are buried in the substrate. Grade control structures will provide fish passage for juvenile and adult salmonids, and will be designed to most current version of the *Anadromous Salmonid Passage Facility Design* manual (NMFS 2011b).

- The guidelines found at http://swr.nmfs.noaa.gov/pdf/Treated%20Wood%20Guidelines-FINALClean_2010.pdf shall be used for any installation of treated wood.

- If the project would facilitate the expansion of brook trout into occupied bull trout habitat, a FWS biologist will consider whether or not the project is appropriate for coverage for bull trout under the programmatic consultation.

2.6.2.3. Instream Flow

Purpose: Increase instream flows to improve fish spawning, rearing, and migration conditions, and to restore riparian functions. This consultation will cover the acquisition of water to improve streamflow, and will also cover activities that would modify irrigation systems so as to leave more water in the stream or allow the water to flow further downstream before being diverted. This consultation will not provide take coverage to the action agencies or project sponsors for the impacts of diverting water.

Description**:** This action category includes (1) leasing or purchasing water to improve instream flows, (2) moving or consolidating points of diversion in order to leave more water instream for a longer downstream distance, (3) converting surface water diversions to groundwater sources to leave more water instream during the irrigation season, and (4) increasing the efficiency of water transmission facilities in order to leave "saved" water in the stream. No projects under this category will result in the diversion of more water than the current use or legal water right, whichever is less.

Multiple existing diversions may be consolidated into one diversion. Under most circumstances, the consolidated diversion will be located at the most downstream existing diversion point, unless site-specific conditions make this impractical. If the consolidated diversion will not be the most downstream existing diversion point, then a NMFS biologist must confirm that the project will benefit fish. Moving points of diversion downstream in order to rewater severely impaired stream reaches would typically involve installation of a pumping system to offset the loss of head, and possibly installation of engineered riffles (including rock structures) where old diversions are removed. Small instream rock structures that facilitate proper pump station operations are allowed when designed in association with the pump station. Infiltration galleries and lay-flat stanchions are not proposed as part of this programmatic consultation. Periodic maintenance of irrigation diversions completed under this programmatic will be conducted to ensure their proper functioning, *i.e*., cleaning debris buildup, and replacement of parts. Heavy equipment will not enter streams for maintenance of diversions. Removal of unneeded diversion structures will follow the conservation measures described above under ***Fish Passage***. NMFS estimates that individual projects to move or consolidate diversions will take between 1 and 14 days of in-channel work, depending on the complexity of the project.

If diversion consolidation involves building a new diversions structure, a NMFS engineer must first review design plans and engineering calculations. During the conceptual design stage (generally three months to two years prior to construction), the Project Sponsor will contact NMFS engineering. After reviewing the plans and engineering calculations, the NMFS engineer may: (1) give approval to move forward with the design; (2) remain engaged with the design process if the project is of sufficient scale to warrant this; or (3) waive engineering involvement (if a small scale project). If the engineer does not waive NMFS' involvement in the design process, the Project Sponsor will submit the final design to NMFS for review at least 90 days prior to construction (or 60 days for small projects requiring less than two weeks construction time). The Project Sponsor will obtain final approval from the engineer via email or by letter prior to initiating construction. The Project Sponsor will note in the Project Information Form whether: (1) engineering involvement for the action has been waived, or (2) the final design is approved.

Flood or other inefficient irrigation systems may be converted to drip or sprinkler irrigation. This proposed activity will involve the installation of pipe, possibly trenched and buried into the ground. Pumps may be installed to pressurize the system. The criteria, plans and specifications, and operation and maintenance protocols of the NRCS conservation practice standards for "Irrigation System, Sprinkler" may be consulted for guidance (NRCS 2011b). Open ditch irrigation water conveyance systems will be replaced with pipelines to reduce evaporation and transpiration losses. Leaking irrigation ditches and canals will be converted to pipeline or lined with concrete, bentonite, or appropriate lining materials, following guidance from NRCS (2011a, 2011c).

Ground water wells can be drilled as an alternative water source to surface water withdrawals. No wells will be drilled within one quarter mile from a stream, unless the Project Sponsor can demonstrate (in the Project Information Form) that the new well is not likely to decrease streamflow in the adjacent stream. Water from the wells will be pumped into ponds or troughs for livestock, or used to irrigate agricultural fields. Abandoned instream diversion infrastructure will be removed or downsized. The criteria, plans and specifications, and operation and maintenance protocols of the NRCS conservation practice standards for water well code (NRCS 2010) may be consulted for guidance.

This programmatic consultation will only cover irrigation efficiency actions and groundwater conversion actions if a NMFS and FWS biologist agrees with the lead federal agency that the project will benefit fish.

Conservation Measures

- If a project opens up fish passage to a previously inaccessible tributary, the lead Action Agency will ensure that all diversions that could entrain listed fish species are on the IDFG screen shop's list for diversions needing screening and that water users will agree to allow installation of a fish screen and bypass system.

- The water diversion rate after a project is completed will not exceed the current water use (documented or estimated) or legal water right, whichever is less.

- Water "saved" with increased irrigation efficiency will be left instream. The Project Sponsor will describe in the Project Information Form how the water conserved through efficiency projects will remain instream for a sufficient downstream distance to benefit fish. The Project Sponsor will make all reasonable efforts to ensure that water purchased or leased remains instream to the most downstream point legally possible.

- For changes from surface water diversions to ground water diversions, all new wells or other stock watering sources installed under this activity will obtain applicable permits from the appropriate state agency.

- For new ground water wells, pre-project analyses will demonstrate that streamflow is expected to improve during the irrigation season.

- Any change in the point of diversion to be covered under this consultation must leave more water instream than current conditions or must leave water instream for a greater downstream distance than the current point of diversion.

- Abandoned ditches and other similar structures that are in continuity with the stream will be converted into off channel habitat where feasible and appropriate. In all other instances, abandoned ditches will be plugged or backfilled, as appropriate, to prevent fish from getting trapped in them.

- When making improvements to pressurized irrigation systems, the Project Sponsor will install a totalizing flow meter capable of measuring rate and duty of water use. For non-pressurized systems, the Project Sponsor will install a staff gage or other measuring device capable of measuring instantaneous rate of water flow, ensuring that the measuring device does not compromise fish passage at the site. Acceptable types of measuring devices include all those approved by IDWR (see http://www.idwr.idaho.gov/WaterManagement/WaterMeasurement/PDFs/MinAccepStand.pdf)

2.6.2.4. Instream Structures

Purpose: Restore instream habitat structures and provide grade control. The purpose of these enhancements is to decrease flow velocities; increase instream structural complexity and diversity; and provide instream spawning, rearing and resting habitat for fish.

This category includes (1) installing grade control structures such as boulder weirs, and (2) installing instream habitat structures (e.g. LWD, stream gravels). Such activities will be implemented in stream reaches with degraded habitat conditions caused by human land uses. In the Project Information Form, the Project Sponsor will demonstrate how the project is linked to a salmonid habitat limiting factor identified in a subbasin plan or recovery plan, or that the project is a recommended restoration activity identified by a local technical oversight and steering committee (e.g. the Upper Salmon Basin Watershed Project Technical Team). Individual projects may include a combination of the activities in this category.

<u>Grade Control through Boulder Weirs or Roughened Channels</u>

Description: The Project Sponsor may install boulder weirs and roughened channels for grade control at culverts, to mitigate headcuts, and to provide passage at small dams or other channel obstructions that cannot otherwise be removed. Structures will be constructed from rock or wood (LWD). For wood-dominated systems, grade control engineered log jams (ELJs) should be considered as an alternative. Grade control ELJs are designed to arrest channel downcutting or incision and retain sediment, lower stream energy, and increase water elevations to reconnect floodplain habitat and diffuse downstream flood peaks. Grade control ELJs also serve to protect infrastructure that is exposed by channel incision and to stabilize over-steepened banks. Unlike hard weirs or rock grade control structures, a grade control ELJ is a complex broad-crested structure that dissipates energy more gradually.

For boulder weirs, roughened channels, and other grade control structures that have an aggregate height of greater than 3 feet, NMFS engineering staff must review the design plans and engineering calculations. The Project Sponsor should provide the following information to the NMFS engineer, plus any additional information requested:

1) A longitudinal profile of the stream channel thalweg for 20 channel widths upstream and downstream of the structure shall be used to determine the potential for channel degradation.

2) A minimum of three cross-sections – one downstream of the structure, one through the reservoir area upstream of the structure, and one upstream of the reservoir area outside of the influence of the structure – to characterize the channel morphology and quantify the stored sediment.

Conservation Measures

- All structures will be designed to fish passage standards described in NMFS (2011b or most recent version).

- Boulder weirs will be installed low in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 1.5-year flow event).

- Boulder weirs are to be placed diagonally across the channel, or in more traditional upstream pointing “V” or “U” configurations with the apex oriented upstream. The apex should be lower than the structure wings to support low flow consolidation.

- Boulder weirs are to be constructed to allow upstream and downstream passage of all native fish species and life stages that occur in the stream. This can be accomplished by providing plunges no greater than 6” in height, allowing for juvenile fish passage at all flows.

- Key weirs into the stream bed to minimize structure undermining due to scour, preferably at least 2.5x their exposure height. The weir should also be keyed into both banks, if feasible greater than 8 feet.

- Include fine material in the weir material mix to help seal the weir/channel bed, thereby preventing subsurface flow. Geotextile material can be used as an alternative approach to prevent subsurface flow.

- Rock for boulder weirs shall be durable and of suitable quality to assure permanence in the climate in which it is to be used. Rock sizing depends on the size of the stream, maximum depth of flow, planform, entrenchment, and ice and debris loading.

- Full spanning boulder weir placement shall be coupled with measures to improve habitat complexity (LWD placement etc.) and protection of riparian areas.

- The use of gabions, cable or other means to prevent the movement of individual boulders in a boulder weir is not allowed.

- Headcut stabilization shall incorporate the following measures:

    1. Armor head-cut with sufficiently sized and amounts of material to prevent continued up-stream movement. Materials can include both rock and organic materials which are native to the area.

    2. Focus stabilization efforts in the plunge pool, the head cut, as well as a short distance of stream above the headcut.

    3. Minimize lateral migration of channel around head cut ("flanking") by placing rocks and organic material at a lower elevation in the center of the channel cross section to direct flows to the middle of channel.

    4. Provide fish passage over a stabilized head-cut through a series of log or rock weir structures or a roughened channel.

    5. Construct headcut stabilization structures using streambed simulation bed material, which will be washed into place until there is apparent surface flow and minimal subsurface material, to ensure fish passage immediately following construction if natural flows are sufficient.

    6. Construct headcut stabilization structures with stream simulation materials and fines added and pressure-washed into the placed matrix. Successful washing will be determined by minimization of voids within placed matrix such that ponding occurs with little to no percolation losses, to ensure fish passage during low flows immediately following construction.

    7. If possible, also address the cause of the head cut as a part of the restoration action.

Large Wood, Boulder, and Gravel Placement

Description: This action includes large wood and boulder placement, ELJs, gravel placement and tree removal for large wood projects. Such activities will occur in areas where channel structure is lacking due to past stream cleaning (i.e. large wood removal), riparian timber harvest, or other riparian and channel modifications, and in areas where natural gravel supplies are low due to anthropogenic

disruptions. These projects will occur in stream channels and adjacent floodplains to increase channel stability, rearing habitat, pool formation, spawning gravel deposition, channel complexity, hiding cover, low velocity areas, and floodplain function.

Engineered logjams (ELJs) are structures designed to redirect flow and change scour and deposition patterns. While providing valuable fish and wildlife habitat, they are also designed to redirect flow and can provide stability to a streambank or downstream gravel bar. To the extent practical, ELJs are designed to simulate stable natural log jams and can be either naturally stable due to large wood size and/or stream width or anchored in place using rebar, rock, or posts. They are also designed to create a hydraulic shadow, a low-velocity zone downstream that allows sediment to settle out and scour holes adjacent to the structure.

For instream structures, the Project Sponsor will use materials that are appropriate for the particular channel type, project objectives, and site conditions. . In most cases, wood for instream structures will come from outside of riparian areas. In projects where logs would be hauled to the site, the logs would be obtained from upland areas or would be salvaged and hauled by the Project Sponsor. The Project Sponsor will include sketches or engineering plans in the Project Information Form, depending on the complexity of the project. The Project Sponsor can refer to following references of techniques for the installation of instream habitat structures:

- WDFW Stream Habitat Restoration Guidelines: http://wdfw.wa.gov/publications/pub.php?id=00043

- WDFW Integrated Streambank Protection Guidelines: http://wdfw.wa.gov/publications/00046/

- USACE's EMRRP Technical Notes, Stream Restoration: http://el.erdc.usace.army.mil/publications.cfm?Topic=technote&Code=emrrp

- NRCS National Engineering Handbook Part 654, Stream Restoration: http://policy.nrcs.usda.gov/viewerFS.aspx?id=3491

Conservation Measures (Large wood and boulder projects)

- Place large wood and boulders in areas where they would naturally occur and in a manner that closely mimics natural accumulations for that particular stream type. For example, boulder placement may not be appropriate in low-gradient meadow streams.

- Structure types shall simulate disturbance events to the greatest degree possible and include, but are not limited to, log jams, debris flows, windthrow, and tree breakage.

- No limits are to be placed on the size or shape of structures as long as such structures are within the range of natural variability of a given location and do not block fish passage.

- The partial burial of large wood and boulders is permitted and may constitute the dominant means of placement. This applies to all stream systems but more so for larger stream systems where use of adjacent riparian trees or channel features is not feasible or does not provide the full stability desired.

- Large wood includes whole conifer and hardwood trees, logs, and rootwads. Large wood size (diameter and length) should account for bankfull width and stream discharge rates. When available, trees with rootwads should be a minimum of 1.5x bankfull channel width, while logs without rootwads should be a minimum of 2.0 x bankfull widths.

- The Project Sponsor will procure logs from an upland area to use as large wood. However, if a NMFS and FWS biologist approves, riparian trees may be dislodged or felled for constructing in-stream habitat in areas where the project will not significantly impact stream shading, sufficient natural recruitment of native woody vegetation is expected, the threat of invasive vegetation filling created gaps is minimal and replanting with native woody species is planned, and the trees to be felled are not providing suitable habitat for ESA-listed terrestrial species.

- Structures may partially or completely span stream channels or be positioned along stream banks.

- Stabilizing or key pieces of large wood will be intact, hard, with little decay, and if possible have root wads (untrimmed) to provide functional refugia habitat for fish. Consider orienting key pieces such that the hydraulic forces upon the large wood increase stability.

- Anchoring Large Wood – Anchoring alternatives may be used in preferential order:
    1. Use adequately-sized wood sufficient for stability;
    2. Orient and place wood in such a way that movement is limited;
    3. Use ballast (gravel or rock) to increase the mass of the structure to resist movement;
    4. Use vertical piles of untreated wood;
    5. Use large boulders as anchor points for the large wood;
    6. Pin large wood with rebar to large rock to increase its weight. For streams that are entrenched (Rosgen F, G, A, and potentially B) or for other streams with very low width to depth ratios (less than 12) an additional 60% ballast weight may be necessary due to greater flow depths and higher velocities. The tips of any rebar posts should be curved to reduce hazards to humans and wildlife.
    7. Anchoring large wood by cable is not allowed under this programmatic.

Conservation Measures (ELJs)

- ELJs will be patterned, to the greatest degree possible, after stable natural log jams.

- Grade control ELJs will be designed to arrest channel down-cutting or incision by providing a grade control that retains sediment, lowers stream energy, and increases water elevations to reconnect floodplain habitat and diffuse downstream flood peaks.

- Stabilizing or key pieces of large wood that will be relied on to provide streambank stability or redirect flows will be intact and solid (little decay).

- If possible, acquire large wood with untrimmed rootwads to provide functional refugia habitat for fish.

- When available, trees with rootwads attached should be a minimum length of 1.5 times the bankfull channel width, while logs without rootwads should be a minimum of 2.0 times the bankfull width.

- The partial burial of large wood and boulders may constitute the dominant means of placement, and key boulders (footings) or large wood can be buried into the streambank or channel.

- Angle and offset – The large wood portions of ELJ structures should be oriented such that the force of water upon the large wood increases stability. If a rootwad is left exposed to the flow, the bole placed into the streambank should be oriented downstream parallel to the flow direction so the pressure on the rootwad pushes the bole into the streambank and bed. Wood pieces that are oriented parallel to flow are more stable than members oriented at 45 or 90 degrees to the flow.

- If large wood anchoring is required, a variety of methods may be used. These include buttressing the wood between riparian trees, or the use of manila, sisal, or other biodegradable ropes for lashing connections. If hydraulic conditions warrant use of structural connections, rebar pinning or bolted connections may be used. Rock may be used for ballast but is limited to that needed to anchor the large wood. The tips of any rebar posts should be curved to reduce hazards to humans and wildlife.

Conservation Measures (Gravel Augmentation)

- Gravel can be placed directly into the stream channel, at tributary junctions, or other areas in a manner that mimics natural debris flows and erosion.
- Augmentation will only occur in areas where the natural supply has been eliminated, significantly reduced through anthropogenic disruptions, or used to initiate gravel accumulations in conjunction with other projects, such as simulated log jams and debris flows.
- Gravel to be placed in streams shall be a properly sized gradation for that stream, clean alluvium with similar angularity as the natural bed material. When possible use gravel of the same lithology as found in the watershed. Reference *Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings* (USDA-Forest Service 2008) to determine gravel sizes appropriate for the stream.
- Gravel can be mined from the floodplain at elevations above bankfull, but not in a manner that will cause stranding during future flood events.
- Crushed rock is not permitted.

- After gravel placement in areas accessible to higher stream flow, allow the stream to naturally sort and distribute the material.
- 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.
- Imported gravel will be free of invasive species and non-native seeds. If necessary, wash gravel prior to placement.

2.6.2.5. Side Channels and Floodplain Function

Purpose: To restore historic side-channel habitat and floodplain function. Off-channel habitat has been reduced by human activities in the floodplain including diking, removal of LWD, straightening of the channel, road and railroad construction, and bank armoring. Thus, there is a need in many Idaho watersheds for off-channel habitat restoration, through reestablishment of side channels and removal of levees.

<u>Reconnection of Historical Side Channels</u>

Description: Side channel habitats are generally small watered remnants of river meanders. They provide important rearing habitat for juveniles and refuge habitat during high flows. They are most common in floodplains with alluvial material along a flat valley floor. Off-channel habitat includes abandoned river channels, spring-flow channels, oxbows and flood swales.

Projects under this consultation will restore self-sustaining off-channel habitat. Self-sustaining is not synonymous with maintaining a static condition. Self-sustaining means the restored habitat would not require major or periodic maintenance but would function naturally within the processes of the floodplain. However, up to two project adjustments, including adjusting the elevation of the created side channel habitat, are included under this proposal. The long-term development of a restored side channel will depend on natural processes like floods and mainstem channel migration. Over time, the side channel may naturally get drier or be taken over by the main river flow. Designs for such projects must be completed with input from a technical expert and must demonstrate a thorough understanding of the hydrology of the project area.

The following off-channel restoration activities are included in the proposed action:

- Restoration of existing side channels, including one-time dredging and then up to two project adjustments for the elevation of the created side channel habitat.

- Reconnecting existing side channels with a focus on restoring fish access and habitat-forming processes (hydrology, riparian vegetation), including installation of culverts or bridges through road and railroad grades, where feasible.[6]

- Installation of engineered log jams, barbs, or groins to direct some flow through a side channel.

Given the complexity of this type of project, the Project Sponsor will include the following additional information about design plans in the Project Information Form:

1) A clear linkage to limiting factors identified within the appropriate subbasin plan, recovery plan, or recommendations by a local technical oversight and steering committee.

2) Evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, remote sensing information, or personal observation.

3) Hydrologic evidence that the project will be self-sustaining over time. Self-sustaining means the restored habitat would not require major or periodic maintenance, but function naturally within the processes of the floodplain.

4) Indication that the proposed action will mimic natural conditions for gradient, width, sinuosity and other hydraulic parameters.

5) Indication that the proposed action will not result in the creation of fish passage issues or post construction stranding of juvenile or adult fish.

Conservation Measures

- Side channel habitat will be constructed to prevent fish stranding by providing a continual positive grade to the intersecting river or stream, or by providing a year-round water connection.

- Ditches previously constructed to drain wetlands will be filled with native material, primarily obtained from the spoil material generated when the ditch was first constructed. The final contour will approximate the natural topography to the degree the available material allows. If the natural contour cannot be obtained with on-site material, clean imported material of similar composition to the adjacent, native banks may be used.

- Side-channel improvements can include minor excavation ($\leq$ 10%) of naturally accumulated sediment within historical channels. There is no limit as to the amount of excavation of fill

[6] Breaching road or railroad grades to access historic channels can only be accomplished with complex coordination with state, tribal, federal and private stakeholders. It is the intent of this proposed action to use the most appropriate means of accessing the historical channel, which will be decided on a case-by-case basis with the appropriate stakeholders.

within historic side channels as long as such channels can be clearly identified through field and/or aerial photographs.

- Excavated material removed from off- or side-channels shall be hauled to an upland site or spread across the adjacent floodplain in a manner that does not restrict floodplain capacity.
- Excavation depth will never exceed the maximum thalweg depth in the main channel.
- Restoration of existing side channels including one-time dredging and an up to two times project adjustment including adjusting the elevation of the created side channel habitat.
- Adequate precautions will be taken to prevent the creation of fish passage issues or stranding of juvenile or adult fish.

Set-back or Removal of Existing Berms, Dikes, and Levees

Description: Set-back or removal of existing berms, dikes, and levees will be conducted to reconnect stream channels with floodplains. Such projects will take place where floodplains have been disconnected from adjacent rivers through drain pipes and anthropogenic fill.

Conservation Measures

- Design actions to restore floodplain characteristics—elevation, width, gradient, length, and roughness—in a manner that closely mimics, to the extent possible, those that would naturally occur at that stream and valley type.
- Any non-native levee material removed will be hauled to an upland site. Native material may be spread across the floodplain provided it does not restrict riparian vegetation establishment, floodplain capacity, and does not result in stranding of juvenile salmonids. If material is used to create or alter micro-topography it must be done in a manner to prevent juvenile stranding. Overburden or fill comprised of native materials, which originated from the project area, may be used within the floodplain to create set-back dikes and fill anthropogenic holes provided that does not impede floodplain function. When necessary, loosen compacted soils once overburden material is removed.
- Remove drain pipes, fences, and other man-made structures to the greatest degree possible.
- Where it is not possible to remove or set-back portions of dikes and berms, or in areas where existing berms, dikes, and levees support abundant riparian vegetation, openings may be created with breaches. Berms, dikes, or levees shall always be breached in a manner that ensures flows will naturally recede back into the main channel to miminize the likelihood of fish entrapment.

- When full removal is not possible and a setback is required, the new structure locations should be prioritized, if possible, to the outside of the meander belt width or to the outside or the channel meander zone margins.

2.6.2.6. Channel Reconstruction/Relocation

Purpose**:** To reconstruct existing stream channels into historic or newly constructed channels that are typically more sinuous and complex. This proposed action applies to stream systems that have been straightened, channelized, dredged, or otherwise modified for the purpose of flood control, increasing arable land, realignment, or other land use management goals. This action could also be appropriate for streams that are incised or otherwise disconnected from their floodplains resulting from watershed disturbances. The purpose of channel reconstruction is to improve aquatic and riparian habitat diversity and complexity, reconnect stream channels to floodplains, reduce bed and bank erosion, increase hyporheic exchange, provide long-term nutrient storage, provide substrate for macroinvertebrates, moderate flow disturbance, increase retention of organic material, and provide refuge for fish and other aquatic species. Channel reconstruction and relocation generally occur in alluvial stream systems that are free to adjust their boundaries over time.

Description**:** Projects may include reconstruction of existing stream channels through excavation and structure placement (LWD and boulders) or relocation (rerouting of flow) into historic or newly constructed channels that are typically more sinuous and complex. The reconstructed stream system should be composed of a naturally sustainable and dynamic planform, cross-section, and longitudinal profile that incorporate unimpeded passage and temporary storage of water, sediment, organic material, and species. Stream channel adjustment over time is to be expected in naturally dynamic systems and is a necessary component to restore a wide array of stream functions. It is expected that for most projects that there will be a primary channel with secondary channels that are activated at various flow levels to increase floodplain connectivity to improve aquatic habitat through a range of flows. This proposed action is not intended to artificially stabilize streams into a single location or into a single channel for the purposes of protecting infrastructure or property.

Channel reconstruction consists of re-meandering or movement of the primary active channel, and may include structural elements such as streambed simulation materials, streambank structures, and hydraulic roughness elements. For bed stabilization and hydraulic control structures, constructed riffles shall be preferentially used in pool-riffle stream types, while roughened channels and boulder weirs shall be preferentially used in step-pool and cascade stream types. Material selection (large wood, rock, gravel) shall also mimic natural stream system materials.

The reconstruction or relocation of existing stream channels would be accomplished through excavation and structure placement (large wood and boulders), or by rerouting streamflow into historic or newly constructed channels that are typically more sinuous and complex. Equipment such as excavators, bull dozers, dump trucks, or front-end loaders would be used to implement such projects. A project might include one or more of the following activities: excavation of an existing channel; construction of new low and high flow channels, side channels and alcoves, adjacent floodplains, flood channels, and wetlands; and installation of structural elements such as streambed simulation materials, streambank restoration, and hydraulic roughness elements. The Project Sponsor would design the overall project to restore floodplain characteristics—elevation, width, gradient, length, and roughness—in a manner that closely mimics, to the greatest degree possible, those that would naturally occur at that stream and valley type. Channel reconstruction projects are complex, and NMFS estimates that such projects may take 2-4 weeks of in-channel work, and possibly longer.

A NMFS engineer must review design plans for channel reconstruction projects. NMFS and FWS would review the project plans using the River Restoration Analysis Tool ("River RAT," www.restorationreview.com). Approval for such projects would require a long-term monitoring plan. For an example of a long-term monitoring plan, please contact the NMFS Boise office. The Project Sponsor would provide the following additional information to NMFS, attached to the Project Information Form:

1. Background and Problem Statement
    a. Site history
    b. Environmental baseline
    c. Problem description
    d. Cause of problem

2. Project Description
    a. Goals/objectives
    b. Project elements
    c. Sequencing, implementation
    d. Stream channel trajectory –how does the reconstructed channel develop and evolve?

3. Detailed construction drawings

4. Design Analysis – includes technical analyses, computations relating design to analysis, and references. Analyses shall be appropriate to the level of project complexity. At a minimum, analyses must include the following:
    a. Hydraulic Analysis
    b. Sediment Assessment
    c. Vegetation Plan
    d. Risk Analysis

5. Monitoring and Adaptive Management – Develop a 10-year monitoring and adaptive management plan, including the following:
    a. Monitoring Frequency, Timing, and Duration – to assess project effectiveness
    b. Monitoring Technique Protocols
    c. Data Storage and Analysis

NMFS will review the project using the River Restoration Analysis Tool (www.restorationreview.com). Therefore the following questions must be addressed in the project documentation described above.

1. Problem Identification
    a. Is the problem identified?
    b. Are causes identified at appropriate scales?

2. Project Context
   a. Is the project identified as part of a plan, such as a watershed action plan or recovery plan?
   b. Does the project consider ecological, geomorphic, and socioeconomic context?

3. Goals & Objectives
   a. Do goals and objectives address problem, causes, and context?
   b. Are objectives measurable?

4. Alternatives/Options Evaluation
   a. Were alternatives/options considered?
   b. Are uncertainties and risks associated with the selected alternative acceptable?

5. Project Design
   a. Do project elements collectively support project objectives?
   b. Are design criteria defined for all project elements?
   c. Do project elements work with stream processes to create and maintain habitat?
   d. Is the technical basis of design sound for each project element?

6. Implementation
   a. Are plans and specifications sufficient in scope and detail to execute the project?
   b. Does plan address potential implementation impacts and risks?

7. Monitoring & Management
   a. Does the monitoring plan address project compliance?
   b. Does the monitoring plan directly measure project effectiveness?

Conservation Measures

- For overall design goals, the channel reconstruction design data must demonstrate:

   1. A clear linkage to limiting factors identified within an appropriate sub-basin plan or recovery plan, or based on recommendations by a technical oversight and steering committee within a localized region.

   2. The identification and, to the extent possible, the correction of the degraded baseline condition.

   3. The use of both analytical approaches and natural analogs for determination of channel cross-section, longitudinal channel geometry, and planform.

   4. Geomorphic appropriateness of structural elements.

   5. Appropriate self-sustaining hydrologic design (taking into account potential changes in streamflow volume and timing due to climate change, as appropriate) such that the restored or created habitat will not require regular maintenance.

6. That the proposed action will not result in the creation of fish passage issues or post-construction stranding of juvenile or adult fish.

- Construct geomorphically appropriate stream channels and floodplains within a watershed and stream-reach context.
- To the greatest degree possible, remove nonnative fill material from the floodplain to an upland site.
- When necessary, loosen compacted soils once overburden material is removed. Overburden or fill comprised of native materials, which originated from the project area, may be used within the floodplain where appropriate to support the project goals and objectives.
- Ensure that structural elements fit the geomorphic context of the stream system. For bed stabilization and hydraulic control structures, constructed riffles shall be preferentially used in pool-riffle stream types, while roughened channels and boulder weirs shall be preferentially used in step-pool and cascade stream types. Material selection (large wood, rock, gravel) shall also mimic natural stream system materials.
- Construct the streambed using Stream Simulation Design principles as described in Section 6.2 of the 2008 Forest Service document *Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings* (USFS 2008), or another appropriate design guidance document.
- Fish passage will be provided for any ESA-listed adult or juvenile fish likely to be migrating through the action area during construction, unless passage did not exist before construction or the stream reach is naturally impassable at the time of construction.

2.6.2.7. Riparian Habitat

Purpose: To reestablish native riparian vegetation in order to stabilize stream banks, provide shade and future source of LWD, and encourage the development of protective cover for fish and other aquatic species. This category includes planting riparian vegetation, managing livestock access to riparian areas, removing nonnative invasive weeds mechanically and with herbicides, and streambank stabilization through bioengineering techniques.

Planting riparian vegetation

Description: Planting riparian vegetation involves planting appropriate species along streams in order to stabilize stream banks and improve riparian function.

Conservation measures

- Use only native plant species.

- Use certified noxious weed-free seed (99.9%), hay, straw, mulch, or other vegetation material.

<u>Livestock restrictions</u>

Description: In many areas in Idaho, livestock have degraded riparian corridors and instream habitat. Riparian vegetation is negatively affected by livestock grazing and trampling. Generally the result is increased and chronic sedimentation and reduced riparian functions including shading and recruitment of large woody debris. Livestock fencing, stream crossings, and off-channel livestock watering facility projects will be implemented by constructing fences to exclude riparian grazing, providing controlled access for walkways that livestock use to transit across streams and through riparian areas, and reducing livestock use in riparian areas and stream channels by providing upslope water facilities. This programmatic consultation would not cover the installation of the projects that are interrelated or interdependent to a federal grazing allotment subject to separate consultation with NMFS and FWS.

Permanent or temporary livestock fences will be installed. For permanent fences, individual fence posts will be pounded or dug using hand tools or augers on backhoes or similar equipment. Fence posts will be set in the holes, backfilled, and fence wire strung or wooden rails placed. Wood fence that does not require setting posts may also be used, as may temporary electric fence. Temporary electric fence involves less ground disturbance but potentially requires more maintenance. Installation of fences may involve the removal of native or non-native vegetation along the proposed fence line.

Livestock stream crossings will provide controlled access for walkways that livestock use to transit across streams and through riparian areas. Culverts or bridges will be installed for frequent crossing locations in accordance with Section 2.5.2.2 of this assessment. Hardened stream crossings will involve the placement of river rock along the stream bottom.

Watering facilities will consist of various low-volume pumping or gravity-feed systems to move the water to a trough or pond at an upland site. Either above-ground or underground piping will be installed between the troughs or ponds and the water source. Water sources may include springs and seeps, streams, or groundwater wells. Placement of the pipes in the ground will typically involve minor trenching using a backhoe or similar equipment.

Conservation measures (fencing)

- To the extent possible, fences will be placed outside the channel migration zone and allow for lateral stream movement.

- Minimize vegetation removal, especially potential large wood recruitment sources, when constructing fence lines.

- Where appropriate, construct fences at water gaps in a manner that allows passage of large wood and other debris.

- When using pressure treated lumber for fence posts, complete all cutting/drilling offsite (to the extent possible) so that treated wood chips and debris do not enter water or flood prone areas. The use of pressure-treated lumber for fence posts in areas with frequent water contact will be avoided. Instead, alternative materials such as steel, concrete and rot resistant wood (*e.g.*, locust) will be used.

- Riparian fencing is not to be used to create livestock handling facilities.

Conservation measures (livestock stream crossings)

- The number of crossings will be minimized.

- Locate crossings or water gaps where streambanks are naturally low. Livestock crossings or water gaps will not be located in areas where compaction or other damage can occur to sensitive soils and vegetation (*e.g.*, wetlands) due to congregating livestock.

- To the extent possible, crossings will not be placed in areas where ESA-listed species spawn or are suspected of spawning (*e.g.*, pool tailouts where spawning may occur), or within 300-feet upstream of such areas.

- Existing access roads and stream crossings will be used whenever possible, unless new construction will result in less habitat disturbance and the old trail or crossing is retired.

- Livestock trails to the stream crossings will have a vegetated buffer that is adequate to avoid or minimize runoff of sediment and other pollutants to surface waters.

- Crossings will be designed and constructed or improved to handle reasonably foreseeable flood risks, including associated bedload and debris, and to prevent the diversion of streamflow out of the channel and down the trail if the crossing fails.

- If necessary, the streambank and approach lanes can be stabilized with native vegetation or angular rock to reduce chronic sedimentation. The stream crossing or water gap should be armored with sufficient sized rock (*e.g.*, cobble-size rock); or use angular rock if natural substrate is not of adequate size.

- Livestock crossings will not create barriers to the passage of adult and juvenile fish.

- The Project Sponsor will monitor a completed ford to determine if the ford is a low flow fish passage barrier. If the ford appears to be a barrier, the Action Agencies and Project Sponsor will discuss measures to address this problem with NMFS immediately. Solutions may include installation of sills or groins and will be implemented as soon as permitting allows.

- Stream crossings and water gaps will be designed and constructed to a width of 10 to 15 feet in the upstream-downstream direction to minimize the time livestock will spend in the crossing or riparian area.

Conservation measures (off-channel livestock watering facilities)

- The development of a spring is not allowed if the spring is occupied by ESA-listed species.

- Water withdrawals will not dewater habitats or cause low stream flow conditions that could affect ESA-listed fish. Troughs or tanks fed from a stream or river will have an existing valid water right.

- Surface water intakes will be screened to meet the most recent version of NMFS fish screen criteria in *Anadromous Salmonid Passage Facility Design* (NMFS 2011b), be self-cleaning, or regularly maintained by removing debris buildup. A responsible party will be designated to conduct regular inspection and as-needed maintenance to ensure pumps and screens are properly functioning.

- Place troughs far enough from a stream or surround with a protective surface to prevent mud and sediment delivery to the stream. Avoid steep slopes and areas where compaction or damage could occur to sensitive soils, slopes, or vegetation due to congregating livestock. Watering facilities will be located sufficiently far from streams so that congregating livestock are unlikely to damage riparian areas.

- Ensure that each livestock water development has a float valve or similar device, a return flow system, a fenced overflow area, or similar means to minimize water withdrawal and potential runoff and erosion. All troughs or tires will be equipped with bird ladders.

- Minimize removal of vegetation around springs and wet areas.

- When necessary, construct a fence around the spring development to prevent livestock damage.

- All new wells or other stock watering sources installed under this activity will be permitted by the appropriate state or Federal agency, and the Project Sponsor will document relevant permits in the Project Information Form. The water diversion rate from a project will not exceed the legal water right. The Project Information Form will specify who is going to maintain the facility.

<u>Removal of non-native invasive plants</u>

Description: Under the proposed action, nonnative invasive weeds will be removed through both physical means and with herbicides. The root systems of many invasive weeds lack the fibrous character of native grasses, and fail to knit the soil together effectively. This could lead to increases in soil erosion (Lacey et. al. 1989, DeBaets et. al. 2007), which could increase sediment delivery to streams, ultimately degrading salmonid habitat. Treatment of weeds by BLM and the USFS in Idaho is covered under separate NMFS consultations, and is therefore not covered under this consultation.

Three mechanisms are proposed for control of invasive plants. These methods may be combined using an integrated weed management plan.

- Manual – Manual control includes hand pulling and grubbing with hand tools; bagging plant residue for burning or other proper disposal; mulching with organic materials; shading or covering unwanted vegetation; controlling brush and pruning using hand and power tools such as chain saws and machetes; or using grazing goats. The use of grazing goats within the riparian area of a stream occupied by ESA-listed species or with critical habitat must be approved by a NMFS and FWS biologist; and the Project Sponsor must specify days of use in the Project Information Form.

- Mechanical – Mechanical control includes techniques such as mowing, tilling, disking, or plowing. Mechanical control may be carried out over large areas or be confined to smaller areas (known as scalping). Mechanical control will not occur within 100 feet of a stream.

- Chemical - The Project Sponsor may also propose to kill invasive weeds with herbicides. Herbicides will be applied in liquid or granular form using wand or boom sprayers mounted on or towed by trucks, backpack equipment containing a pressurized container with an agitation device, injection, hand wicking cut surfaces, and ground application of granular formulas. Herbicides will be mixed with water as a carrier (no oil-based carriers will be used) and may also contain one of several additives (see adjuvant paragraph below) to promote saturation and adherence, to stabilize, to enhance chemical reactions, or to provide a dye. Aerial treatment is not proposed to be covered under this consultation, nor is treatment of aquatic weeds.

The following herbicides may be used under this consultation:

Table 5. Active ingredients and end-use products that may be used for weed control.

Herbicide (Active Ingredient)	End-Use Product	General Application
2,4-D amine	Amine 4 Weedar 64 Riverdale Weedestroy AM-40	Upland-Riparian
Aminopyralid	Milestone	Upland and Riparian spot spraying
Chlorsulfuron	Telar XP	Upland-Riparian
Clopyralid	Transline	Generally Upland
Dicamba	Banvel Vanquish	Upland
Glyphosate	Rodeo GlyPro Accord Concentrate AquaMaster AquaNeat Aquatic Herbicide Foresters	Upland-Riparian
Imazapic	Plateau	Upland
Metsulfuron-methyl	Escort XP	Upland-Riparian

Herbicide (Active Ingredient)	End-Use Product	General Application
Picloram	Tordon 22K Tordon K	Upland
Sulfometuron methyl	Oust XP	Upland-Riparian
Triclopyr[1]	Garlon 3A Renovate 3 Tahoe 3A Triclopyr 3A Triclopyr 3SL	Upland-Riparian

Several adjuvants may be combined with the herbicides listed above prior to application. Adjuvants are generally defined as any substance added separately to a pesticide end-use product (typically as part of a spray tank mixture). Adjuvants can either enhance the activity of an herbicide's active ingredient or offset any problems associated with spray application. Typical adjuvants include surfactants, anti-foaming agents, crop oil or crop oil concentrates, drift retardants, compatibility agents, dyes, and pH buffers. Adjuvants proposed for this action include Activator 90, Spread 90, LI700, Syl-Tac, R11, Agri-Dex, and methylated seed oil (MSO); two drift retardants, 41-A and Valid; as well as three dyes (Bullseye, Insight, and Hilight)[7].

Activator 90, Spread 90, Agri-Dex, and LI700 are non-ionic surfactants, meaning they have no ionic charge and are hydrophilic (water-loving). They are generally biodegradable. R11 is a spreading agent that lowers the surface tension on the droplet so it covers the target plant more efficiently. MSO is an adjuvant that increases the penetration of oil-soluble herbicides into a plant. Drift retardants are used to maximize droplet size during spraying operations. The three dyes (Bullseye, Insight, and Hilight) provide a bright blue color and are non-hazardous. The dyes make it easier to see where the herbicide has been applied, and where or whether it has dripped, spilled, or leaked. Dyes also make it easier to detect missed spots, helping the applicator avoid spraying a plant or area twice. Use of dyes can thus reduce overall pesticide use. Both the herbicide and the adjuvant labels include instructions on the use of additives such as these for proper herbicide application. Adjuvant should be used when recommended on product labels to achieve the required efficacy and reduce need for follow-up applications.

Several inert ingredients may also be included in the herbicide. Inert ingredients are any substances, other than the active ingredient, that are intentionally added to a pesticide formulation. Inert ingredients serve to enhance the action of the active ingredient. Inert ingredients may include carriers, surfactants, preservatives, dyes, and anti-foaming agents among other chemicals. Because many manufacturers consider inert ingredients in their herbicide formulations to be proprietary, they do not list specific chemicals. Therefore we do not know the complete list of inert ingredients in the end-use products listed in Table 5 above. A partial list of inert ingredients for the herbicide end-use products in

[7] These are the same adjuvants as proposed for use by the Salmon-Challis National Forest in "Reinitiation of Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Frank Church-River of No Return Weeds Management Program- Salmon-Challis, Boise, Payette, Nez Perce, and Bitterroot National Forests," July 16, 2012, NMFS No: 2012/02094.

Table 5 (those listed by the manufacturers) includes water, ethanol, isopropanol, isopropanolamine, kerosene, and polyglycol 26-2. EPA has classified many of these chemicals as "List 3" compounds (inert ingredients of unknown toxicity) or "List 4B" compounds (other ingredients for which EPA has sufficient information to reasonably conclude that the current use pattern in pesticide products will not adversely affect public health or the environment).

No herbicides will be applied to open water, and a stream buffer of either 15 feet, 50 feet, or 100 feet is required for many of the chemicals proposed under this consultation. For each individual herbicide, Table 6 lists the stream buffer in which no herbicide application is allowed. Table 7 shows additional buffer restrictions for different herbicide application methods and different windspeeds. For example, broadcast spraying is not allowed within 100 feet of a stream's ordinary high water mark. Furthermore, of the adjuvants proposed for this action, Activator 90, Spread 90, LI700, Sylatac, Valid, Hilight, and R11 would not be used within 50 feet of open water. MSO, Agridex, and 41-A could be used up to within 15 feet of open water.

Herbicide application within 100 feet of live water would be limited to 190 acres per year for the entire program, with no more than 50 acres per year in any particular subbasin. No acreage limits would be placed on herbicide application farther than 100 feet from live water. The riparian limits are based on application rates in Idaho under BPA's HIP consultation. From 2008 through 2011, BPA or its project sponsors treated 377 riparian acres in North Idaho (north of the Salmon River), which makes 95 acres per year (BPA 2012). To estimate herbicide use under this programmatic consultation, NMFS doubled the BPA Clearwater River average to accommodate potential herbicide use in the Salmon River drainage—arriving at an estimate of 190 acres per year.

Table 6. Buffer Restrictions Associated with Herbicide Use. Also see Table 7 for additional buffer restrictions for different herbicide application methods and different windspeeds.

Active Ingredient	End-Use Product	Buffer from Open Water
2,4-D	2,4-D Amine 4[1]	50 ft.
	Weedar 64[2]	50 ft.
	Weedestroy AM-40[3]	50 ft.
Aminopyralid	Milestone	50 ft
Chlorsulfuron	Telar XP	15 ft
Clopyralid	Transline	15 ft
Dicamba	Banvel	50 ft
	Vanquish	50 ft
Glyphosate	Rodeo[4]	15 ft
	AquaMaster	15 ft
	AquaNeat Herbicide	15 ft
	Foresters	15 ft
Imazapic	Plateau	15 ft
Metsulfuron-methyl	Escort XP	15 ft
Picloram	Tordon 22K	100 ft
	Tordon K	100 ft
Sulfometuron-methyl	Oust XP	15 ft
Triclopyr TEA	Garlon 3A[5]	50 ft
	Tahoe 3A	50 ft
	Trichlopyr 3A	50 ft

	Triclopyr 3SL	50 ft

[2] This formulation is also sold as 2,4-D Lo V and 2,4-D Amine
[3] This formulation is also sold as Base Camp Amine 4 and Tenkoz Amine 4 2,4-D
[4] This formulation is also sold under 20 additional product names.
[5] This formulation is also sold as GlyPro, AquaPro, and Accord Concentrate
[6] This formulation is also sold as Renovate 3.

Table 7. Additional Buffer Restrictions for Different Herbicide Application Methods and Different Windspeeds.

Herbicide Application Method		
Broadcast Spray	**Spot Spray**	**Hand Application**
Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms.	Spot and localized foliar and basal/stump applications using a hand-pump backpack sprayer or field-mixed or pre-mixed hand-operated spray bottle.	Hand applications to a specific portion of the target plant using wicking, wiping or injection techniques. This technique implies that herbicides do not touch the soil during the application process.
• If windspeed > 10 mph, no spraying • If windspeed < 10 mph, 100 ft. minimum buffer from high water mark	• If windspeed > 10 mph, no spraying • If windspeed 5-10 mph, 50 ft. minimum buffer from high water mark (100 ft. minimum buffer for picloram) • If windspeed < 5 mph, 15 ft. minimum buffer from high water mark or buffer from Table 6, whichever is greater	• Minimum buffer from Table 6.

Conservation Measures

- Limit ground disturbance from mechanical treatments.
- No aerial application of herbicides is proposed under this consultation, nor is any application of herbicides to open water.
- A State or Federal licensed applicator would develop the herbicide application plan. The plan would identify herbicides specifically targeted for a particular plant species and those that will cause the least impact to non-target plant species. The State or Federal licensed applicator would perform or directly supervise all applications of Restricted Use Pesticides (e.g. picloram).
- The applicator would prepare and carry out an herbicide safety/spill response plan to reduce the likelihood of spills or misapplication, to take remedial actions in the event of spills, and to 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 and storage; (e) outline reporting procedures, including reporting spills to the appropriate regulatory agency; (f) ensure applicators are trained in safe handling and transportation procedures and spill cleanup; (g) require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition; (h) address transportation routes so that hazardous conditions are avoided to the extent possible; (i) specify mixing and loading locations away from waterbodies so that accidental spills do not contaminate surface waters; (j) require that spray tanks be mixed or washed further than 150 feet of surface water and wellheads; (k) ensure safe disposal of herbicide containers and rinsate; (l) identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft; and (m) require regular maintenance and calibration of spray equipment through the spray season to ensure proper application rates.

- All chemicals will be applied in accordance with EPA registration label requirements and restrictions. Specific label directions, recommendations, and guidelines will be followed to reduce drift potential (i.e., nozzle size and pressure, additives, wind speed).

- *2,4-D.* As a result of the National Consultation[11], this herbicide shall comply with all relevant reasonable and prudent alternatives from the 2011 Biological Opinion (NMFS 2011f): (a) Do not apply when wind speeds are below 2 mph or exceed 10 mph, except when winds in excess of 10 mph will carry drift away from salmonid-bearing waters. (b) 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 h following application. (c) Control of invasive plants within the riparian habitat shall be by individual plant treatments for woody species, and spot treatment of less than 1/10 acre for herbaceous species.

- Herbicide applicators will obtain a weather forecast for the area prior to initiating a spraying project to ensure no extreme precipitation or wind events could occur during or immediately after spraying that could allow runoff or drift into streams.

- Herbicide drift and leaching would be minimized as follows: (a) Do not spray when wind speeds exceed 10 miles per hour, or are less than 2 miles per hour if the potential for temperature inversion exists; (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 expected within 24 hours; (g) assure that products with leaching hazard are applied only to appropriate soil types and textures as indicated on label. Wind and other weather data will be monitored and reported for all broadcast applications.

- To address potential concerns with the use of the listed adjuvants, Activator 90, Spread 90, LI700, Syl-Tac, R11, Agri-Dex, Valid, and Hi-Light will not be used within 50 feet of open water. The MSO surfactant could be used up to within 15 feet of open water.

- All mixing of herbicides will occur at least 150 feet from surface water or well heads to minimize the risk of an accidental discharge.

- All hoses used to add dilution water to spray containers will be equipped with a device to prevent back-siphoning.

- Applicators will mix only those quantities of herbicides that can be reasonably used in a day.

- All empty containers will be triple rinsed and rinsate disposed of by spraying near the treatment site at rates that do not exceed those on the treatment site.

- No chemical herbicides will be used within a 100-foot radius of any potable water spring development.

- Herbicides will be applied at the lowest effective label rates, including the typical and maximum rates given. For broadcast spraying, application of herbicide or surfactant will not exceed the typical label rates.

- Dyes (e.g., Insight) will be used in riparian areas, and other locations as appropriate to provide visual evidence of treated vegetation. Dyes should be used around any sensitive areas, or where larger areas are sprayed (especially when using boom sprayers, for example), to reduce overlap and overapplication. Hi-Light, however, will not be used within 50 feet of the water's edge.

- The Project Sponsor will use herbicides and surfactants with the least toxicity to listed fish and other non-target organisms whenever possible.

- The Project Sponsor will use caution when applying herbicides near streams or roadside ditches that drain directly into streams. Herbicides containing glyphosate without surfactants or toxic additives, such as Rodeo®, will be the product of choice under appropriate site conditions.

- The Project Sponsor will avoid the use of picloram, clopyralid, chlorsulfuron, dicamba, imazapic, triclopyr, and metsulfuron-methyl within annual floodplains where the water table is within 6 feet of the surface and soil permeability is high (silt loam and sand soils).

- The Project Sponsor will insure that herbicides are not applied when wind speeds are less than 2 mph if the potential for temperature inversions exists.

- Most weed patches are expected to have overland access. However, some sites may be reached only by water travel, either by wading or inflatable raft (or kayak). The following measures will be used to reduce the risk of a spill during water transport: (a) No more than 2.5 gallons of herbicide will be transported per person or raft, and typically it will be one gallon or less. (b)

Herbicide will be carried in 1 gallon or smaller plastic containers. The containers will be wrapped in plastic bags and then sealed in a dry-bag. If transported by raft, the dry-bag will be secured to the watercraft.

- Do not apply herbicides if whitebark pine is present at the site. Do not apply herbicides where Northern Idaho ground squirrels or ESA-listed plants are known to be present.

- On the Project Completion Form, the Project Sponsor will list all herbicides use and acres treated.

Streambank Stabilization

Description: This consultation includes the restoration of eroding streambanks through bank shaping and installation of coir logs or other soil reinforcements – bioengineering techniques as necessary to support development of riparian vegetation and/or planting or installing large wood, trees, shrubs, and herbaceous cover as necessary to restore ecological function in riparian and floodplain habitats. The goal of streambank restoration is to reestablish long term riparian processes through re-vegetation, or to ameliorate chronic erosion in locations where roads, bridges or other permanent floodplain developments preclude lateral channel migration.

The following bioengineering techniques[8] may be used either individually or in combination: (1) Woody plantings and variations (*e.g.*, live stakes, brush layering, fascines, brush mattresses); (2) herbaceous cover, where analysis of available records (*e.g*., historical accounts and photographs) shows that trees or shrubs did not exist on the site within historic times, primarily for use on small streams or adjacent wetlands; (3) deformable soil reinforcement, consisting of soil layers or lifts strengthened with biodegradable coir fabric and plantings that are penetrable by plant roots; (4) coir logs (long bundles of coconut fiber), straw bales, and straw logs used individually or in stacks to trap sediment and provide a growth medium for riparian plants; (5) bank reshaping and slope grading, when used to reduce a bank slope angle without changing the location of its toe, to increase roughness and cross section, and to provide more favorable planting surfaces; (6) tree and LWD rows, live siltation fences, brush traverses, brush rows and live brush sills in floodplains, used to reduce the likelihood of avulsion in areas where natural floodplain roughness is poorly developed or has been removed; and (7) floodplain flow spreaders, consisting of one or more rows of trees and accumulated debris used to spread flow across the floodplain.

[8] For detailed descriptions of each technique refer to the WDFW Integrated Streambank Protection Guidelines: http://wdfw.wa.gov/publications/00046/,http://wdfw.wa.gov/publications/00046/,the USACE's EMRRP Technical Notes, Stream Restoration: http://el.erdc.usace.army.mil/publications.cfm?Topic=technote&Code=emrrphttp://el.erdc.usace.army.mil/publications.cfm?Topic=technote&Code=emrrp, or the NRCS National Engineering Handbook Part 654, Stream Restoration: http://policy.nrcs.usda.gov/viewerFS.aspx?id=3491http://policy.nrcs.usda.gov/viewerFS.aspx?id=3491

Conservation Measures

- Without changing the location of the bank toe, damaged streambanks will be restored to a natural slope 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, thus promoting better plant survival.

- Streambank restoration projects shall include the placement of a riparian buffer strip consisting of a diverse assemblage of species native to the action area or region, including trees, shrubs, and herbaceous species, as appropriate to site conditions. Use certified seed sources that are free of noxious or invasive species.

- Large wood may be used as an integral component of streambank protection treatments. Large wood will be placed to maximize near bank hydraulic complexity and interstitial habitats through use of various large wood sizes and configurations of the placements.

- Structural placement of large wood should focus on providing bankline roughness for energy dissipation vs. flow re-direction that may affect the stability of the opposite bankline.

- Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.

- Large wood anchoring will not utilize cable or chain. Manila, sisal or other biodegradable ropes may be used for lashing connections. If hydraulic conditions warrant use of structural connections, then wooden posts should be used in preference to rebar or steel posts. If rebar or steel posts with a height less than 4 feet tall are used, the tops of the posts must be bent downward to reduce the hazards to humans and wildlife.

- Rock will not be used for streambank restoration, except as ballast to stabilize large wood, unless it is necessary to prevent scouring or downcutting of an existing flow control structure (*e.g.*, culvert or bridge support, headwall). In this case rock may be used as the primary structural component for construction of vegetated riprap with large woody debris. Rock may also be used for barbs to protect an existing structure (see below) in conjuction with bioengineering streambank stabilization tecniques.

- Fencing will be installed as necessary to prevent access and grazing damage to revegetated sites and project buffer strips.

- Surface fertilizer will not be applied within 50 feet of any stream.

2.6.2.8. Road and Trail Erosion Control, Maintenance and Decommissioning

Purpose: To reduce sediment delivery to streams from man-made sources.

Description: This category includes road projects aimed at reducing sediment delivery to streams and thereby improving aquatic habitat, where necessary as part of a larger aquatic habitat restoration project. This includes road obliteration, relocating roads and trails away from riparian areas, road drainage system improvements, and other sediment reduction projects. Road maintenance activities within the riparian zone may include (1) creating barriers to human access: gates, fences, boulders, logs, tank traps, vegetative buffers, and signs, (2) surface maintenance, such as building and compacting the road prism, grading, and spreading rock or surfacing material, (3) drainage maintenance and repair of inboard ditch lines, waterbars, sediment traps, (4) removing and hauling or stabilizing pre-existing cut and fill material or slide material, (5) water spraying for dust abatement, and (6) relocating portions of roads and trails to less sensitive areas outside of riparian buffer areas. The proposed activity does not include asphalt resurfacing, widening roads, or new construction or relocation of any permanent road inside a riparian buffer area except for a bridge approach in accordance to the section on **Fish Passage.** Road grading and shaping will maintain, not destroy, the designed drainage of the road, unless modification is necessary to improve drainage problems that were not anticipated during the design phase. Road maintenance will not be attempted when surface material is saturated with water and erosion problems could result. Where road maintenance on federal lands is covered under a separate existing consultation with NMFS, this consultation will not apply.

The Project Sponsor may decommission and obliterate roads that are no longer needed, e.g., logging roads. Water bars will be installed, road surfaces will be insloped or outsloped, asphalt and gravel will be removed from road surfaces, culverts and bridges will be altered or removed, streambanks will be recontoured at stream crossings, cross drains will be installed, fill or sidecast materials will be removed, road prism will be reshaped, sediment catch basins will be created, all surfaces will be revegetated to reduce surface erosion of bare soils, surface drainage patterns will be recreated, and dissipaters, chutes or rock will be placed at remaining culvert outlets. Ground cover on the old road bed is provided by transplanted bushes or placement of branches from nearby vegetation. Grass and forb seeds are typically applied to any bare soil. These activities will be conducted during dry-field conditions—low to moderate soil moisture levels. Slide and waste material will be disposed in stable, non-floodplain sites unless materials are to restore natural or near-natural contours, and approved by a geotechnical engineer or other qualified personnel.

Conservation Measures

- For road obliteration projects, disturbance of existing vegetation in ditches and at stream crossings will be minimized to the extent necessary to restore hydrologic functions.
- For road obliteration projects, culvert removal will be designed to restore the natural drainage pattern.
- Dust-abatement and stabilization chemicals are not covered by this programmatic. Only water may be used for dust abatement.
- Waste material generated from road maintenance activities and slides will be disposed on stable, nonfloodplain sites approved by a geotechnical engineer or other qualified personnel.

- Disturbance of existing vegetation in ditches and at stream crossings will be minimized to the greatest extent possible.

- Ditches and culverts will be promptly cleaned of materials resulting from slides or other debris.

- Berms will not be left along the outside edge of roads, unless an outside berm was specifically designed to be a part of the road, and low-energy drainage is provided.

- Ditch back slopes will not be undercut, to avoid slope destabilization and erosion acceleration.

- When blading and shaping roads, road surface material will not be sidecast onto the fill. All excess material that cannot be bladed into the surface will be hauled to a site where sediment will not enter water. Slides and rock failures including fine material of more than approximately ½ yard at one site will be hauled to disposal sites. Fine materials (1 inch or smaller) from slides, ditch maintenance, or blading may be worked into the road. Scattered clean rocks (1 inch or larger) may be raked or bladed off the road in locations where there is a sufficient buffer between the road and stream to prevent materials from washing into the water.

- Road maintenance will not be attempted when surface material is saturated with water and erosion problems could result. When replacing or adding cross drains, coarse rock shall be used at outlets of the cross drains to dissipate energy in locations where the water is likely to create gullies.

2.6.2.9. Surveying and Monitoring

Purpose: To collect information about the project site, current habitat conditions, and species presence and abundance; and to monitor the site for several years after project completion to assess the effectiveness of the project. In addition, this consultation covers the installation of passive integrated transponder (PIT) tag detection arrays for monitoring fish movement.

<u>Surveying and Monitoring at Habitat Restoration Project Sites</u>

Description: Conduct habitat and animal inventories in riparian areas, streams, and wetlands, and install monitoring equipment. Electroshocking for research purposes is not included under this consultation, as this work must have an ESA Section 10 research permit. (However, electroshocking and other fish removal methods are covered under this program for the purpose of removing fish from an in-stream work area prior to dewatering, as described under ***2.5.1. General Conservation Measures***.) Under this category, work may include survey equipment and crews using hand tools for the following activities:

- Measuring and recording physical measurements by visual estimates or with survey instruments.
- Manually installing rebar or other markers along transects or at reference points.
- Manually installing piezometers and staff gauges to assess hydrologic conditions.
- Manually installing recording devices for streamflow and temperature.

- Excavating cultural resource test pits using hand shovel only.

Conservation Measures

- Hydraulic and topographic measurement within the wetted channel may be completed anytime except during the spawning and incubation periods for ESA-listed species, unless a natural resource specialist with experience in fish handling verifies that no redds occur within 300 feet downstream from the measurement site.

- No in-water work will occur within 300 feet of spawning areas during anadromous fish spawning and incubation times, which will be dictated by the approved work window.

- Workers will avoid redds and listed spawning fish while walking within or near stream channels to the extent possible. Avoidance will be accomplished by examining pool tailouts and low-gradient riffles for clean gravel and characteristic shapes and flows prior to walking or snorkeling through these areas.

- If redds or listed spawning fish are observed at any time, workers will step out of the channel and walk on dry land at a distance from the active channel.

- Surveyors will coordinate with local agencies to prevent redundant surveys.

- Excavated material from cultural resource test pits will be placed away from stream channels. All material will be replaced back into test pits when testing is completed.

- Multiple stream sites will be used for field trips to minimize effects on any given stream or riparian buffer area.

- Rebar stakes left on site must have the tops bent downward to reduce hazards to humans and wildlife.

Installation of PIT Tag Detection Arrays

Description: This category may also include the installation and maintenance of PIT tag detection arrays. PIT tag detection arrays consist of antennas laid out on stream substrate perpendicular to streamflow in order to detect and identify fish marked with PIT tags. This habitat restoration programmatic consultation would cover only the installation and maintenance of PIT tag arrays in Idaho, and not the actual fish studies (capture, handling, tagging, sampling, live release, etc.) associated with the operation of the PIT tag arrays, which would be covered under existing NMFS and FWS permits or consultations.

PIT tag antennas can be fixed to stream substrate using manta ray anchors, all thread, and end caps, which are driven into the substrate with hand tools. A trench may be excavated for cable placement. Excavation of substrate would be completed using hand tools, including a hydraulic pump and jackhammer where necessary to dislodge embedded substrate. All excavated substrate material would be redistributed within the channel at the project site. On-shore construction could include installation of posts with concrete footers to support electrical equipment; and installation of a power source (domestic, thermoelectric generator, or solar panels). Where thermoelectric power is used, propane tanks (up to 250 gallons) would be placed on site.

PIT tag detection array installations are often completed within a day, although some sites could require multiple days of instream or on-shore work. PIT tag array sites are typically selected for substrate and channel structure most readily classified as "migration corridors." As a result, sites are typically downstream of spawning habitat and have low habitat complexity, little woody debris, uniform depth, larger substrate, and high velocities. Generally, these conditions result in sites with little potential for spawning and low value as juvenile rearing habitat.

Conservation Measures

- Installation would occur during periods of low instream flow, preferably in advance of adult migration. If the Project Sponsor proposes to install a PIT tag array outside of the preferred instream work window (e.g. Appendix D for the Upper Salmon River), the Project Sponsor must specify an alternative low-water work window in the Project Information Form. NMFS must provide electronic approval of this variance prior to the work proceeding.

- Instream and bank disturbance would be minimized to preserve the current condition of each site and all work will be conducted by hand.

- Staging of equipment and materials would occur more than 150 feet from all streams.

- Arrays must not be placed in areas that are likely to be used for spawning. Prior to installations, the Project Sponsor would review available redd survey data to evaluate the possible presence of redds near project locations. Additionally, a reach no shorter than 100 yards upstream and downstream of each site would be surveyed for the presence of redds and adult salmonids immediately prior to installation. If redds or spawning activity are observed in this reach, installation would be delayed until the next NMFS-approved work window.

3.0 Description of the species and their habitat

The summaries that follow describe the status of the five ESA-listed fish species and their designated critical habitats within the geographic area of this proposed action. More detailed information on the status and trends of these ESA-listed resources, and their biology and ecology, can be found in the listing regulations and critical habitat designations published in the Federal Register (Table 7). On August 15, 2011, NMFS published the results of the agency's most recent 5-year review of ESA-listed Pacific salmonid species, including the four listed species in Idaho (Ford et al. 2011). NMFS defines the three salmon species as "evolutionarily significant units" (ESUs) and the steelhead species as a "distinct population segment" (DPS).

General descriptions for other species, along with environmental baseline information, are provided for in Appendix F, *Species Description for Wildlife and Plants*.

Table 7. Federal Register notices for final rules that list threatened and endangered species, designated critical habitat, or apply protective regulations to ESA-listed species considered in this consultation (Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered).

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (*Oncorhynchus tshawytscha*)			
Snake River spring/summer run	T 6/28/05; 70 FR 37160	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Snake River fall-run	T 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160
Sockeye salmon (*O. nerka*)			
Snake River	E 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	ESA Section 9 applies
Steelhead (*O. mykiss*)			
Snake River Basin	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Bull trout (*Salvelinus confluentus*)			
Columbia Basin	T 6/10/98; 64 FR 58909	10/18/10; 75 FR 63898	

3.1 Status of Listed Species

When evaluating the status of an ESA-listed species, the parameters considered in recovery plans, status reviews, and listing decisions are relevant. For Pacific salmon and steelhead, viability of the populations that make up the species can be assessed using four parameters: spatial structure, diversity, abundance, and productivity (McElhany et al. 2000). These VSP criteria therefore encompass the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. When these parameters are at appropriate levels, collectively, they maintain a population's capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment. These attributes are influenced by survival, behavior, and experiences throughout the entire life cycle, characteristics that are influenced, in turn, by habitat and other environmental conditions.

"Spatial structure" refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population's spatial structure depends fundamentally on habitat quality and spatial configuration, and the dynamics and dispersal characteristics of individuals in the population. "Diversity" refers to the distribution of traits within and among populations. These range in scale from deoxyribonucleic acid (DNA) sequence variation at single genes to complex life history traits (McElhany et al. 2000). "Abundance" generally refers to the number of naturally-produced adults (i.e., the progeny of naturally-spawning parents) in the natural environment (e.g., on spawning grounds).

"Productivity" as applied to viability factors refers to the entire life cycle (i.e., the number of naturally-spawning adults produced per parent). When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is declining. McElhany et al. (2000) use the terms "population growth rate" and "productivity" interchangeably when referring to production over the entire life cycle. They also refer to "trend in abundance," which is the manifestation of long-term population growth rate.

Once the biological status of a species' populations has been determined, NMFS assesses the status of the entire species using criteria for groups of populations, as described in recovery plans and guidance from technical recovery teams. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close to allow functioning as metapopulations (McElhany et al. 2000).

The four ESA-listed species in Idaho fall under the Interior Columbia Recovery Domain. Recovery domains are geographically-based areas that NMFS is using to prepare multi-species recovery plans for salmon and steelhead. For each domain, NMFS appointed an interagency team of scientists to provide a scientific foundation for recovery plans. The Interior Columbia Technical Recovery Team (ICTRT) has delineated populations for each species in its domain, assessed the current viability of each population, and made recommendations for recovery of the species based on viability goals for the species' component populations. The rangewide species status summaries in this Opinion rely on several ICTRT reports, such as population status assessments and viability criteria. These reports can be found at http://www.nwfsc.noaa.gov/trt/pubs.cfm, or by contacting the NMFS Boise office.

NMFS and the State of Idaho are currently developing a recovery plan for the four Snake River species, based on the recommendations of the ICTRT. The recovery plan will describe the status of the species and their component populations, limiting factors, recovery goals, and actions to address limiting factors. The most recent working drafts of the Idaho Snake River recovery plan are posted at http://www.idahosalmonrecovery.net/.

3.1.1. Snake River Spring/Summer Chinook Salmon

The Snake River spring/summer Chinook salmon ESU was listed as threatened on April 22, 1992 (57 FR 14653). This ESU occupies the Snake River basin, which drains portions of southeastern Washington, northeastern Oregon, and north/central Idaho. Several factors led to NMFS' conclusion that Snake River spring/summer Chinook were threatened: (1) Abundance of naturally produced Snake River spring and summer Chinook runs had dropped to a small fraction of historical levels; (2) short-term projections were for a continued downward trend in abundance; (3) hydroelectric development on the Snake and Columbia Rivers continued to disrupt Chinook runs through altered flow regimes and impacts on estuarine habitats; and (4) habitat degradation existed throughout the region, along with risks associated with the use of outside hatchery stocks in particular areas (Good et al 2005). On August 15, 2011, in the agency's most recent 5-year review for the Snake River ESU, NMFS concluded that the species should remain listed as threatened (76 FR 50448).

Adult spring and summer Chinook destined for the Snake River enter the Columbia River on their upstream spawning migration from February through March and arrive at their natal tributaries between June and August. Spawning occurs in August and September. Eggs incubate over the winter and hatch in late winter and early spring of the following year. Juveniles exhibit a river-type life history strategy, rearing in tributary streams during their first year of life before migrating to the ocean the following spring. Depending on the tributary and the specific habitat conditions, juveniles may migrate extensively from natal reaches into alternative summer-rearing or overwintering areas. After reaching the ocean as smolts, the fish typically spend 2 to 3 years in the ocean before beginning their migration back to their natal freshwater streams.

Spatial Structure and Diversity. The Snake River ESU includes all naturally spawning populations of spring/summer Chinook in the mainstem Snake River (below Hells Canyon Dam) and in the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins (57 FR 23458), as well as the progeny of 15 artificial propagation programs (70 FR 37160). The hatchery programs include the South Fork Salmon River (McCall Hatchery), Johnson Creek, Lemhi River, Pahsimeroi River, East Fork Salmon River, West Fork Yankee Fork Salmon River, and Upper Salmon River (Sawtooth Hatchery) programs in Idaho; and the Tucannon River (conventional and captive broodstock programs), Lostine River, Catherine Creek, Lookingglass Creek, Upper Grande Ronde River, Imnaha River, and Big Sheep Creek programs in Oregon. The historical Snake River spring/summer Chinook ESU likely also included populations in the Clearwater River drainage and extended above the Hells Canyon Dam complex.

Within the Snake River ESU, the ICTRT identified 28 extant and 4 extirpated or functionally extirpated populations of spring/summer-run Chinook salmon, listed in Table 8 (ICTRT 2003; McClure et al. 2005). The ICTRT aggregated these populations into five MPGs, of which the South Fork Salmon, Middle Fork Salmon, and Upper Salmon River MPGs are in central Idaho. All populations in Idaho are extant with the exception of Panther Creek, which the ICTRT classified as functionally extirpated due to severe water quality and habitat degradation in Lower Panther Creek during the 1950s and 1960s from Blackbird Mine operations (ICTRT 2003). For each population, Table 8 shows the current risk ratings that the ICTRT assigned to the four parameters of a viable salmonid population (spatial structure, diversity, abundance, and productivity).

In general, current spatial structure risk is low in this ESU and is not preventing the recovery of the species. Spring/summer Chinook spawners are distributed throughout the ESU albeit at very low numbers. Diversity risk, on the other hand, is somewhat higher, driving the moderate and high combined spatial structure/diversity risks shown in Table 8 for some populations. In the Upper Salmon, high diversity risks are caused by chronically high proportions of hatchery spawners in natural areas, and by loss of access to tributary spawning and rearing habitats and the associated reduction in life history diversity (Ford et al. 2011). Diversity risk will need to be lowered in multiple populations in order for the ESU to recover (NMFS 2011b).

Abundance and Productivity. Historically, the Snake River drainage is thought to have produced more than 1.5 million adult spring/ summer Chinook salmon in some years (Matthews and Waples 1991), yet by the mid-1990s counts of wild fish passing Lower Granite Dam dropped to less than 10,000 (IDFG 2007). Wild returns have since increased somewhat but remain highly variable and a fraction of historic estimates (Ford et al. 2011). For individual populations, abundance remains below viability thresholds for all populations, reflected in the ICTRT's high risk rating for abundance/productivity for each population listed in Table 8 (Ford et al. 2011). For some populations, mean abundance from 2000 to 2009 is extremely low, such as for the Yankee Fork and Camas Creek populations, which have recent mean abundances of just 21 and 30 natural spawners, respectively, compared to minimum viability targets of at least 500 spawners (Ford et al. 2011). Relatively low natural production rates and spawning levels remain a major concern across the ESU, and each population in the ESU currently faces a high risk of extinction over the next 100 years (Table 8).

Table 8. Summary of viable salmonid population (VSP) parameter risks and overall current status for each population in the Snake River spring/summer Chinook salmon ESU (Ford et al. 2011; ICTRT 2010a; 2010b; 2010c).

MPG	Population	VSP Parameter Risk		Overall Viability Rating
		Abundance/ Productivity	Spatial Structure/ Diversity	
South Fork Salmon River (Idaho)	*Little Salmon River*	High	High	High Risk
	South Fork Salmon River mainstem	High	Moderate	High Risk
	Secesh River	High	Low	High Risk
	East Fork South Fork Salmon River	High	Low	High Risk
Middle Fork Salmon River (Idaho)	Chamberlain Creek	High	Low	High Risk
	Middle Fk. Salmon River below Indian Ck.	High	Moderate	High Risk
	Big Creek	High	Moderate	High Risk
	Camas Creek	High	Moderate	High Risk
	Loon Creek	High	Moderate	High Risk
	Middle Fk. Salmon River above Indian Ck.	High	Moderate	High Risk
	Sulphur Creek	High	Moderate	High Risk
	Bear Valley Creek	High	Low	High Risk
	Marsh Creek	High	Low	High Risk
Upper Salmon River (Idaho)	*North Fork Salmon River*	High	Low	High Risk
	Lemhi River	High	High	High Risk
	Salmon River Lower Mainstem	High	Low	High Risk
	Pahsimeroi River	High	High	High Risk
	East Fork Salmon River	High	High	High Risk
	Yankee Fork Salmon River	High	High	High Risk

	Valley Creek	High	Moderate	High Risk
	Salmon River Upper Mainstem	High	Moderate	High Risk
	Panther Creek			Extirpated
Lower Snake (Washington)	Tucannon River	High	Moderate	High Risk
	Asotin River			Extirpated
Grande Ronde and Imnaha Rivers (Oregon/ Washington)	Wenaha River	High	Moderate	High Risk
	Lostine/Wallowa River	High	Moderate	High Risk
	Minam River	High	Moderate	High Risk
	Catherine Creek	High	Moderate	High Risk
	Upper Grande Ronde R.	High	High	High Risk
	Imnaha River	High	Moderate	High Risk
	Big Sheep Creek			Extirpated
	Lookingglass Creek			Extirpated

Note: The 10 populations in italics are those with state highways within the population boundaries, all within the Salmon River Basin.

Limiting Factors. Limiting factors and threats to the Snake River spring/summer-run Chinook salmon ESU include the following (NOAA Fisheries 2011, NMFS 2011a):

- Mainstem Columbia River and Snake River hydropower impacts;
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, elevated water temperature, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, mining, forestry, road-building, and development;
- Hatchery impacts;
- Predation by pinnipeds, birds, and piscivorous fish in the mainstem river and estuary migration corridor; and,
- Harvest-related effects.

3.1.2. Snake River Basin Steelhead

The Snake River steelhead was listed as a threatened ESU on August 18, 1997 (62 FR 43937), with a revised listing as a DPS on January 5, 2006 (71 FR 834). This DPS occupies the Snake River basin, which drains portions of southeastern Washington, northeastern Oregon, and north/central Idaho. Reasons for the decline of this species include substantial modification of the seaward migration corridor by hydroelectric power development on the Snake and mainstem Columbia Rivers, and widespread habitat degradation and reduced streamflows throughout the Snake River basin (Good et al. 2005). Another major concern for the species is the threat to genetic integrity from past and present hatchery practices, and the high proportion of hatchery fish in aggregate run of Snake River Basin steelhead over Lower Granite Dam (Good et al. 2005; Ford et al. 2011). On August 15, 2011, in the agency's most recent 5-year review for the Snake River DPS, NMFS concluded that the species should remain listed as threatened (76 FR 50448).

Adult Snake River Basin steelhead enter the Columbia River from late June to October to begin their migration inland. After holding over the winter in larger rivers in the Snake River basin, steelhead disperse into smaller tributaries to spawn from March through May. Earlier dispersal occurs at lower elevations and later dispersal occurs at higher elevations. Juveniles emerge from the gravels in 4 to 8 weeks, and move into shallow, low-velocity areas in side channels and along channel margins to escape high velocities and predators (Everest and Chapman 1972). Juvenile steelhead then progressively move toward deeper water as they grow in size (Bjornn and Rieser 1991). Juveniles typically reside in fresh water for 1 to 3 years, although this species displays a wide diversity of life histories. Smolts migrate downstream during spring runoff, which occurs from March to mid-June depending on elevation, and typically spend 1 to 2 years in the ocean.

Spatial Structure and Diversity. This species includes all naturally-spawning steelhead populations below natural and manmade impassable barriers in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho, as well as the progeny of six artificial propagation programs (71FR834). The hatchery programs include Dworshak National Fish Hatchery, Lolo Creek, North Fork Clearwater River, East Fork Salmon River, Tucannon River, and the Little Sheep Creek/Imnaha River steelhead hatchery programs. The Snake River Basin steelhead listing does not include resident forms of *O. mykiss* (rainbow trout) co-occurring with steelhead.

The ICTRT identified 24 extant populations within this DPS, organized into 5 MPGs (ICTRT 2003). The ICTRT also identified a number of potential historical populations associated with watersheds above the Hells Canyon Dam complex on the mainstem Snake River, a barrier to anadromous migration. Two of the five MPGs with extant populations are in Idaho: the Clearwater River MPG (5 extant populations, 1 extirpated); and the Salmon River MPG (12 populations). In the Clearwater River, the historic North Fork population was blocked from accessing spawning and rearing habitat by Dworshak Dam. Current steelhead distribution extends throughout the DPS, such that spatial structure risk is generally low. For each population in the DPS, Table 9 shows the current risk ratings that the ICTRT assigned to the four parameters of a viable salmonid population (spatial structure, diversity, abundance, and productivity).

The Snake River Basin steelhead DPS exhibit a diversity of life-history strategies, including variations in fresh water and ocean residence times. Traditionally, fisheries managers have classified Snake River Basin steelhead into two groups, A-run and B-run, based on ocean age at return, adult size at return, and migration timing. A-run steelhead predominantly spend 1 year at sea and are assumed to be associated with low to mid-elevation streams in the Snake River Basin. B-run steelhead are larger with most individuals returning after 2 years in the ocean. The ICTRT has identified each population in the DPS as either A-run or B-run. Recent research, however, suggests that some populations may support multiple life history strategies. Within one population in the Clearwater River, IDFG reports at least nine different phenotypes, with steelhead spending 1, 2, or 3 years in the ocean (Bowersox 2011). Maintaining life history diversity is important for the recovery of the species.

Diversity risk for the DPS is low to moderate, and drives the moderate combined spatial structure/diversity risks shown in Table 9 for some populations. Moderate diversity risks for some populations are caused by the high proportion of hatchery fish on natural spawning grounds. The current moderate diversity risks for populations in Idaho do not preclude those populations from achieving viability goals under the draft recovery plan for Idaho's salmon and steelhead (NMFS 2011c, 2011d).

Abundance and Productivity. Historical estimates of steelhead production for the entire Snake River basin are not available, but the basin is believed to have supported more than half the total steelhead production from the Columbia River basin (Mallet 1974, as cited in Good et al. 2005). Historical estimates do exist for portions of the basin. Estimates of steelhead passing Lewiston Dam (removed in 1973) on the lower Clearwater River were 40,000 to 60,000 adults (Ecovista et al. 2003). Based on relative drainage areas, the Salmon River basin likely supported substantial production as well (Good et al. 2005). In contrast, at the time of listing, the 5-year (1991-996) mean abundance for natural-origin steelhead passing Lower Granite Dam was 11,462 adults (Ford et al. 2011). Steelhead passing Lower Granite Dam include those returning to: (1) The Grande Ronde and Imnaha Rivers in Oregon; (2) Asotin Creek in Washington; and (3) the Clearwater and Salmon Rivers in Idaho. The most recent 5-year (2003-2008) mean abundance passing Lower Granite Dam was substantially larger at 18,847 natural-origin fish (Ford et al. 2011). These natural-origin fish represent just 10% of the total steelhead run over Lower Granite Dam of 162,323 adults for the same time period. However, a large proportion of the hatchery run returns to hatchery racks or is removed by hatchery selective harvest and therefore does not contribute to natural production in most Snake River tributaries (Ford et al. 2011).

Despite recent increases in steelhead abundance, population-level natural origin abundance and productivity inferred from aggregate data indicate that many populations in the DPS are likely below the viability targets necessary for species recovery (ICTRT 2010d). Population-specific abundance estimates are not available for most Snake River steelhead populations, including all populations in Idaho. Instead, the ICTRT estimated average population abundance and productivity using annual counts of wild steelhead passing Lower Granite Dam, generating separate estimates for a surrogate A-run and B-run population. Most population abundance/productivity risks shown in Table 9 are based on a comparison of the surrogate population current abundance and productivity estimates to a population viability threshold of 1,000 natural-origin spawners and a productivity of 1.14 recruits per spawner. The surrogate A-run population has a mean abundance of 556 spawners and productivity of 1.86, indicating a moderate abundance/productivity risk. The surrogate B-run population has a mean abundance of 345 spawners and productivity of 1.09, indicating a high abundance/productivity risk (NMFS 2011c). Based on these tentative risk ratings, all populations in Idaho are currently at either high or moderate risk of extinction over the next 100 years. Joseph Creek in Oregon, for which population-specific abundance information is available, is the only population in the DPS currently rated as viable (Ford et al. 2011).

Limiting Factors. Limiting factors and threats to the Snake River Basin steelhead DPS include the following (NOAA Fisheries 2011; NMFS 2011e):

- Mainstem Columbia River and Snake River hydropower impacts;

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, elevated water temperature, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, mining, forestry, road-building, and development;

- Impaired tributary fish passage;
- Harvest impacts, particularly for B-run steelhead;
- Predation by pinnipeds, birds, and piscivorous fish in the mainstem river and estuary migration corridor; and,
- Genetic diversity effects from out-of-population hatchery releases.

Table 9. Summary of viable salmonid population (VSP) parameter risks and overall current status for each population in the Snake River Basin steelhead DPS (Ford et al. 2011; ICTRT 2010d).

MPG	Population	VSP Parameter Risk		Overall Viability Rating
		Abundance/ Productivity	Spatial Structure/ Diversity	
Lower Snake River	Tucannon River	High	Moderate	High Risk?
	Asotin Creek	Moderate	Moderate	High/Moderate Risk?
Grande Ronde River	*Lower Grande Ronde*		Moderate	Moderate Risk?
	Joseph Creek	Very Low	Low	Highly Viable
	Wallowa River	High	Low	High Risk?
	Upper Grande Ronde	Moderate	Moderate	Moderate Risk
Imnaha River	Imnaha River	Moderate	Moderate	Moderate Risk
Clearwater River (Idaho)	*Lower Mainstem Clearwater River*	Moderate	Low	Moderate Risk?
	South Fork Clearwater River	High	Moderate	High Risk?
	Lolo Creek	High	Moderate	High Risk?
	Selway River	High	Low	High Risk?
	Lochsa River	High	Low	High Risk?
	North Fork Clearwater River			Extirpated
Salmon River (Idaho)	*Little Salmon River*	Moderate	Moderate	Moderate Risk?
	South Fork Salmon River	High	Low	High Risk?
	Secesh River	High	Low	High Risk?
	Chamberlain Creek	Moderate	Low	Moderate Risk?
	Lower Middle Fork Salmon River	High	Low	High Risk?
	Upper Middle Fork Salmon River	High	Low	High Risk?
	Panther Creek	Moderate	High	Moderate Risk?
	North Fork Salmon River	Moderate	Moderate	Moderate Risk?
	Lemhi River	Moderate	Moderate	Moderate Risk?
	Pahsimeroi River	Moderate	Moderate	Moderate Risk?

	East Fork Salmon River	Moderate	Moderate	Moderate Risk?
	Upper Mainstem Salmon River	Moderate	Moderate	Moderate Risk?
Hells Canyon	Hells Canyon Tributaries			Extirpated

Note: The 12 populations in italics are those with state highways within the population boundaries, all but one in the Salmon River Basin or the Clearwater River Basin. The Lower Grande Ronde River steelhead population, predominantly located in Oregon, also includes the mainstem Snake River from the Grande Ronde River to the Clearwater River, and encompasses a stretch of Idaho state highway in the city of Lewiston.

3.1.3 Snake River Fall Chinook Salmon

The Snake River fall Chinook salmon ESU was listed as threatened on April 22, 1992 (57 FR 14653). This ESU occupies the Snake River basin, which drains portions of southeastern Washington, northeastern Oregon, and north/central Idaho. Snake River fall Chinook salmon have substantially declined in abundance from historic levels, primarily due to the loss of primary spawning and rearing areas upstream of the Hells Canyon Dam complex (57 FR 14653). Additional concerns for the species have been the high percentage of hatchery fish returning to natural spawning grounds and the relatively high aggregate harvest impacts by ocean and in-river fisheries (Good et al. 2005). On August 15, 2011, NMFS completed a 5-year review for the Snake River fall Chinook salmon ESU and concluded that the species should remain listed as threatened (76 FR 50448).

Fall Chinook salmon are larger on average than spring/summer Chinook salmon and spawn in larger, mainstem river reaches and the lower sections of larger tributaries (e.g. the Snake, Clearwater, and Salmon River mainstems in Idaho). Adults typically return to fresh water beginning in July, migrate past the lower Snake River dams from August through November, and spawn from October through early December. Juveniles emerge from the gravels in March and April the following spring. Snake River fall Chinook salmon generally exhibit an ocean-type life history. Parr undergo a smolt transformation usually as subyearlings in the spring and summer, at which time they migrate to the ocean. However, in recent years many Snake River fall Chinook juveniles have been overwintering in the reservoirs upstream of the Columbia River and Snake River dams and migrating to the ocean as yearlings the following year (ICTRT 2010e). Adult Snake River fall Chinook return from the ocean to spawn when they are between 2 and 5 years of age, with 4 years being the most common.

Spatial Structure and Diversity. The Snake River fall Chinook salmon ESU includes one extant population of fish spawning in the lower mainstem of the Snake River and the lower reaches of several of the associated major tributaries including the Tucannon, Grande Ronde, Clearwater, Salmon, and Imnaha Rivers. The ESU also includes four artificial propagation programs: the Lyons Ferry Hatchery and the Fall Chinook Acclimation Ponds Program in Washington; the Nez Perce Tribal Hatchery in Idaho; and the Oxbow Hatchery in Oregon and Idaho (70 FR 37160). Historically, this ESU included two large additional populations spawning in the mainstem of the Snake River upstream of the Hells Canyon Dam complex, an impassable migration barrier. The spawning and rearing habitat associated with the current extant population represents approximately 15% of the total historical habitat available to the ESU (ICTRT 2010e). Although most current spawning is concentrated in a relatively small section of the Snake River upstream from Asotin Creek, spawner surveys in recent years have documented spawning across almost the entire population

(ICTRT 2010e). Therefore, spatial structure risk for the existing ESU is low and is not precluding recovery of the species.

There are several diversity concerns for Snake River fall Chinook. The hydropower system and associated reservoirs on the Snake and Columbia Rivers appear to impose some selection on juvenile downstream and adult return migration timing (ICTRT 2010e). Additionally, the natural run of Snake River fall Chinook salmon was historically predominated by a subyearling ocean-migration life history, but currently half of the adult returns have overwintered in freshwater reservoirs as juveniles (yearling migration life history). This change in life history strategy may be due to mainstem river flow and temperature conditions, which have been altered from historic conditions by the hydropower system, and may ultimately reduce the ESU's extinction risk (ICTRT 2010e). On the other hand, substantial diversity risk is generated by the high proportion of hatchery fish spawning naturally. For the 5-year period ending in 2008, 78% of the estimated total spawners were of hatchery origin (Ford et al. 2011). Based on these factors, the ICTRT gave the one extant population a moderate diversity risk, which leads to a moderate cumulative spatial structure/diversity risk. Diversity risk will need to be reduced to low in order for this population to be considered highly viable, a requirement for recovery of the species (ICTRT 2007).

Abundance and Productivity. Historical abundance of Snake River fall Chinook salmon is estimated to have been 416,000 to 650,000 fish (NMFS 2006a), but numbers declined drastically over the 20th century to natural returns of less than 100 fish in 1978 (ICTRT 2010e). The first hatchery-reared Snake River fall Chinook salmon returned to the Snake River in 1981, and since then the number of hatchery returns has increased steadily, such that hatchery fish dominate the Snake River fall Chinook run. However, natural returns have also increased. The most recent 10-year (1998-2008) mean abundance of natural-origin fall Chinook passing Lower Granite Dam was 2,200 adults, and the most recent short-term trend in natural-origin spawners was strongly positive, with the population increasing at an average rate of 16% per year (Ford et al. 2011). However, current abundance remains below the ICTRT's recovery goal of a minimum mean of 3,000 natural-origin spawners for the species' single extant population (Ford et al. 2011). Therefore, the ICTRT assigned the population an abundance/productivity risk of moderate. The cumulative moderate risks for both abundance/productivity and spatial structure/diversity put this population at moderate risk of extinction over the next 100 years (ICTRT 2010e).

Limiting Factors. Limiting factors and threats to Snake River fall-run Chinook salmon include the following (NOAA Fisheries 2011; NMFS 2006b):

- Lost access to historic spawning and rearing habitat above the Hells Canyon Dam complex;
- Mainstem Columbia River and Snake River hydropower impacts to spawning, rearing, and migration habitat;
- Alteration to freshwater habitat caused by upriver dams and water management. Major effects include changes in river flows, temperature regime, dissolved oxygen, substrate condition, and riparian vegetation;
- Hatchery-related effects;

- Harvest-related effects; and,
- Degraded estuarine and nearshore habitat.

3.1.4 Snake River Sockeye Salmon

This ESU includes all anadromous and residual sockeye salmon from the Snake River Basin, Idaho, as well as artificially propagated sockeye salmon from the Redfish Lake captive propagation program. The ESU was first listed as endangered under the ESA in 1991, the listing was reaffirmed in 2005 (70 FR 37160 & 37204). Reasons for the decline of this species include high levels of historic harvest, dam construction including hydropower development on the Snake and Columbia Rivers, water diversions and water storage, predation on juvenile salmon in the mainstem river migration corridor, and active eradication of sockeye from some lakes in the 1950s and 1960s (56 FR 58619; ICTRT 2003). On August 15, 2011, NMFS completed a 5-year review for the Snake River sockeye salmon ESU and concluded that the species should remain listed as endangered (76 FR 50448).

Snake River sockeye salmon adults enter the Columbia River primarily during June and July, and arrive in the Sawtooth Valley peaking in August. The Sawtooth Valley supports the only remaining run of Snake River sockeye salmon. The adults spawn in lakeshore gravels, primarily in October (Bjornn *et al*. 1968). Eggs hatch in the spring between 80 and 140 days after spawning. Fry remain in the gravel for 3 to 5 weeks, emerge from April through May, and move immediately into the lake. Once there, juveniles feed on plankton for 1 to 3 years before they migrate to the ocean, leaving their natal lake in the spring from late April through May (Bjornn *et al*. 1968). Snake River sockeye salmon usually spend 2 to 3 years in the Pacific Ocean and return to Idaho in their 4^{th} or 5^{th} year of life.

Spatial Structure and Diversity. Within the Snake River ESU, the ICTRT identified historical sockeye salmon production in five Sawtooth Valley lakes, in addition to Warm Lake and the Payette Lakes in Idaho and Wallowa Lake in Oregon (ICTRT 2003). The sockeye runs to Warm, Payette, and Wallowa Lakes are now extinct, and the ICTRT identified the Sawtooth Valley lakes as a single MPG for this ESU. The MPG consists of the Redfish, Alturas, Stanley, Yellowbelly, and Pettit Lake populations (ICTRT 2007). The only extant population is Redfish Lake, supported by a captive broodstock program. Hatchery fish from the Redfish Lake captive propagation program have also been outplanted in Alturas and Pettit Lakes since the mid-1990s in an attempt to reestablish those populations (Ford et al. 2011). With such a small number of populations in this MPG, increasing the number of populations would substantially reduce the risk faced by the ESU (ICTRT 2007).

Currently, the Snake River sockeye salmon run is highly dependent on a captive broodstock program operated at the Sawtooth Hatchery and Eagle Hatchery. Although the captive brood program rescued the ESU from the brink of extinction, diversity risk remains high without sustainable natural production (Ford et al. 2011).

Abundance and Productivity. Prior to the turn of the 20^{th} century (ca. 1880), around 150,000 sockeye salmon ascended the Snake River to the Wallowa, Payette, and Salmon River basins to spawn in natural lakes (Evermann 1896, as cited in Chapman et al. 1990). The Wallowa River sockeye run was considered extinct by 1905, the Payette River run was blocked by Black Canyon Dam on the Payette River in 1924, and anadromous Warm Lake sockeye may have been trapped in Warm Lake by a land upheaval in the early 20th century (ICTRT 2003). In the Sawtooth Valley, the IDFG eradicated sockeye from Yellowbelly, Pettit, and Stanley Lakes in favor of other species in the 1950s and 1960s, and irrigation diversions led to the extirpation of sockeye in Alturas Lake in the early 1900s (ICTRT 2003) leaving only the Redfish Lake sockeye. From 1991 to 1998, a total of just 16 wild adult anadromous sockeye salmon returned to Redfish Lake. These 16 wild fish were incorporated into a captive broodstock program that began in 1992 and has since expanded so that the program currently releases hundreds of thousands of juvenile fish each year in the Sawtooth Valley (Ford et al. 2011). With the increase in hatchery production, adult returns to Sawtooth Valley have increased in past few years to 605 adults in 2008, 833 adults in 2009, and 1,355 adults in 2010 (IDFG 2011). The increased abundance of hatchery reared Snake River sockeye reduces the risk of immediate loss, yet levels of naturally produced sockeye returns remain extremely low (Ford et al. 2011). The ICTRT's viability target is at least 1,000 naturally produced spawners per year in each of Redfish and Alturas Lakes and at least 500 in Pettit Lake (ICTRT 2007).

The species remains at high risk across all four risk parameters (spatial structure, diversity, abundance, and productivity). Although the captive brood program has been highly successful in producing hatchery *O. nerka,* substantial increases in survival rates across all life history stages must occur in order to reestablish sustainable natural production (Ford et al. 2011).

Limiting Factors. Low survival rates outside of the Sawtooth Valley are limiting the recovery of the species (NOAA Fisheries 2011):

- Migrating juvenile sockeye are heavily impacted by the hydrosystem on the mainstem Snake and Columbia Rivers;

- Predation on juvenile sockeye in the migration corridor is assumed to be high; piscivorous fish consume an estimated 8% of migrating juvenile salmon and terns and cormorants consume 12% of all salmon smolts reaching the estuary (NOAA Fisheries 2011);

- For returning adults, portions of the migration corridor in the Salmon River are impeded by water quality and high temperature (IDEQ 2011). The natural hydrological regime in the upper mainstem Salmon River Basin has been altered by water withdrawals, which can lead to elevated summer water temperatures. In many years, sockeye adult returns to Lower Granite Dam suffer relatively high losses before reaching the Sawtooth Valley, perhaps due to high migration corridor water temperatures and poor initial fish condition or parasite loads (Ford et al. 2011).

3.1.5 Bull trout

Status. Columbia River bull trout were listed as threatened by the FWS [Federal Register, June 10, 1998 (63 FR 31647)]. Bull trout occurring in the analysis area are part of the Columbia River distinct population segment (DPS). Resident and migratory forms of bull trout occur in streams throughout the analysis area.

Designated Critical Habitat. Critical habitat for bull trout was designated on October 18, 2010 (75 FR 63898). FWS identified occupied habitat with primary constituent elements (PCEs) and unoccupied habitat that are essential for bull trout conservation within each Recovery Unit. These habitats are designated as critical habitat. There are four Recovery Units in the programmatic action area: Salmon River Basin, Clearwater River Basin, Imnaha-Snake River Basin, and Snake River Basin.

Distribution/Abundance. The Columbia River bull trout DPS is represented by relatively widespread subpopulations that have declined in overall range and numbers of fish. Bull trout presently occur in about 45 percent of their historic range in the interior Columbia Basin. Declining trends and habitat loss have been documented across their range. Numerous extirpations of local subpopulations have been reported throughout the Columbia River Basin. The Snake River basin is considered a bull trout stronghold by the FWS, as it is a large area of contiguous habitats.

In the Columbia River Basin, and within the analysis area, bull trout habitat overlaps with that of the other listed fishes and extends beyond that, higher up in some watersheds and above barriers. Bull trout have more specific habitat requirements compared to other salmonids (Rieman and McIntyre 1993). Water temperature, cover, channel form and stability, valley form, substrates and migration corridors act to influence bull trout distribution and abundance. Bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993).

Habitat Requirements/Life History. Bull trout exhibit resident and migratory life-history strategies through much of the current range (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the streams where they spawn and rear. Migratory bull trout spawn and rear in streams for one to four years before migrating to either a lake (adfluvial), river (fluvial), or in certain coastal areas, to saltwater (anadromous), where they reach maturity. Resident and migratory forms often occur together and it is suspected that individual bull trout may give rise to offspring exhibiting both resident and migratory behavior (Rieman and McIntyre 1993).

Bull trout are found primarily in colder streams, although individual fish are migratory in larger, warmer river systems throughout the Columbia River basin (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995). Water temperature above 15°C (59°F) is believed to limit bull trout distribution, which may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989; Rieman and McIntyre 1995). Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Rieman and McIntyre 1993; Rieman et al. 1997).

Factors of Decline/Threats. The final rule listing bull trout identifies the factors of decline for this species (63 FR 31647). The final rule listing bull trout identifies dams, forest management practices, livestock grazing, agriculture, and agricultural diversions and mining as activities that degrade and continue to threaten bull trout and their habitat.

The decline of Columbia River bull trout is primarily due to habitat degradation and fragmentation, blockage of migration corridors, poor water quality, past fishery management practices and the introduction of non-native species (63 FR 31647). Grazing, road construction and maintenance, past over harvest, inadequacy of existing regulatory mechanisms, and isolation and habitat fragmentation have played a part in the decline of bull trout and their habitat. Widespread introductions of non-native fishes have caused local bull trout declines and extirpations. Negative effects of interactions with introduced non-native species may be the most widespread threat to bull trout in the Columbia River Basin.

Although restrictive fishing regulations have been instituted by states, with observations of increased numbers of adult bull trout in some areas seen as a result, illegal harvest and incidental harvests still continue to threaten bull trout. The rule concludes that over harvest historically likely contributed to the decline of Columbia River bull trout. The rule discusses the NFMA (National Forest Management Act), existing Forest Plans, ICBEMP (Interior Columbia Basin Management Plan), PACFISH and INFISH, as well as other entities and their programs outside of the Forest Service and BLM, such as the Clean Water Act, state regulations, and conservation planning efforts. The general conclusion is that these have not adequately protected salmonid habitat on Federal lands and recovery of degraded lands has not occurred as predicted. Policies put in place to address anadromous fish concerns and other efforts have not been successful at removing threats to bull trout.

The bull trout final rule concludes that negative effects of interactions with introduced non-native fish species may be the most pervasive threat to bull trout in the Columbia Basin. The final rule also identifies introductions of non-native fish that compete or hybridize with bull trout, fragmentation and isolation of subpopulations due to habitat changes caused by human activities, and subpopulation extirpations due to naturally occurring events (droughts and floods) as factors affecting the continued existence of bull trout.

3.2. Status of Critical Habitat for ESA-listed anadromous fish

NMFS reviews the status of designated critical habitat affected by the proposed action by examining the condition and trends of essential physical and biological features throughout the designated area. These features are essential to the conservation of the listed species because they support one or more life stages of the species. NMFS refers to these features as the PCEs of critical habitat. Since the ESA-listed species addressed in this consultation occupy many of the same geographic areas and have similar life history characteristics, PCEs are also similar (Table 10). In general, these PCEs include sites essential to support one or more life stages of the ESA-listed species (e.g., spawning, rearing, or migration), and contain physical or biological features essential to the conservation of the listed species (e.g., spawning gravels, water quality and quantity, side channels, or food).

Table 10. Types of sites and essential physical and biological features designated as PCEs, and the species life stage each PCE supports (70 FR 52630 and 58 FR 68543).

Site Type	Essential Physical and Biological Features	Species Life Stage
Snake River Steelhead[a]		

Freshwater spawning	Water quality, water quantity, and substrate	Adult spawning, embryo incubation, and larval development
Freshwater rearing	Floodplain connectivity, forage[b], natural cover[c], water quality, and water quantity	Fry emergence from gravel, juvenile growth and development
Freshwater migration	Free of artificial obstructions, water quality and quantity, and natural cover[c]	Juvenile migration, adult migration and holding
Snake River Spring/Summer Chinook, Fall Chinook, & Sockeye Salmon		
Spawning and juvenile rearing	Spawning gravel, water quality and quantity, cover/shelter, food, riparian vegetation, space (sockeye and Chinook); water temperature and access (sockeye only)	Adult spawning, embryo incubation, and juvenile growth and development
Migration	Substrate, water quality and quantity, water temperature, water velocity, cover/shelter, food[d], riparian vegetation, space, safe passage (sockeye and Chinook)	Juvenile migration, adult migration and holding

a Additional PCEs pertaining to estuarine, nearshore, and offshore marine areas have also been described for Snake River steelhead. These PCEs will not be affected by the proposed action and have therefore not been described in this Opinion.
b Forage includes aquatic invertebrate and fish species that support growth and maturation.
c Natural cover includes shade, large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
d Food applies to juvenile migration only.

Table 11 describes the geographical extent within Idaho of critical habitat for each of the four anadromous ESA-listed species. Critical habitat includes the stream channel and water column with the lateral extent defined by the ordinary high-water line, or the bankfull elevation where the ordinary high-water line is not defined. In addition, critical habitat for the three salmon species includes the adjacent riparian zone, which is defined as the area within 300 feet of the line of high water of a stream channel or from the shoreline of standing body of water (58 FR 68543). The riparian zone is critical because it provides shade, streambank stability, organic matter input, and regulation of sediment, nutrients, and chemicals.

Table 11. Geographical extent of designated critical habitat in Idaho for ESA-listed anadromous species.

ESU/DPS	Designation	Geographical Extent of Critical Habitat in Idaho
Snake River sockeye salmon	58 FR 68543; December 28, 1993	Snake and Salmon Rivers; Alturas Lake Creek; Valley Creek, Stanley Lake, Redfish Lake, Yellowbelly Lake, Pettit Lake, Alturas Lake; all inlet/outlet creeks to those lakes
Snake River spring/summer Chinook salmon	58 FR 68543; December 28, 1993. 64 FR 57399; October 25, 1999.	All river reaches presently or historically accessible, except river reaches above impassable natural falls and Dworshak and Hells Canyon Dams
Snake River fall Chinook salmon	58 FR 68543; December 28, 1993	Snake River to Hells Canyon Dam, Clearwater River from its confluence with the Snake River upstream to Lolo Creek, North Fork Clearwater River from its confluence with the Clearwater River upstream to Dworshak Dam, and all other river reaches presently or historically accessible within the

		Clearwater, Lower Clearwater, Lower Snake Asotin, Hells Canyon and Lower Salmon subbasins
Snake River Basin steelhead	70 FR 52630; September 2, 2005	Specific stream reaches are designated within the Snake, Salmon, and Clearwater River basins. Table 21 in the Federal Register details habitat areas within the DPS's geographical range that are excluded from critical habitat designation.

Spawning and rearing habitat quality in tributary streams in the Snake River varies from excellent in wilderness and roadless areas to poor in areas subject to intensive human land uses (NMFS 2011d). Critical habitat throughout much of the Snake River basin has been degraded by intensive agriculture, alteration of stream morphology (*i.e.*, channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Reduced summer stream flows, impaired water quality, and reduction of habitat complexity are common problems for critical habitat in non-wilderness areas. Human land use practices throughout the basin have caused streams to become straighter, wider, and shallower, thereby reducing rearing habitat and increasing water temperature fluctuations.

In many stream reaches designated as critical habitat in the Snake River basin, stream flows are substantially reduced by water diversions (NMFS 2011d). Withdrawal of water, particularly during low-flow periods that commonly overlap with agricultural withdrawals, often increases summer stream temperatures, blocks fish migration, strands fish, and alters sediment transport (Spence *et al.* 1996). Reduced tributary stream flow has been identified as a major limiting factor for Snake River spring/summer Chinook and Snake River Basin steelhead in particular (NOAA Fisheries 2011; NMFS 2011b; NMFS 2011d).

Many stream reaches designated as critical habitat are listed on the state of Idaho's CWA section 303(d) list for impaired water quality, such as elevated water temperature (IDEQ 2011). Many areas that were historically suitable rearing and spawning habitat are now unsuitable due to high summer stream temperatures. Removal of riparian vegetation, alteration of natural stream morphology, and withdrawal of water for agricultural or municipal use all contribute to elevated stream temperatures. Water quality in spawning and rearing areas has also been impaired by high levels of sedimentation and by heavy metal contamination from mine waste (e.g., IDEQ and USEPA 2003; IDEQ 2001).

Migration habitat quality for Snake River salmon and steelhead has also been severely degraded, primarily by the development and operation of dams and reservoirs on the mainstem Columbia and Snake Rivers (NMFS 2008b). Hydroelectric development has modified natural flow regimes in the migration corridor—causing in higher water temperatures and changes in fish community structure that have led to increased rates of piscivorous and avian predation on juvenile salmon and steelhead, and delayed migration for both adult and juveniles. Physical features of dams such as turbines also kill migrating fish.

For many ESA-listed species of salmon and steelhead in the Pacific Northwest, NMFS convened a critical habitat analytical review team (CHART) to assess the conservation value of each watershed with designated critical habitat (NOAA Fisheries 2005). Of the four Snake River species, a CHART assessment has only been completed for Snake River Basin steelhead. However, the essential physical and biological features of critical habitat for each Snake River species are similar, and there is considerable overlap in the geographic extent of critical habitat areas. The CHART results presented below for steelhead therefore give an approximation of the conservation value of each watershed for other listed species, keeping in mind that fall Chinook and sockeye salmon do not occupy many of the smaller tributaries occupied by steelhead.

For Snake River Basin steelhead, NMFS ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) as to the conservation value they provide to the species[9]; conservation rankings are high, medium, or low. To determine the conservation value of each watershed to the species viability, the CHART for Snake River Basin steelhead evaluated the quantity and quality of habitat features (e.g., spawning gravels, wood and water condition, side channels), the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area (NOAA Fisheries 2005). Thus, even a location that has poor quality of habitat could be ranked at high conservation value if that location was essential due to factors such as limited availability (e.g., one of a very few spawning areas), the unique contribution of the population it served (e.g., a population at the extreme end of geographic distribution), or other important role (e.g., obligate area for migration to upstream spawning areas).

Table 12 shows the CHART's conservation ranking for watersheds (HUC5s) in the Snake River basin. The CHART determined that relatively few watersheds have PCEs in good to excellent condition (score 3), with no potential for additional improvement for steelhead habitat (also score 3). In Idaho, many of those watersheds are located in the Middle Fork Salmon River, Selway River, and Lochsa

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[9] The conservation value of a site depends upon "(1) the importance of the populations associated with a site to the ESU [or DPS] conservation, and (2) the contribution of that site to the conservation of the population through demonstrated or potential productivity of the area" (NOAA Fisheries 2005).

River drainages. Far more HUC5 watersheds in the Snake River basin are in fair-to-poor (score 1) or fair-to-good (score 2) condition, with some potential for improvement.

Table 12. Current and potential quality of PCEs, by watershed, for Snake River Basin steelhead (NOAA Fisheries 2005).

Geo-graphic Regions and HUC4s	Watershed Name and HUC5 Code(s)	Current Quality	Potential Quality
Lower Snake River #1706010xxx	Snake River/Granite (101), Getta (102), & Divide (104) Creeks; Upper (201) & Lower (205) Imnaha River; Snake River/Rogersburg (301); Minam (505) & Wenaha (603) Rivers	3	3
	Grande Ronde River/Rondowa (601)	3	2
	Big (203) & Little (204) Sheep Creeks; Asotin River (302); Catherine Creek (405); Lostine River (502); Bear Creek (504); & Upper (706) & Lower (707) Tucannon River	2	3
	Middle Imnaha River (202); Snake River/Captain John Creek (303); Upper Grande Ronde River (401); Meadow (402); Beaver (403); Indian (409), Lookingglass (410) & Cabin (411) Creeks; Lower Wallowa River (506); Mud (602), Chesnimnus (604) & Upper Joseph (605) Creeks	2	2
	Ladd Creek (406); Phillips/Willow Creek (408); Upper (501) & Middle (503) Wallowa rivers; & Lower Grande Ronde River/Menatche Creek (607)	1	3
	Five Points (404); Lower Joseph (606) & Deadman (703) Creeks	1	2
	Tucannon/Alpowa Creek (701)	1	1
	Mill Creek (407)	0	3
	Pataha Creek (705)	0	2
	Snake River/Steptoe Canyon (702) & Penawawa Creek (708)	0	1
	Flat Creek (704) & Lower Palouse River (808)	0	0
Upper Salmon & Pahsimeroi #1706020xxx	Germania (111) & Warm Springs (114) Creeks; Lower Pahsimeroi River (201); Alturas Lake (120), Redfish Lake (121), Upper Valley (123) & West Fork Yankee (126) Creeks	3	3
	Basin Creek (124)	3	2
	Salmon River/Challis (101); East Fork Salmon River/McDonald Creek (105); Herd Creek (108); Upper East Fork Salmon River (110); Salmon River/Big Casino (115), Fisher (117) & Fourth of July (118) Creeks; Upper Salmon River (119); Valley Creek/Iron Creek (122); & Morgan Creek (132)	2	3
	Salmon River/Bayhorse Creek (104); Salmon River/Slate Creek (113); Upper Yankee Fork (127) & Squaw Creek (128); Pahsimeroi River/Falls Creek (202)	2	2
	Yankee Fork/Jordan Creek (125)	1	3
	Salmon River/Kinnikinnick Creek (112); Garden Creek (129); Challis Creek/Mill Creek (130); & Patterson Creek (203)	1	2
	Road Creek (107)	1	1
	Unoccupied habitat in Hawley (410), Eighteenmile (411) & Big Timber (413) Creeks	Conservation Value for ST "Possibly High"	
Middle Salmon, Panther & Lemhi #1706020xxx	Salmon River/Colson (301), Pine (303) & Moose (305) Creeks; Indian (304) & Carmen (308) Creeks, North Fork Salmon River (306); & Texas Creek (412)	3	3
	Deep Creek (318)	3	2
	Salmon River/Cow Creek (312) & Hat (313), Iron (314), Upper Panther (315), Moyer (316) & Woodtick (317) Creeks; Lemhi River/Whimpey Creek (402); Hayden (414), Big Eight Mile (408), & Canyon (408) Creeks	2	3
	Salmon River/Tower (307) & Twelvemile (311) Creeks; Lemhi River/Kenney Creek (403); Lemhi River/McDevitt (405), Lemhi River/Yearian Creek (406); & Peterson Creek (407)	2	2
	Owl (302) & Napias (319) Creeks	2	1
	Salmon River/Jesse Creek (309); Panther Creek/Trail Creek (322); & Lemhi River/Bohannon Creek (401)	1	3

Geo-graphic Regions and HUC4s	Watershed Name and HUC5 Code(s)	Current Quality	Potential Quality
	Salmon River/Williams Creek (310)	1	2
	Agency Creek (404)	1	1
	Panther Creek/Spring Creek (320) & Clear Creek (323)	0	3
	Big Deer Creek (321)	0	1
Mid-Salmon-Chamberlain, South Fork, Lower, & Middle Fork Salmon #1706020xxx	Lower (501), Upper (503) & Little (504) Loon Creeks; Warm Springs (502); Rapid River (505); Middle Fork Salmon River/Soldier (507) & Lower Marble Creek (513); & Sulphur (509), Pistol (510), Indian (511) & Upper Marble (512) Creeks; Lower Middle Fork Salmon River (601); Wilson (602), Upper Camas (604), Rush (610), Monumental (611), Beaver (614), Big Ramey (615) & Lower Big (617) Creeks; Middle Fork Salmon River/Brush (603) & Sheep (609) Creeks; Big Creek/Little Marble (612); Crooked (616), Sheep (704), Bargamin (709), Sabe (711), Horse (714), Cottonwood (716) & Upper Chamberlain Creek (718); Salmon River/Hot Springs (712); Salmon River/Kitchen Creek (715); Lower Chamberlain/McCalla Creek (717); & Slate Creek (911)	3	3
	Marsh (506); Bear Valley (508) Yellow Jacket (604); West Fork Camas (607) & Lower Camas (608) Creeks; & Salmon River/Disappointment Creek (713) & White Bird Creek (908)	2	3
	Upper Big Creek (613); Salmon River/Fall (701), California (703), Trout (708), Crooked (705) & Warren (719) Creeks; Lower South Fork Salmon River (801); South Fork Salmon River/Cabin (809), Blackmare (810) & Fitsum (812) Creeks; Lower Johnson Creek (805); & Lower (813), Middle (814) & Upper Secesh (815) rivers; Salmon River/China (901), Cottonwood (904), McKenzie (909), John Day (912) & Lake (913) Creeks; Eagle (902), Deer (903), Skookumchuck (910), French (915) & Partridge (916) Creeks	2	2
	Wind River (702), Salmon River/Rabbit (706) & Rattlesnake (710) Creeks; & Big Mallard Creek (707); Burnt Log (806), Upper Johnson (807) & Buckhorn (811) Creeks; Salmon River/Deep (905), Hammer (907) & Van (914) Creeks	2	1
	Silver Creek (605)	1	3
	Lower (803) & Upper (804) East Fork South Fork Salmon River; Rock (906) & Rice (917) Creeks	1	2
Little Salmon #176021xxx	Rapid River (005)	3	3
	Hazard Creek (003	3	2
	Boulder Creek (004)	2	3
	Lower Little Salmon River (001) & Little Salmon River/Hard Creek (002)	2	2
Selway, Lochsa & Clearwater #1706030xxx	Selway River/Pettibone (101) & Gardner (103) Creeks; Bear (102), White Cap (104), Indian (105), Burnt Knob (107), Running (108) & Goat (109) Creeks; & Upper Selway River (106); Gedney (202), Upper Three Links (204), Rhoda (205), North Fork Moose (207), Upper East Fork Moose (209) & Martin (210) Creeks; Upper (211), Middle (212) & Lower Meadow (213) Creeks; Selway River/Three Links Creek (203); & East Fork Moose Creek/Trout Creek (208); Fish (302), Storm (309), Warm Springs (311), Fish Lake (312), Boulder (313) & Old Man (314) Creeks; Lochsa River/Stanley (303) & Squaw (304) Creeks; Lower Crooked (305), Upper Crooked (306) & Brushy (307) forks; Lower (308), Upper (310) White Sands, Ten Mile (509) & John's (510) Creeks	3	3
	Selway River/Goddard Creek (201); O'Hara Creek (214) Newsome (505) Creeks; American (506), Red (507) & Crooked (508) rivers	2	3
	Lower Lochsa River (301); Middle Fork Clearwater River/Maggie Creek (401); South Fork Clearwater River/Meadow (502) & Leggett Creeks; Mill (511), Big Bear (604), Upper Big Bear (605), Musselshell (617), Eldorado (619) & Mission (629) Creeks, Potlatch River/Pine Creek (606); & Upper Potlatch River (607);	2	2

Geo-graphic Regions and HUC4s	Watershed Name and HUC5 Code(s)	Current Quality	Potential Quality
	Lower (615), Middle (616) & Upper (618) Lolo Creeks		
	South Fork Clearwater River/Peasley Creek (502)	2	1
	Upper Orofino Creek (613)	2	0
	Clear Creek (402)	1	3
	Three Mile (512), Cottonwood (513), Big Canyon (610), Little Canyon (611) & Jim Ford (614) Creeks; Potlatch River/Middle Potlatch Creek (603); Clearwater River/Bedrock (608), Jack's (609) Lower Lawyer (623), Middle Lawyer (624), Cottonwood (627) & Upper Lapwai (628) Creeks; & Upper (630) & Lower (631) Sweetwater Creeks	1	2
	Lower Clearwater River (601) & Clearwater River/Lower Potlatch River (602), Fivemile Creek (620), Sixmile Creek (621) and Tom Taha (622) Creeks	1	1

Note: Current conditions are ranked as either poor (score 0), fair-to-poor (score 1), fair-to-good (score 2), or good-to-excellent (score 3). Potential conditions are ranked as having little or no improvement potential (score 0), some improvement potential (score 1), high improvement potential (score 2), or are highly functioning and are at their historic potential (score 3).

4.0 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

4.1 Biological Requirements of Salmonids

The biological requirements of salmonids in the action area vary depending on the life history stage and natural range of variation present within that system. Generally, during spawning migrations, adult salmonids require clean water with cool temperatures and access to thermal refugia, dissolved oxygen near 100% saturation, low turbidity, adequate flows and depths to allow passage over barriers to reach spawning sites, and sufficient holding and resting sites. Salmonids select spawning areas that are based on species-specific requirements of flow, water quality, substrate size, and groundwater upwelling. Embryo survival and fry emergence depend on substrate conditions (e.g., gravel size, porosity, permeability, and oxygen concentrations), substrate stability during high flows, and, for most species, water temperatures of 55.4°F or less. Habitat requirements for juvenile rearing include seasonally suitable microhabitats for holding, feeding, and resting. Migration of juveniles to rearing areas - whether the ocean, lakes, or other stream reaches - requires access to these habitats. Physical, chemical, and thermal conditions may all impede movements of adult or juvenile fish.

Each ESA-listed fish species considered here resides in or migrates through the action area. Thus, for this action area, the biological requirements for salmonids are the habitat characteristics that would support those species' successful spawning, rearing, and migration (i.e., the PCEs for freshwater spawning sites, rearing sites, and freshwater migration corridors associated with those species).

4.2 Effects of Land Management and Development

In general, the environment for ESA-listed salmon and steelhead in the referenced basins has been dramatically affected by the development and operation of the Federal Columbia River Power System (FCRPS). Storage dams have eliminated mainstem spawning and rearing habitat, and have altered the natural flow regime of the Snake and Columbia Rivers, decreasing spring and summer flows, increasing fall and winter flow, and altering natural thermal patterns. The FCRPS kills or injures a portion (approximately 46%) of the smolts passing through the system (NMFS 2004). Slowed water velocity and increased temperatures in reservoirs delays smolt migration timing and increases predation in the migratory corridor (NMFS 2004; Independent Scientific Group 2000; National Research Council 1996). Formerly complex mainstem habitats have been reduced to predominantly single channels, with reduced floodplains and off-channel habitats eliminated or disconnected from the main channel (Sedell and Froggatt 2000; Independent Science Group 2000; Coutant 1999). The amount of large woody debris in these rivers has declined, reducing habitat complexity and altering the rivers' food webs (Maser and Sedell 1994).

Other anthropogenic activities that have degraded aquatic habitats or affected native fish populations in the Snake River Basin include stream channelization, elimination of wetlands, construction of flood-control dams and levees, construction of roads (many with impassable culverts), timber harvest, splash dams, mining, water withdrawals, unscreened water diversions, agriculture, livestock grazing, urbanization, outdoor recreation, fire exclusion/suppression, artificial fish propagation, fish harvest, and introduction of non-native species (Henjum et al. 1994; Rhodes et al. 1994; National Research Council 1996; Spence et al. 1996; Lee et al. 1997; NMFS 2004). In many watersheds, land management and development activities have:

- Reduced connectivity (i.e., the flow of energy, organisms, and materials) between streams, riparian areas, floodplains, and uplands;
- Elevated fine sediment yields, degrading spawning and rearing habitat;
- Reduced large woody material that traps sediment, stabilizes stream banks, and helps form pools;
- Reduced vegetative canopy that minimizes solar heating of streams;
- Caused streams to become straighter, wider, and shallower, thereby reducing rearing habitat and increasing water temperature fluctuations;
- Altered peak flow volume and timing, leading to channel changes and potentially altering fish migration behavior; and,

- Altered floodplain function, water tables and base flows (Henjum et al. 1994; McIntosh et al. 1994; Rhodes et al. 1994; Wissmar et al. 1994; National Research Council 1996; Spence et al. 1996; and Lee et al. 1997).

4.3 Basins in Action Area

The action area covers 18 subbasins (4th -field HUCs), encompassing all areas potentially affected directly or indirectly by this programmatic consultation. Because of the potential for downstream effects and additive effects within watersheds, the action area encompasses entire subbasins where ESA-listed species and designated critical habitat occur. A general review of the environmental baseline has been divided up into the three major basins within the action area: (1) the Clearwater River Basin; (2) the Salmon River Basin; and (3) the Snake River Basin. All but two of the 18 subbasins in the action area (see Figure 1) fall within the Clearwater River and the Salmon River basins, so NMFS assumes that most projects under this programmatic consultation would occur in these first two basins. Whereas the action area encompasses the entire Clearwater River and Salmon River basins, for the Snake River basin the action area includes only the Snake River and its tributaries along the Idaho-Oregon border from Hells Canyon Dam down to the Clearwater River confluence.

Clearwater River Basin. The Clearwater River Basin is located in north-central Idaho between the 46^{th} and 47^{th} latitudes in the northwestern portion of the continental United States. It is a region of mountains, plateaus, and deep canyons within the Northern Rocky Mountain geographic province. The basin is bracketed by the Salmon River Basin to the south and St. Joe River subbasin to the north.

The Clearwater River drains approximately a 9,645-mi^2 area. The basin extends approximately 100 miles north to south and 120 miles east to west. There are four major tributaries that drain into the mainstem of the Clearwater River: the Lochsa, Selway, South Fork Clearwater, and North Fork Clearwater Rivers. The Idaho-Montana border follows the upper watershed boundaries of the Lochsa and Selway Rivers, and the eastern portion of the North Fork Clearwater River in the Bitterroot Mountains. The North Fork Clearwater River then drains the Clearwater Mountains to the north, while the South Fork Clearwater River drains the divide along the Selway and Salmon Rivers. Dworshak Dam, located 2 miles above the mouth of the North Fork Clearwater River, is the only major water regulating facility in the basin. Dworshak Dam was constructed in 1972 and eliminated access to one of the most productive systems for anadromous fish in the basin. The mouth of the Clearwater is located on the Washington-Idaho border at the town of Lewiston, Idaho, where it enters the Snake River 139 river miles upstream of the Columbia River.

More than two-thirds of the total acreage of the Clearwater River Basin is evergreen forests (over 4 million acres), largely in the mountainous eastern portion of the basin. The western third of the basin is part of the Columbia plateau and is composed almost entirely of crop and pastureland. Most of the forested land within the Clearwater Basin is owned by the Federal government and managed by the USFS (over 3.5 million acres), but the State of Idaho and Potlatch Corporation also own extensive forested tracts. The western half of the basin is primarily in the private ownership of small forest landowners and timber companies, as well as farming and ranching families and companies. There are some small private in-holdings within the boundaries of USFS lands in the eastern portion of the basin. Nez Perce Tribe lands are located primarily within or adjacent to Lewis, Nez Perce, and Idaho

Counties within the current boundaries of the Nez Perce Indian Reservation. These properties consist of both Fee lands owned and managed by the Nez Perce Tribe, and properties placed in trust status with the Bureau of Indian Affairs. Other agencies managing relatively small land areas in the Clearwater basin include the National Park Service, the Bureau of Land Management (BLM), ITD, and IDFG (Ecovista 2004a).

Water quality limited segments are streams or lakes which are listed under section 303(d) of the CWA for either failing to meet their designated beneficial uses, or for exceeding state water quality criteria. The current list of 303(d) listed segments was compiled by the IDEQ in 2010, and includes many stream reaches within the Clearwater basin (IDEQ 2011). Individual stream reaches are often listed for multiple parameters, making tabular summary difficult. However, please refer to the following website for reach-specific 303(d) listed stream segments: http://www.deq.idaho.gov/water-quality/surface-water/monitoring-assessment/integrated-report.aspx.

Small-scale irrigation, primarily using removable in-stream pumps, is relatively common for hay and pasture lands scattered throughout the lower elevation portions of the subbasin, but the amounts withdrawn have not been quantified. The only large-scale irrigation/diversion system within the Clearwater basin is operated by the Lewiston Orchards Irrigation District within the Lower Clearwater subbasin. Seventy dams currently exist within the boundaries of the Clearwater basin. The vast majority of existing dams exist within the Lower Clearwater subbasin (56), although dams also currently exist in the Lower North Fork (3), Lolo/Middle Fork (5), and South Fork (6) watersheds (Ecovista 2004a).

Agriculture primarily affects the western third of the basin on lands below 2,500 feet elevation, primarily on the Camas Prairie both south and north of the mainstem Clearwater and the Palouse. Additional agriculture is found on benches along the main Clearwater and its lower tributaries such as Lapwai, Potlatch, and Big Canyon Creeks. Hay production in the meadow areas of the Red River and Big Elk Creek in the American River watershed accounts for most of the agriculture in the South Fork Clearwater. Total cropland and pasture in the subbasin exceeds 760,000 acres. Agriculture is a particularly large part of the economy in Nez Perce, Latah, Lewis, and Idaho Counties, which all have large areas of gentle terrain west of the Clearwater Mountains. Small grains are the major crop, primarily wheat and barley. Landscape dynamics, hydrology, and erosion in these areas are primarily determined by agricultural practices (Ecovista 2004a).

Subwatersheds with the highest proportion of grazeable area within the Clearwater Basin are typically associated with USFS grazing allotments in lower-elevation portions of their ownership areas. However, the majority of lands managed by the USFS within the Clearwater basin are not subjected to grazing by cattle or sheep, including all or nearly all of the Upper Selway, Lochsa, and Upper and Lower North Fork watersheds. Subwatersheds outside of the USFS boundaries typically have less than 25% of the land area defined as grazeable, although this is as much as 75% for some. Privately owned property within the basin typically contains a high percentage of agricultural use, with grazeable lands found only in uncultivated areas. In contrast, grazing allotments on USFS lands are typically large, often encompassing multiple HUCs, resulting in higher proportions of grazeable area than those contained in primarily privately owned lands (Ecovista 2004a).

Mines are distributed throughout all eight subbasins in the Clearwater basin, with the fewest being located in the Upper and Lower Selway. Ecological hazard ratings for mines (delineated by the Interior Columbian Basin Ecosystem Management Project) indicate that the vast majority of mines throughout the subbasin pose a low relative degree of environmental risk. However, clusters of mines with relatively high ecological hazard ratings are located in the South Fork Clearwater River and in the Orofino Creek drainage (Ecovista 2004a).

Salmon River Basin. The Salmon River flows 410 miles north and west through central Idaho to join the Snake River. The Salmon River is one of the largest basins in the Columbia River drainage, and has the most stream miles of habitat available to anadromous fish. The total basin is approximately 14,000 square miles in size. Public lands account for approximately 91% of the Salmon River basin, with most of this being in Federal ownership and managed by seven National Forests or the BLM. Public lands within the basin are managed to produce wood products, forage for domestic livestock, mineral commodities, and to provide recreation, wilderness, and terrestrial and aquatic habitats. Approximately 9% of the basin land area is privately owned.

Primary land use on private lands is agricultural cultivation, which is concentrated in valley bottom areas within the upper and lower portions of the basin. Other land management practices within the basin vary among landowners. The greatest proportion of National Forest lands are Federally designated wilderness area or are areas with low resource commodity suitability.
One-third of the National Forest lands in the basin are managed intensively for forest, mineral, or range resource commodity production. The BLM lands in the basin are managed to provide domestic livestock rangeland and habitats for native species. State of Idaho endowment lands within the basin are managed for forest, mineral, or range resource commodity production.

Since the State Stream Channel Protection Act became law in 1971, the IDWR has issued a total of 1,763 stream alteration permits within the Salmon River basin (IDWR 2001, as cited in Ecovista 2004b). Examination of the geographic distribution of permitted channel alterations during the past 30 years suggests that the long-term frequency of these activities was relatively consistent across much of the Salmon River basin, but less common in the Upper Middle Fork Salmon, Lower Middle Fork Salmon, Middle Salmon-Chamberlain, and Pahsimeroi watersheds. It is unclear to what degree channel modifying activities completed without permits may have had on the observed pattern. Stream channels in the basin are also altered, albeit on a smaller scale, by recreational dredging activities (Ecovista 2004b).

Water quality in many areas of the basin is affected to varying degrees by land uses that include livestock grazing, road construction, logging and mining (Ecovista, 2004b). The IDEQ has classified many water bodies in the Salmon River basin as impaired under section 303(d) of the CWA (IDEQ 2011). The primary parameters of concern are sediments, nutrients, flow alteration, high stream temperatures, and habitat alteration. Please refer to the following website for reach-specific 303(d) listed stream segments within the basin: http://www.deq.idaho.gov/water-quality/surface-water/monitoring-assessment/integrated-report.aspx.

Agricultural diversions within the Salmon River basin have a major impact near developed areas, particularly the Lemhi River, Pahsimeroi River, the mainstem Salmon River, and several other tributaries of the Salmon River. Although the majority of diversions accessible to ESA-listed species are screened, several need repair and upgrading. A major problem is localized stream de-watering due to over allocation. In addition to water diversions, numerous small pumping operations for private use occur throughout the subbasin. Impacts of water withdrawal on fish production are greatest during the summer month when streamflows are critically low (Ecovista 2004b).

Grazing on private lands continues to impact aquatic and riparian habitat. Grazing impacts are particularly noticeable in the lower reaches of most of Lemhi River tributaries, the Pahsimeroi subbasin, Panther Creek subbasin (upper Napias Creek above Smith Gulch, in Sawpit Creek and Phelan Creek), and the North Fork Salmon River subbasin (Hull Creek, Hughes Creek, and Indian Creek subwatersheds) (USFS 2000).

Mining, though no longer as active as it was historically, is still prevalent in parts of the Salmon River basin. Impacts from mining include severe alteration of substrate composition, channel displacement, bank and riparian destruction, and loss of instream cover and pool forming structures. Natural stream channels within the Yankee Fork, East Fork of the South Fork, and Bear Valley Creek have all had documented spawning and rearing habitat destroyed by dredge mining. Furthermore, heavy metal pollution from mine wastes and drainage can eliminate all aquatic life and block access to valuable habitat as seen in Panther Creek (IDFG 1990).

Snake River Basin. The Snake River originates at 9,500 feet, along the continental divide in the Wyoming portion of Yellowstone National Park. The Snake River flows 1,038 miles westward to the Idaho-Oregon border, and then to Pasco, Washington, where it flows into the Columbia River as a major tributary. At the Idaho-Oregon border (in the action area), the Snake River passes through Hells Canyon and Idaho Power Company's Hells Canyon dam complex, which blocks upstream access for anadromous fish. The Snake River basin includes rugged mountains, semi-arid desert, fertile agricultural land (primarily irrigated), and barren outcrops of lava flows. Rangeland, lava flows, and timber are the dominant land covers in the basin, with pine and spruce forests at the higher elevations. Most of the land in the basin is owned by the Federal government (BLM, USFS, and U.S. Department of Energy).

Irrigated agriculture is one of the primary land uses in the Snake River basin. Upstream from the Hells Canyon dam complex there are 31 dams and reservoirs with at least 20,000 acre-feet of storage each. The Bureau of Reclamation, Idaho Power Company, and a host of other organizations own and operate various water storage facilities, which have substantial influence on water resources and the movement of surface and groundwater through the region. As of 2002, about 3.3 million acres were being irrigated in the State of Idaho, much of this along the Snake River plain.

The middle Snake River is thus a managed water system where normal flow regimes are no longer present. Development of the middle and upper Snake River for irrigation, and later for hydroelectricity, has severely altered aquatic conditions. Development for irrigation began in the late 1860s when the first major irrigation diversion was built. The first hydroelectric dam (Swan Falls) was built in 1901. Today, there are at least 44 hydroelectric projects and countless diversions, all of which have cumulatively affected the hydrology of the Snake River and its tributaries and the aquatic species present. The downstream hydroelectric and water storage projects act as barriers to fish migration and have eliminated anadromous fish, not only impacting the fisheries populations, but also resulting in a significant decrease in biomass input to the terrestrial ecosystems and influencing wildlife population potentials. Upstream projects (e.g., Milner and American Falls Dams) have greatly changed the Snake River hydrograph, decreasing spring high flows for example.

Within the Snake River portion of the action area, Idaho Department of Environmental Quality (IDEQ) has listed several streams under section 303(d) of the Clean Water Act for either failing to meet their designated beneficial uses, or for exceeding state water quality criteria. IDEQ updated the 303(d) list in 2010, and it includes seven stream reaches within the Hells Canyon and Lower Snake River Asotin subbasins. These stream reaches are listed for parameters such as water temperature, sedimentation/siltation, escherichia coli, dissolved oxygen, pH, and nutrient/eutrophication biological indicators. Please refer to the following website for reach-specific 303(d)-listed stream segments: http://www.deq.idaho.gov/water-quality/surface-water/monitoring-assessment/integrated-report.aspx.

5.0 Effects of the Proposed Action

"Effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

The habitat improvement actions addressed by this programmatic BA will all have long-term beneficial effects to salmonids and their habitats. These beneficial effects will improve three salmon and steelhead VSP parameters: abundance, productivity, and spatial structure. These improvements will translate into decreased risk of extinction and increased probability of recovery for all of the species addressed by this consultation. Habitat improvement projects carried out in critical habitat will improve the condition of that habitat at the site and watershed scale. The categories of actions selected for this programmatic consultation all have predictable effects regardless of where in Idaho they are carried out. NMFS has conducted a number of individual consultations on each activity type over the past 15 years. NMFS applied the knowledge gained from these individual consultations to compose the activity design criteria and conservation measures for this consultation.

The implementation of many activities in this BA will have some minor, unavoidable, short-term adverse effects such as increased stream turbidity and riparian disturbance, in order to gain more permanent habitat improvements. NMFS has incorporated minimization measures into the proposed action to reduce these adverse effects, but short-term effects are not completely avoidable. Most short-term adverse effects of the proposed activities would result from riparian or in-stream construction, fish handling when isolating in-water work sites, or application of chemical herbicides. This analysis first summarizes the long-term benefits to salmonid habitat from the actions in the programmatic consultation, and then describes the short-term adverse effects.

5.1. Long-term benefits to salmonids and their habitat

The activities covered under this consultation would be aimed at protecting or restoring aquatic habitat, with long-term benefits for ESA-listed species and their habitat.

- **Fish screening** projects would prevent fish from entering and becoming stranded in unscreened or inadequately-screened diversion ditches.

- **Fish passage** projects would restore fish passage at human-made barriers, increasing access for all salmonid life stages to historical habitat. Culvert replacement projects would also be designed to prevent streambank and roadbed erosion and facilitate natural sediment and wood movement.

- **Instream flow** projects would increase stream flows in some reaches, thereby improving spawning, rearing, and migration conditions for salmonids, as well as restoring riparian functions. Benefits of habitat restoration projects that improve streamflow have been documented for stream-dwelling salmonids (Pierce et al. 2013). Acquiring water from irrigators through purchase or lease has the potential to improve habitat quality in all stream reaches downstream from the original point of diversion. Moving points of diversion downstream from severely water limited reaches can result in improved habitat function in short reaches, which can dramatically improve habitat function of entire drainages if the water limited reach impaired upstream or downstream fish passage. Converting surface water diversions to groundwater sources can improve streamflow during the irrigation season, especially the early part of the irrigation season, but the resultant impacts on groundwater could reduce streamflow during late summer, fall, and winter. Increasing efficiency of water transmission facilities can also reduce the amount of water diverted and, therefore, improve streamflow. Activities that increase the ability of irrigators to efficiently deliver water to fields have the potential to amount of water consumptively used and reduce streamflow (Samani and Skaggs 2006; Ward and Pulido-Velazquez 2008). However, this programmatic consultation will only cover irrigation efficiency actions and groundwater conversion actions if a NMFS biologist agrees with the lead federal agency that the project will benefit fish.

- **Instream structures** would enhance spawning, rearing, and migration habitat for salmonids through a combination of the following mechanisms: increasing pockets of low-velocity holding habitat; increasing instream structural complexity and diversity including pool formation; providing high flow refugia; increasing interstitial spaces for benthic organisms; reducing embeddedness in spawning gravels and promote spawning gravel deposition; reducing siltation in pools; reducing the width/depth ratio of the stream; mimicing natural input of LWD (*e.g.*, whole conifer and hardwood trees, logs, root wads); deflecting flows into adjoining floodplain areas to increase channel and floodplain function; and increasing bank stability and riparian vegetation.

- **Side-channel, floodplain, and channel reconstruction** projects would restore and provide access to historic side-channel habitat and would increase floodplain function. Restoring side-channels would improve aquatic and riparian habitat diversity and complexity, reconnect stream channels to floodplains, reduce bed and bank erosion, increase hyporheic exchange, provide long-term nutrient storage, provide substrate for macroinvertebrates, moderate high flow disturbance, increase retention of organic material, and provide refuge for fish and other aquatic species when flows or temperatures are unsuitable in the main stream channel. Levee modification or removal can improve fish habitat, reduce erosion, improve water quality, reduce high flow velocities, enhance groundwater recharge, and reduce flooding in other sections of the river.

- **Riparian vegetation** projects would reestablish native riparian vegetation in order to stabilize stream banks, provide shade and future source of LWD, and encourage the development of protective cover and undercut banks for fish and other aquatic species.

- **Sediment reduction** projects would reduce fine sediment delivery to streams from human-made sources, thereby reducing turbidity and cobble embeddedness and increasing pool habitat.

5.2. Short-term adverse effects to salmonids and their habitat

Despite a thorough list of conservation measures to minimize adverse effects, project construction activities may adversely affect ESA-listed species and their habitat in the short term, largely though turbidity plumes below project sites, fish handling while dewatering project sites, or application of herbicides. The magnitude of these effects would vary as a result of the nature, extent, and duration of the individual project activities, though the major factors would be whether or not any work occurs in the stream and whether ESA-listed fish are present at the time of implementation. NMFS has determined that the proposed programmatic action would be likely to adversely affect Snake River spring/summer Chinook salmon, Snake River basin steelhead, Snake River sockeye salmon, Snake River fall Chinook salmon, bull trout, and critical habitat for all these species within the action area.

5.2.1. Effects on ESA-listed Fish

The proposed activities would directly affect individual fish (temporarily) through noise at construction sites, handling and stranding at temporarily de-watered stream reaches, exposure to reduced water quality, and exposure to reduced habitat quality. We discuss each of these effects below.

5.2.1.1. Noise

Noise from heavy equipment operating adjacent to live water may disturb fish in the immediate vicinity causing short-term displacement. Heavy equipment operation for multiple categories of activities (e.g. culvert replacement or side channel restoration) would create noise, vibration, and potentially water surface disturbance. Besides temporary stream crossings, which are to be minimized, heavy equipment operation would only occur away from the stream channel, or in de-watered stream channels. Popper et al. (2003) and Wysocki et al. (2007) discussed potential impacts to fish from long-term exposure to anthropogenic sounds, predominately air blasts and aquaculture equipment, respectively. Popper *et al.* (2003) and Popper and Hastings (2009) reported possible effects to fish include temporary, and potentially permanent hearing loss (via sensory hair cell damage), reduced ability to communicate with conspecifics due to hearing loss, non-auditory tissue damage, and masking of potentially biologically important sounds. Studies referenced by Popper *et al.* (2003) evaluated peak noise levels ranging from 170 to 255 dB (re: 1µPa). Wysocki *et al.* (2007) did not identify any adverse impacts to rainbow trout from prolonged exposure to three sound treatments common in aquaculture environments (115, 130, and 150 dB RMS) (re: 1µPa). In the studies identified by Popper *et al.* (2003) that caused ear damage in fishes, all evaluated fish were caged and thus incapable of moving away from the disturbance. Popper and Hastings (2009) discuss how differences in how fish use sound (i.e., generalist versus specialists), fish size, development, and possibly genetics can lead to different effects from the same sounds. As a result, they caution that studies on the effects of sound, particularly if they are from different sources, are not readily extrapolated between species, fish sizes, or geographic location.

Machinery operation adjacent to the stream will be intermittent in all cases. The FHWA (2008) indicates that backhoe and truck noise production ranges between 80 and 89 dB. These noises are in-air and cannot be compared against the 150 dB RMS disturbance threshold for underwater noise. It is unknown if the expected dB levels will cause fish to temporarily move away from the disturbance or if fish will remain present. Visual stimulus from the nearby activities may also cause temporary behavior modifications. Even if fish move, juveniles are expected to migrate only short distances to an area where they feel more secure and only for a few hours in any given day. Adult fish would likely simply continue their upstream migration unharmed. NMFS does not anticipate that short-term movements caused by construction equipment will result in effects substantially different than those typically experienced by fish in their natural environment. The expected noise levels and level of disturbance caused by construction equipment will be minimal and are unlikely to rise to the level of take.

5.2.1.2. Fish handling

De-watering of stream channels and associated fish-handling procedures to remove fish from these stream reaches would adversely impact individual juvenile fish, including juvenile spring/summer Chinook, juvenile fall Chinook, juvenile steelhead, and juvenile bull trout; and could also adversely impact adult bull trout. The fish work windows set by IDFG would ensure that no adult ESA-listed salmon or steelhead would be present during the construction phase of restoration actions under this program. Sockeye salmon of any life-stage would also not be present during dewatering of stream reaches. Restoration projects adjacent to the lakes in the Sawtooth Valley where sockeye rear (Redfish Lake, Alturas Lake) would not require fish handling, and out-migrating juvenile sockeye would not be present at potential project sites on the Salmon River during fish work windows, which generally run from early July to mid-August.

Any work area within a wetted stream channel would be completely isolated from the active stream whenever ESA-listed fish are reasonably certain to be present, or if the work area is 300 feet or less upstream from spawning habitats, except for large wood restoration actions. This conservation measure would typically apply to Fish Passage and Channel Reconstruction/Relocation projects and might also apply to other project types, depending on the extent of excavation within the stream channel. Fish trapped within the isolated work area would be captured and released using a trap, seine, hand net, or other methods as prudent to minimize the risk of injury, and then released at a safe release site. Capture and release would be supervised by a fishery biologist experienced with work area isolation and competent to ensure the safe handling of all fish. Electrofishing would be implemented only where other means of fish capture are not feasible or effective, and would follow NMFS (2000) guidelines.

Capturing and handling fish causes them stress, though they typically recover fairly rapidly from the process. Types of stress likely to occur during project implementation include increased plasma levels of cortisol and glucose (Frisch and Anderson 2000; Hemre and Krogdahl 1996). Even short-term, low intensity handling may cause reduced predatory avoidance for up to 24 hours (Olla et al. 1995). The primary contributing factors to stress and death from handling with nets and buckets 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. Stress on salmonids increases rapidly from handling if the water temperature exceeds 64.4°F or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process. NMFS assumes that all handled fish will be held in 5 gallon buckets filled with stream water for a period only long enough to transport fish to an appropriate release site immediately upstream of the individual project sites. Buckets will likely be placed into the water and slowly inverted to allow captured fish to move into the selected release sites. Handling fish in this manner is likely to minimize the potential stress fish experience.

The effects of electrofishing on juvenile salmonids will consist of the direct and indirect effects of exposure to an electric field, capture by netting (described above), and handling associated with transferring the fish back to the river (also described above). Most of the studies on the effects of electrofishing have been conducted on adult fish greater than 12 inches in length (Dalbey et al. 1996). The few studies that have been conducted on juvenile salmonids indicate that spinal injury rates are substantially lower than they are for large fish. Smaller fish intercept a smaller head-to-tail potential than larger fish (Sharber and Carothers 1988) and may therefore be subject to lower injury rates (Dalbey et al. 1996; Thompson et al. 1997). McMichael et al. (1998) found a 5.1% injury rate for juvenile middle Columbia River steelhead captured by electrofishing in the Yakima River subbasin; while Ainslie et al. (1998) reported injury rates of 15% for direct current applications on juvenile rainbow trout. The incidence and severity of electrofishing damage is partly related to the type of equipment used and the waveform produced (Sharber and Carothers 1988; Dalbey et al. 1996; Dwyer and White 1997). Continuous direct current or low-frequency (equal or less than 30 Hz) pulsed direct current have been recommended for electrofishing because lower spinal injury rates occur with these waveforms (Dalbey et al. 1996; Ainslie et al. 1998). Only a few recent studies have examined the long-term effects of electrofishing on salmonid survival and growth (Ainslie et al. 1998; Dalbey et al. 1996). These studies indicate that although some of the fish suffer spinal injury, few die as a result. However, severely injured fish grow at slower rates and sometimes show no growth at all (Dalbey et al. 1996).

Electrofishing will be conducted by qualified personnel with appropriate training and experience, who will follow standard guidelines (NMFS 2000) that will minimize the levels of stress and mortality related to electrofishing. For example, field crews will be trained in observing animals for signs of stress and shown how to adjust electrofishing equipment to minimize that stress. Although McMichael et al. (1998) indicated electrofishing injury rates for wild salmonids were only 5%, NMFS assumes a more conservative injury rate of 25% (Nielson 1998) of the total number of fish electrofished to account for variable site conditions and experience levels.

This analysis of fish handling impacts relies on the assumption that not more than 40 projects per year would be implemented under this consultation. At most, half of these projects would involve instream construction and work area isolation—based on BPA's HIP programmatic consultation, a highly similar action, under which 20 of 53 habitat restoration projects in Idaho from 2008 to 2012 involved in-stream work and fish handling (BPA 2012). At these 20 BPA habitat restoration projects in Idaho, biologists removing fish from the work area encountered an average of 16 salmonids per project site.

For this BA, if we double the estimate of fish per project site, to allow for the possibility that some project sites might have higher densities of fish, that gives an estimate of 640 juvenile salmonids per year captured during work area isolation (20 projects per year, with 32 juvenile salmonids each). These salmonids could include juvenile spring/summer Chinook, juvenile fall Chinook, and juvenile steelhead.

The estimated 640 juvenile salmonids captured during work area isolation each year would experience lethal and non-lethal effects. NMFS makes the following assumptions about injury and death rates for different fish handling methods, which lead to the calculations presented in Table 13.

- A maximum of 20 project sites per year are likely to involve de-watering of stream reaches and handling and removal of individual ESA-listed fish from these stream reaches. An estimated 640 juvenile salmonids will be captured each year.

- 70% of individual fish in the de-watered areas will be captured by nets (based on FWS 2004—a programmatic opinion with similar actions in Oregon and Washington).

- Of the remaining individuals, 50% will be captured through electrofishing (Peterson et al. 2004).

- Electrofishing will injure 25% of fish captured (Nielson 1998) and kill 5% of fish captured (Hudy 1985; McMichael et al. 1998).

- Many of the remaining fish will be collected with nets out of pools as the stream reach is slowly de-watered, but up to half may be stranded in the de-watered reach and die (7.5% of total fish in the stream reach before handling).

Table 13. Estimates for the number of salmon and steelhead juveniles per year that will be disturbed, injured, or killed from netting, electrofishing, and de-watering as a result of annual implementation of the proposed action.

Maximum # of projects to capture fish per year	20
Maximum # of fish captured	640
Maximum # of fish injured by electrofishing per year	24
Maximum # of fish potentially killed by electrofishing per year (also included in injury total)	5
Maximum # of fish killed by stranding per year	48

Maximum total # of fish killed per year	**53**

As shown in Table 13, NMFS estimates that the proposed action would result in the capture, handling, transport, or stranding of a maximum of 640 juvenile salmonids per year. This individual fish could be spring/summer Chinook salmon, fall Chinook salmon, or steelhead. This handling is likely to result in various levels of harm and stress. The conservation measures in the proposed action should reduce the potential harm to individuals during capture and transport such that the risk of death is minimized. Adequate monitoring of the number of fish handled will be necessary to validate assumptions and to adaptively manage the programmatic consultation to reduce take levels over time. NMFS estimates that the proposed action is likely to directly result in the death of up to 53 juvenile spring/summer Chinook salmon, fall Chinook salmon, or steelhead per year through electrofishing and stranding in de-watered stream reaches. NMFS further estimates that the proposed action would directly injure up to 24 juvenile ESA-listed fish per year through electrofishing. Juvenile and adult bull trout are likely to experience similar impacts from fish handling.

5.2.1.3. Water Quality-related Effects on Fish

Reductions in water quality from the proposed action could affect juvenile salmonids and adult bull trout. The proposed action could degrade water quality through additions of suspended sediment to the water column, increases in stream temperatures, or chemical contamination. All near-stream ground disturbing activities and in-stream work have the potential to create increased levels of suspended sediment in the water column. Water quality may also be adversely affected by increases in temperature caused by clearing riparian vegetation. Chemical contamination could occur any time heavy construction equipment is being used within or adjacent to the stream channel, and could also occur from application of herbicides near streams.

Suspended Sediment. Fish exposed to elevated turbidity levels may be temporarily displaced from preferred habitat or could potentially exhibit sublethal responses such as gill flaring, coughing, avoidance, and increases in blood sugar levels (Bisson and Bilby 1982; Sigler *et al*. 1984; Berg and Northcote 1985; Servizi and Martens 1991), indicating some level of stress (Bisson and Bilby 1982; Berg and Northcote 1985; Servizi and Martens 1987). The magnitude of these stress responses is generally higher when turbidity is increased and particle size decreased (Bisson and Bilby 1982; Servizi and Martens 1987; Gregory and Northcote 1993). The most critical aspects of sediment-related effects are timing, duration, intensity and frequency of exposure (Bash et al. 2001). Depending on the level of these parameters, turbidity can cause lethal, sublethal, and behavioral effects in juvenile and adult salmonids (Newcombe and Jensen 1996). Although turbidity may cause stress, Gregory and Northcote (1993) have shown that moderate levels of turbidity (35 to 150 NTUs) accelerate foraging rates among juvenile Chinook salmon, likely because of reduced vulnerability to predators (camouflaging effect). Turbidity and fine sediments can reduce prey detection, alter trophic levels, reduce substrate oxygen, smother redds, and damage gills, among other negative effects (Spence et al. 1996).

Conservation measures included in the proposed action are intended to prevent the majority of sediment from being delivered to stream habitat but cannot prevent all sediment due to the nature of the in-channel work. Juvenile spring/summer Chinook salmon, fall Chinook, steelhead, and bull trout, as well as adult bull trout, may experience short-term adverse effects as a result. Substrate may inadvertently fall from excavation equipment buckets or accidentally be pushed over stream bank edges while working in close proximity to the stream channel during site preparation or during structure repair, replacement, or installation (e.g., culverts). Rain events during and following construction activities may also result in mobilization of disturbed soils resulting in stream delivery, even with sediment control measures in place (Foltz and Yanosek 2005). Rewatering of de-watered stream reaches may mobilize sediment in areas disturbed by project activity, such as channel reconstruction. However, conservation measures included in the proposed action will minimize the risk of sediment entering streams.

The Project Sponsor would carry out erosion and pollution control measures commensurate with the scope of the action. Conservation measures to reduce the likelihood and intensity of sediment plumes would include the following:

- Temporary erosion controls would be in place before any significant alteration of the action site and appropriately installed down slope of project activity within the riparian buffer area until site rehabilitation is complete. Temporary erosion control measures would include fiber wattles, silt fences, jute matting, wood fiber much and soil binder, or geotextiles and geosynthetic fabric. The Project Sponsor would ensure that materials for emergency erosion control are also onsite (e.g., silt fence, straw bales).

- Temporary roads would not be built on slopes steeper than 30%, or where grade, soil and other features suggest a likelihood of excessive erosion or failure. When the project is completed, the Project Sponsor would obliterate all temporary access roads, stabilize the soil, and revegetate the site.

- Heavy equipment would be selected and operated in a manner that minimizes erosion (e.g., minimally-sized, low pressure tires, minimal hard turn paths for tracked vehicles, temporary mats or plates within wet areas or sensitive soils).

- Vegetation would be dug up only from areas where permanent ground alteration would occur. Vegetation would be cut at ground level and root wads retained where temporary clearing occurs.

- To the extent feasible, heavy equipment would work from the top of the bank, unless work from another location would result in less habitat disturbance.

- Project operations would cease under high flow conditions that might result in inundation of the project area, except for efforts to avoid or minimize resource damage.

- The Project Sponsor would begin site restoration immediately following completion of ground disturbing activities. Temporary soil stabilization measures, e.g. jute matting, would be required until permanent measures are established and functioning properly. The Project Sponsor would replant each area requiring revegetation prior to or at the beginning of the first growing season following construction. The Project Sponsor would be required to achieve re-establishment of vegetation in disturbed areas to at least 70% of pre-disturbance levels.

- The Project Sponsor would remove sediment from erosion controls once it has reached one-third of the exposed height of the control.

Sediment plumes may occur downstream of project sites immediately after reintroducing streamflow to a dewatered reach. Based on similar past projects, NMFS expects that any resulting sediment plumes associated with the proposed action will be 1000 feet or less per project and will dissipate within a few minutes to hours at any given project site (Casselli et al. 2000; Jakober 2002; Foltz et al. 2012; Eisenbarth 2013; BPA 2013). Affected streams are likely to quickly return to background suspended sediment levels considering the expected small volume of substrate likely to be introduced (Casselli et al. 2000; Jakober 2002). Juvenile fish would likely respond to a turbidity plume for this distance along the streams edge by avoiding the plume and temporarily seeking alternate rearing areas. Fish present downstream from program activities are thus expected to be able to avoid or reduce their exposure to turbidity by swimming to adjacent, less turbid habitat (i.e., behavioral response only). However, harm to juveniles is still likely to occur as a result of increased turbidity, as exposure of juveniles to predators will likely increase as they seek alternate rearing habitat. NMFS is unable to quantify the amount of harm to juveniles from exposure to project-related turbidity, but the amount is likely to be extremely low due to the avoidance responses explained above.

Temperature. The proposed action has the potential to reduce streamside shade through the removal of vegetation. Reductions in shade can increase the amount of solar radiation reaching the stream surface and lead to increases in steam temperatures. Elevated water temperatures may adversely affect salmonid physiology, growth, and development, alter life history patterns, induce disease, and may exacerbate competitive predator-prey interactions (Spence et al. 1996). As described in the proposed action, individual projects would be designed to preserve existing vegetation. In instances where riparian shrubs are removed during construction, vegetation would be replanted. Many actions under this consultation would result in long-term increases in shade. Because actions completed under this programmatic consultation would occur at disturbed sites in need of habitat restoration, short-term riparian vegetation removal is expected to be minimal enough to have unmeasureable effects on stream shade.

Chemical Contamination. Use of construction equipment and heavy machinery adjacent to stream channels poses the risk of an accidental spill of fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone, or directly into the water. If these contaminants enter the water, these substances could adversely affect habitat, injure or kill aquatic food organisms, or directly impact ESA-listed species. Petroleum-based contaminants such as fuel, oil, and some hydraulic fluids contain poly-cyclic aromatic hydrocarbons, which can cause chronic sublethal effects to aquatic organisms (Neff 1985). Ethylene glycol, the primary ingredient in antifreeze, has been shown to result in sublethal effects to rainbow trout at concentrations of 20,400 mg/L (Beak Consultants Ltd., 1995 as cited in Staples 2001). Brake fluid is also a mixture of glycols and glycol ethers, and has about the same toxicity as antifreeze.

Although many projects would require heavy machinery, equipment would not enter flowing water, which limits the potential for chemical contamination to occur. Furthermore, this BA includes multiple conservation measures aimed at minimizing the risk of fuel or oil leakage into the stream. The Project Sponsor would prepare a spill prevention and contingency plan prior to the start of the project. All staging, fueling, and storage areas would be located away from aquatic areas. NMFS believes that fuel spill and equipment leak contingencies and preventions described in the proposed action should be sufficient to minimize the risk of negative impacts to ESA-listed fish and fish habitat from toxic contamination.

Herbicides. Herbicides may be applied to invasive plant species in or near riparian areas under this program, in order to make space for native plant species that may provide greater riparian function to aquatic habitat, such as shade, LWD recruitment, or bank stability. The conservation measures in this BA are designed to minimize the risk of herbicides entering surface water and thereby impacting ESA-listed fish or their prey base. However, due to the possibility of surface water run-off, leaching through ground water, or wind drift, small amounts of herbicide could enter streams or other surface water, negatively impacting ESA-listed species. The analysis of the effects of herbicides on salmonids in this BA is based on: (1) Assessing the likelihood that listed fish and other aquatic organisms will be exposed to the herbicides, and estimating the concentrations of herbicides to which fish would be exposed; (2) reviewing the toxicological effects of the herbicides, inert ingredients, and adjuvants on listed fish and other aquatic organisms; and (3) comparing the estimated concentrations of herbicides in surface water from the proposed action to the concentrations known to cause lethal and sublethal effects to salmonids.

Under the proposed action, the risks to salmonids from herbicides are likely to occur primarily through the direct toxicological effects of the herbicides and adjuvants on the fish, rather than through effects on aquatic vegetation or prey species. However, both types of effects may occur and are considered in this BA. Unfortunately, the toxicological effects and ecological risks to aquatic species, including ESA-listed fish, are not fully known for all of herbicides, end-use products, and adjuvants in the proposed action.

Due to concerns about the uncertainty of effects of pesticides on ESA-listed fish, the EPA was directed by the 9th District Court (Washington Toxics Coalition v. EPA) to consult with NMFS on the effects of 55 pesticides used in the states of Washington, Oregon, and California. On August 1, 2008, NMFS entered into a settlement agreement to complete consultations on 37 active ingredients by April 30, 2012. To date, NMFS has completed four biological opinions, covering 24 active ingredients. Of those active ingredients, two (2,4-D and triclopyr) are proposed for use in this BA. Results of the national consultation on the registration of 2,4-D and triclopyr are incorporated in this BA.

Exposure to Herbicides. Since herbicides could be applied throughout the plant growing season, all life stages of the ESA-listed salmonids in Idaho could potentially be exposed to herbicides, including incubating eggs, rearing juveniles, and adults. Herbicides can enter water through spray drift, surface water runoff, percolation, groundwater contamination, and direct application. The proposed action includes numerous conservation measures intended to minimize or avoid water contamination from herbicides. The conservation measures include stream and riparian buffers where chemical use is restricted or prohibited, limits on the amount of chemicals applied to a given area, and rules governing application methods and timing. The direct application of herbicides to surface water is not allowed. The likelihood of herbicides entering the water depends on the type of treatment and mode of transport.

Wind drift is a significant source of off-site herbicide transport with aerial applications (not allowed under the proposed action), but may also occur during boom or hand spraying. Wind drift is more likely to occur during aerial applications, and less likely to occur to a significant extent during ground-based spraying, unless sprays are directed into the air, or sprays are delivered in a fine mist. Wind drift is largely dependent on droplet size, elevation of the spray nozzle, and wind speed (Rashin and Graber 1993). The smaller a droplet, the longer it stays aloft in the atmosphere, allowing it to travel farther. In still air, a droplet of pesticide the size of 100 microns (mist-size) takes 11 seconds to fall 10 feet. The same size droplet at a height of 10 feet travels 13.4 feet horizontally in a 1 mile per hour wind, and 77 feet at 5 mph wind. Thus the proposed action includes wider stream buffers at wind speeds over 5 mph. During temperature inversions little vertical air mixing occurs and drift can transport long distance. This possibility is addressed through a conservation measure prohibiting spraying when wind speeds are less than 2 mph and there is a potential for temperature inversions. Since aerial application is not part of the proposed action, it is likely that spray drift will reach water only where chemicals are applied in riparian areas. Water contamination through wind drift from ground application of chemicals to riparian areas is likely to be small due to the short distance that a spray droplet is likely to travel as a result of the wind speed restrictions and no-spray buffers.

In the absence of aerial spraying, herbicide transport by surface runoff or percolation are the most likely mechanisms to cause water contamination with the proposed action, but the potential is minimized through timing spray activities to avoid precipitation and the use of no-spray buffers along stream courses. The no-spray buffers reduce the potential for chemicals to reach streams from overland flows by surface flows that might otherwise carry herbicides directly into a stream. The use of riparian buffers for interrupting overland flows is well-established as an effective mitigation technique for reducing sediment delivery to streams and the same mechanism would reduce delivery of herbicides from surface runoff. Overland flows occur when precipitation or snowmelt rates exceed the infiltration capacity of soils, which occurs infrequently in the action area. Overland flows are likely to occur briefly during intense thunder storms in summer, during the spring runoff period (at elevations where there is significant snow accumulation), or extended rainy periods. The proposed action includes provisions to suspend spraying when rain is likely to occur. However, summer thunderstorms are not entirely predictable and there is no practical way to ensure that rainfalls will not occur in herbicide treatment areas shortly after herbicides are applied.

Introduction of herbicides into a stream though percolation occurs when herbicides dissolve in water and through gravity and capillary action, are transported through the soils into an aquifer connected to the stream channel. Water contamination through groundwater is a highly variable process and is not readily predictable. In general, the distance from the point where herbicides reach an aquifer to a stream likely affects the concentration of the herbicides reaching the particular stream. Herbicide concentrations in the aquifer are reduced through dilution with increasing discharge as the aquifer approaches the stream and greater amount of contact with soil particles that may sorb herbicide molecules. The vertical distance to the water table and soil types also affect herbicide transport through ground water. Highly permeable soils with low organic content, such as alluvium and glacial till, provide little filtering or sorption and rapidly deliver pollutants. Soils with high amounts of clays can be virtually impermeable and large amounts of organic matter can bind herbicide molecules for long periods of time. Because the variables affecting transport of herbicides in groundwater are site-specific and highly variable, there is no particular buffer width that works equally well in all settings.

Pesticide movement ratings are derived from soil half-life, sorption in soil, and water solubility, and indicate the propensity for a pesticide to reach a stream through groundwater. As indicated by movement ratings, glyphosate is least likely to reach groundwater or move from the site, while chemicals such as picloram, dicamba, and triclopyr are highly mobile and are likely to be transported by runoff or percolation. All of the herbicides proposed for use are susceptible to transport in groundwater or surface runoff, especially if applications are followed immediately by high rainfall events or if the water table is relatively shallow.

Although no-spray buffers can reduce the likelihood of water contamination from herbicides, there is no general rule to determine appropriate buffer widths. The buffer distances in the proposed action are based on the presumption that herbicides applied near water can more readily reach water than herbicides that are not applied near water, but the specific distances for ground-based spraying are based on practical weed control considerations and are not derived from scientifically-based calculations. The effectiveness of no-spray buffers for preventing water contamination through runoff or percolation is generally unknown, but the buffers provide some increment of additional protection due to filtering and sorption of herbicides that could otherwise reach the stream.

Fish or their prey base are most likely to be exposed to herbicides in occasional circumstances where wind gusts or unexpected precipitation carries chemicals into the water. Chemical contamination of water from the proposed ground-based treatments is unlikely to occur beyond occasional and localized circumstances given the small amounts of chemicals used, precautionary measures that minimize or avoid water contamination, and limited riparian acreage treated within any given subbasin. Water contamination is most likely to occur in situations where spraying occurs in riparian areas with coarse alluvial soils and when a significant unexpected rainfall occurs shortly after weed treatment. Available water quality monitoring for past weed treatments are limited, but suggest that conservation measures similar to those in the proposed action are likely limiting the occurrence of water contamination and the concentrations of chemicals in the water when contamination occurs (Berg 2004).

Although the conservation measures in the proposed action would likely limit exposure of salmonids and their prey base to herbicides, some exposure is nonetheless possible. Site-specific estimates of fish exposure cannot be predicted since the exact treatment locations, the amount of chemicals that will be applied, and weather conditions are not known ahead of time. Instead NMFS has developed estimated environmental concentrations (EECs) of herbicides in surface water based on modeled water contamination rates found in the most recent U.S. Forest Service Risk Assessments prepared by the Syracuse Environmental Research Associates, Inc. (SERA) (http://www.fs.fed.us/foresthealth/pesticide/risk.shtml). The SERA reports predict water contamination rates associated with the application of 1pound of chemical per acre. To establish EECs for each herbicide in the proposed action, NMFS multiplied the SERA water contamination rate by the maximum allowed application rate in Table 14, for a worse-case scenario. Table 14 shows EECs for each chemical, along with some general physical property information.

Table 14. Physical properties, application rates, and estimated environmental concentrations for herbicides proposed for use under this program.

Active Ingredient	Persistence in Soil (days)[1]	Mobile in Soil	Max Label Application Rate (lb a.e./Acre)	Water Contamination Rate (mg a.e./L)[2]	Estimated Environmental Concentration (EEC) (mg a.e./L)[3]
2,4-D amine	10 Low	Yes, but degrades quickly	4.0	0.44	1.76
Aminopyralid	5 - 343 Low-High	No	0.11	0.056	0.0062
Clopyralid	40 Moderate	No	0.5	0.07	0.035
Chlorsulfuron	40 (28-42) Low-Mod	No	0.12	0.2	0.024
Dicamba	7-42 Low-Mod	Yes	2	0.01	0.02
Glyphosate	47 Moderate	No	8	0.083	0.66
Imazapic	7-150 Low-High	No	0.19	0.01	0.002
Metsulfuron-methyl	30 (7-28) Low	No	0.15	0.01	0.002
Picloram[4]	90 (20-300) Mod-High	Yes	1.0	0.18	0.18
Sulfometuron-methyl	20-28 Low	No	0.378	0.02	0.008
Triclopyr (Garlon 3A)	30 Low	Yes	9.00	Acid: 0.24 TCP: 0.02	Acid: 2.16 TCP: 0.18

1 Soil half-life values for herbicides are from Herbicide Handbook (Ahrens 1994). Pesticides that are considered non-persistent are those with a half-life of less than 30 days; moderately persistent herbicides are those with a half-life of 30 to 100 days; pesticides with a half-life of more than 100 days are considered persistent.

2 Water contamination rates for direct spraying of ponds were obtained from the most recent SERA risk assessments (http://www.fs.fed.us/foresthealth/pesticide/risk.shtml).

3 Estimated environmental concentrations (EECs) were derived by multiplying the maximum label application rate by the SERA water contamination rate for application of 1 pound of chemical per acre.

4 Maximum application rate for picloram is 1 lb a.e./acre; rates may be higher for smaller portions of the acre, but the total use on the acre cannot exceed 1 lb a.e./acre/year.

Toxicological Effects of Herbicides. Herbicides (including the active ingredient, inert ingredients, and adjuvants) can potentially harm fish directly or indirectly. Herbicides can directly affect fish by killing them outright or causing sublethal changes in behavior or physiology. Herbicides can indirectly affect fish by altering their environment (Scholz *et al.* 2005), such as by changing the availability of prey species. Below we first discuss direct effects of herbicides, then indirect effects, and then conclude with a table showing concentrations of each herbicide known to cause lethal and sublethal impacts to salmonids and lethal impacts to salmonid prey species. Appendix F, *Toxicological Effects of Herbicides Proposed for Use Under the Idaho Habitat Restoration Program*, provides more detail on the specific toxicological effects of each herbicide proposed for use under this program.

Herbicide exposure may directly result in one or more of following impacts to the fitness of salmonids and other fish species:

- Direct mortality at any life history stage;

- An increase or decrease in growth;
- Changes in reproductive behavior;
- A reduction in the number of eggs produced, fertilized, or hatched;
- Developmental abnormalities, including behavioral deficits or physical deformities;
- Reduced ability to osmoregulate or adapt to salinity gradients;
- Reduced ability to tolerate shifts in other environmental variables (*e.g*., temperature or increased stress);
- An increased susceptibility to disease;
- An increased susceptibility to predation; and
- Changes in migratory behavior.

In addition to effects of direct exposure on listed fish, indirect effects of pesticides can occur through their effects on the aquatic environment and non-target species. The likelihood of adverse indirect effects is dependent on environmental concentrations, bioavailability of the chemical, and persistence of the herbicide in salmon habitat. For most herbicides, including those in the proposed action, there is little information available on environmental effects such as negative impacts on primary production, nutrient dynamics, or the trophic structure of macroinvertebrate communities. Most available information on potential environmental effects must be inferred from laboratory assays, although a few observations of environmental effects are reported in the literature.

Juvenile salmonids feed on a diverse array of aquatic invertebrates, with terrestrial insects, aquatic insects, and crustaceans comprising the large majority of the diets of fry and parr in all salmonid species (Higgs *et al.* 1995). In general, insects and crustaceans are more acutely sensitive to the toxic effects of environmental contaminants than fish or other vertebrates. However, with a few exceptions (e.g., daphnids), the impacts of pesticides on salmonid prey taxa have not been widely investigated. Factors affecting prey species are likely to affect the growth of salmonids, which is largely determined by the availability of prey in freshwater systems (Mundie 1974). Food supplementation studies (e.g., Mason 1976) have shown a clear relationship between food abundance and the growth rate and biomass yield of juveniles in streams. Therefore, herbicide applications that kill or otherwise reduce the abundance of macroinvertebrates in streams can also reduce the energetic efficiency for growth in salmonids. Less food can also induce density-dependent effects, such as increased competition among foragers as prey resources are reduced (Ricker 1976). These considerations are important because juvenile growth is a critical determinant of freshwater and marine survival (Higgs *et al.* 1995). A study on size-selective mortality in Chinook salmon from the Snake River (Zabel and Williams 2002) found that naturally reared wild fish did not return to spawn if they were below a certain size threshold when they migrated to the ocean. There are two primary reasons mortality is higher among smaller salmonids. First, fish that have a slower rate of growth suffer size-selective predation. Second, salmon that grow more slowly may be more vulnerable to starvation or exhaustion (Sogard 1997).

It is possible that the action may also cause detrimental effects when non-target plants are killed by herbicides. Herbicide spraying in riparian areas can kill non-target plants that provide streambank stability, shade, and cover for fish. Spraying can also increase surface runoff by creating areas of bare soil devoid of any vegetation. This is particularly true for non-selective herbicides that kill all plants, such as glyphosate. However, non-target species killed by herbicides tend to be mostly forbs, grasses, and legumes, which are capable of reestablishing themselves within a few growing seasons. Although shrubs and trees are also susceptible to herbicide effects, the quantity of herbicide applied during spot spraying is not likely to kill mature shrubs or trees that have matured beyond the pole stage.

Available information on the toxicological effects of each of the active ingredients and end-use products proposed for use is summarized in Appendix F. Table 15 summarizes toxicity information for active ingredients and surfactants, using rainbow trout as a surrogate for ESA-listed salmonids and daphnid as a surrogate for salmonid prey species. Lethal effects for rainbow trout are reported as the lethal concentration required to kill half of the test organisms within 96 hours ("96-hour LC_{50}"). Lethal effects for daphnids are reported as the lethal concentration required to kill half of the test organisms within 48 hours ("48-hour LC_{50}"). Table 15 reports toxicities separately for herbicide active ingredients and surfactants, but the toxicities of mixtures of the two are largely unknown. Mitchell et al. (1987) tested the toxicity of Rodeo with and without a surfactant. Without the surfactant, the 96-hour LC_{50} for rainbow trout was 429 mg a.e./L. With the surfactant X-77 (not proposed for use under this action), the 96-hour LC_{50} ranged from 96.4 mg a.e./L (rainbow trout) to 180.2 mg a.e./L (Chinook salmon). The addition of X-77 thus altered the toxicity of the formulation by up to four times. However, the surfactants proposed for use are not hazardous nor are they categorized by EPA as List 1 (inert ingredients of toxicological concern) or List 2 (potentially toxic other ingredients/high priority for testing inerts) compounds when used as intended and label directions are followed (CH2MHILL 2004).

Table 15. Toxicity of active ingredients and adjuvants proposed for use under this program.

Active Ingredient	**Rainbow trout 96-hour LC_{50} (mg a.e./L)[1]**	**Lowest Sublethal Effect Threshold for Salmonids (mg a.e./L)[1]**	**Daphnid 48-hour LC_{50} (mg/L)**
2,4-D amine	162	5	25
Aminopyralid	100	Unknown	98.6
Clopyralid	103.5	NOEC = 68	225
Chlorsulfuron	40	No Observed Effects Concentration (NOEC) = 32	>100
Dicamba[8]	28	Unknown	100
Glyphosate	96.4	NOEC = 25.7	128
Imazapic	100	Unknown	>100
Metsulfuron-methyl	150	4.7	>150
Picloram	8	NOEC = 0.55	48
Sulfometuron-methyl	148	NOEC = 1.17	>150
Triclopyr: Garlon 3A	Acid: 117 Trichloropyridinol (TCP): 1.5	32.2 TCP: 0.178	Acid: 132.9 TCP: 10.9
Adjuvant			
Activator 90	2.0[2]	NA	2.0[2]
LI 700	17 – 130[3,4]	NA	170 – 190[3,4]
Methylated Seed Oil (MSO)	48[5]	NA	>100[5]
R11	3.8 – 6[2,4]	NA	5.7 – 19[2,4]
Spreader 90	3.3[5]	NA	7.3 (96-hr)[5]
Syl-Tac	>5[5]	NA	>5[5]

Active Ingredient	Rainbow trout 96-hour LC_{50} (mg a.e./L)[1]	Lowest Sublethal Effect Threshold for Salmonids (mg a.e./L)[1]	Daphnid 48-hour LC_{50} (mg/L)
Agridex	>1000[6]	NA	>1000
Valid	10[7]	NA	NA
41-A	1000[7]	NA	NA

[1]Lowest available LC_{50} values for salmonids, obtained from the most recent SERA risk assessments. For triclopyr, the values presented are for the formulated product and a metabolite.
[2] McLaren-Hart Environmental Engineering Corporation 1995; [3] LI 700 MSDS;
[4] Smith *et al.* 2004; [5] Bakke 2003; [5]McLaren/Hart 1995, as cited in Diamond and Durkin (1997); [7] as reported in BPA (2012, p.B-25).

Risk Assessment. To predict the effects of the proposed action on ESA-listed salmonids, we compare estimated concentrations of herbicides in surface water after application to riparian plants to known toxic concentrations of these herbicides to salmonids and their prey species (Table 15). However, there are numerous uncertainties in this analysis:

- Table 15 presents toxicities for the active ingredients in herbicides, but end-use products (e.g. Rodeo) have other inert ingredients besides the active ingredients (e.g. glyphosate) listed above. End-use products containing the same active ingredient may have different toxicities to aquatic organisms. This is because they have different formulations (i.e., different proportion of active ingredient, different inert ingredient composition, or different proportions of each inert ingredient).

- Surfactants are toxic by themselves and have been documented to increase the toxicity of herbicide formulations. The increase in toxicity is not necessarily additive; it depends upon the type of surfactant used as well as the proportion of surfactant in the formulation or tank mixture. As started above, Table 15 reports toxicities separately for herbicide active ingredients and surfactants, but the toxicities of mixtures of the two are largely unknown.

- Table 15 reports the known toxicities from the SERA reports, which synthesize available literature. In some cases, available literature is limited. There is little information available on the sublethal effects (e.g., feeding, spawning, or migration) or ecological effects (e.g., effects on prey species) of the active ingredient, end-use products, and tank mixtures.

- To further complicate the evaluation, many sublethal toxicological effects may harm fish in ways that are not readily apparent. When small changes in the health or performance of individual fish are observed (e.g., a small percentage change in the activity of a certain enzyme, an increase in oxygen consumption, or the formation of pre-neoplastic hepatic lesions), it may not be possible to infer a significant loss of essential behavior patterns of fish in the wild, even in circumstances where a significant loss could occur. Where sublethal tests have been conducted, they are typically reported for individual test animals under laboratory conditions that lack predators, competitors, certain pathogens, and numerous other hazards found in the natural environment that affect the survival and reproductive potential of individual fish.

Table 16 compares estimated environmental concentrations of each active ingredient proposed in this BA to concentrations causing lethal and sublethal effects. These comparisons provide only a rough estimate of effects, given the caveats listed above. Table 16 suggests that the concentrations of most herbicides proposed for use would occur at concentrations well below (at least one to two orders of magnitude) concentrations where lethal effects are known to occur in salmonids. Estimated environmental concentrations of active ingredients would also be below the lowest threshold of sublethal effects, where known. Furthermore, the estimated environmental concentration (EEC) is for a worst-case scenario. To develop these “worst-case” scenarios, the EEC was derived from a direct application of the active ingredients to a 1-acre pond (1-foot deep) using the maximum rate specified on the label. The EEC is therefore an extreme level that is unlikely to occur during implementation of this programmatic action.

Table 16. Comparison of estimated environmental concentrations (EECs) of herbicide active ingredients to known toxicities to salmonids and their prey species.

Active Ingredient	Estimated Environmental Concentration (EEC) (mg a.e./L)	Toxicity 96-hour LC_{50} (mg a.e./L)[1]	Lowest Sublethal Effect Threshold (mg a.e./L)[1]	Daphnid 48-hour LC_{50} (mg/L)
2,4-D amine	1.76	162	5	25
Aminopyralid	0.0062	100	Unknown	98.6
Clopyralid	0.035	103.5	NOEC = 68	225
Chlorsulfuron	0.024	40	NOEC = 32	>100
Dicamba[8]	0.02	28	Unknown	100
Glyphosate	0.66	96.4	NOEC = 25.7	128
Imazapic	0.002	100	Unknown	>100
Metsulfuron-methyl	0.002	150	4.7	>150
Picloram	0.18	8	NOEC = 0.55	48
Sulfometuron-methyl	0.008	148	NOEC = 1.17	>150
Triclopyr: Garlon 3A	Acid: 2.16 TCP: 0.18	Acid: 117 TCP: 1.5	32.2 TCP: 0.178	Acid: 132.9 TCP: 10.9

1 Lowest available LC_{50} values for salmonids, obtained from the most recent SERA risk assessments. For triclopyr, the values presented are for the formulated product and a metabolite.

Estimated environmental concentrations are not available for all adjuvants, so NMFS was not able to compare such levels to known toxicities for salmonids and their prey species. Rather, NMFS characterized the ecological risk of each adjuvant using EPA’s classification system for ecotoxicity. The ecological risk characterization ranges from very highly toxic (LC_{50} values <0.1 mg/L) to practically non-toxic (LC_{50} values > 100 mg/L). Table 17 summarizes the ecological risk characterization for each adjuvant proposed for use in this BA. Ecotoxicity ratings range from practically non-toxic to moderate. All of the surfactants with moderate ecotoxicity cannot be applied within a 50-foot buffer of open water, which should lessen the possibility of fish being exposed to these chemicals.

Table 17. Toxicity values for surfactants proposed for use under this program.

Active Ingredient	Rainbow Trout 96-hour LC_{50} (mg/L)	Ecotoxicity Category[1]	Daphnid 48-hour LC_{50} (mg/L)	Ecotoxicity Category[1]
Activator 90	2.0	Moderate	2.0	Moderate
LI 700	17 – 130	Moderate – Practically non-toxic	170 – 190	Practically non-toxic
Methylated Seed Oil (MSO)	48	Slight	>100	Practically non-toxic
R11	3.8 – 6	Moderate	5.7 – 19	Moderate – Slight
Spreader 90	3.3	Moderate	7.3 (96-hr)	Moderate
Syl-Tac	>5	Moderate	>5	Moderate
Agridex	>1000[6]	Practically non-toxic	>1000	Practically non-toxic
41-A	10	Low[2]		
Valid	1000	Moderate[2]		

[1]EPA Ecotoxicity categories for aquatic organisms.
[2]BPA Aquatic Level of Concern (BPA 2012).

Summary. There are numerous uncertainties that weigh into the effects analysis for herbicides in this BA. First, there are significant gaps in our knowledge about toxic effects from: (1) Unspecified inert ingredients contained in the end-use product formulations; and (2) tank mixtures containing multiple active ingredients and/or additives (i.e., surfactants). Second, estimates for lethality are measured for a surrogate species and are for 50% of the test organisms. Even in light of all this uncertainty, NMFS believes that outright lethality from the use of herbicides under this program is unlikely to occur. This is because the estimated environmental concentrations for herbicides represent worse-case scenarios and environmental concentrations are expected to actually be much less than these estimates due to implementation of BMPs. Furthermore, a small proportion of the action area will be treated, thus any potential water contamination will be short in duration, small in magnitude, and infrequent. However, NMFS cannot say with any certainty that ESA-listed fish would not be harmed through sublethal effects or indirectly through toxic effects on other aquatic organisms. Sublethal effects from water contamination by herbicides cannot be discounted based on the available information. Water contamination by herbicides is likely to occur in occasional circumstances, and sublethal effects of herbicides or their adjuvants can occur within the range of concentrations likely to occur under the proposed action. Of the particular herbicides and surfactants proposed for use, little is known about their sublethal effects on salmon and steelhead, their effects on aquatic ecosystems, or threshold concentrations where these effects might occur. Where sublethal assays have been reported for salmonids, harmful effects occur at concentrations as much as several orders of magnitude less than the lethal endpoints used by EPA to assess pesticide risk.

5.2.1.4. Habitat-related Effects on Fish

As explained above, the proposed action would have many long-term beneficial impacts on salmonid habitat, but construction activities might also lead to small negative impacts to habitat, primarily through sediment deposition. Near and in-stream ground disturbance is likely to increase in-channel sediment deposition, potentially affecting habitat suitability for spawning, rearing, and migrating ESA-listed salmonids.

Sediment Deposition. The methods for sediment introduction to the stream channel were described in the suspended sediment discussion above. The same suite of conservation measures proposed to reduce the potential for suspended sediment would likewise minimize the potential for in-channel sediment deposition.

The potential effects of sediment deposition on fish habitat, and subsequently on individual fish, are described in the scientific literature and include smothering of redds and spawning gravels, changes to primary and secondary productivity, and reduction of available cover for juveniles. Egg-to-emergence survival and size of alevins is negatively affected by fine sediment intrusion into spawning gravel (Young et al. 1991). Fine sediment deposition in spawning gravel reduces the oxygen supply rate to redds (Wu 2000). However, female salmonids displace fine sediment when they dig redds, cleaning out the gravel and increasing permeability and interstitial flow (Kondolf et al. 1993). Given the small level of sediment likely to be introduced to streams from project activities with proposed sediment control BMPs, the process of digging a redd will likely displace most of this sediment. Furthermore, it is extremely unlikely that redds will be present within any work site during the work period due to the proposed instream work windows. Thus sedimentation is not expected to directly affect incubating eggs or alevins.

Fine sediment deposition also has the potential to adversely affect primary and secondary productivity (Spence et al. 1996; Suttle et al. 2004). Suttle et al. (2004) found that increases in fine sediment concentration led to a change from aquatic insects available to salmonids (i.e., surface grazers and predators) to unavailable burrowing species. However, due to the conservation measures included in the action to minimize sediment delivery to streams, NMFS expects that any effects to primary production will be minimal.

Finally, fine sediment delivery to streams can reduce cover for juvenile salmonids (Bjornn and Reiser 1991). Fine sediment can fill pools as well as interstitial spaces in rocks and gravels used by fish for thermal cover and for predator avoidance (Waters 1995). NMFS expects that juvenile cover will be affected in the short term within the affected individual 1,600 foot stream reaches; but that habitat quality will then recover as fine sediments are flushed downstream during high flows after project completion. Any loss of habitat that occurs from sediment deposition caused by the proposed action would likely last less than 10 hours and be confined to the project area, and thus would not have any long-term effects on ESA-listed fish. Fish are expected to seek alternate habitat in adjacent areas during this temporary loss of habitat from program-related sediment deposition. Furthermore, NMFS expects that project-related sediments introduced into the stream channel will be a much smaller amount than the annual sediment budget of a watershed, such that sediment impacts from the program will be unmeasureable at the watershed-scale.

5.2.2. Effects on Salmonid Critical Habitat

NMFS designates critical habitat based on physical and biological features that are essential to the ESA-listed species. Essential features for designated critical habitat include substrate, water quality, water quantity, water temperature, food, riparian vegetation, access, water velocity, space, and safe passage. The action area provides widespread freshwater spawning, rearing, and migration habitat for Snake River spring/summer Chinook salmon, Snake River fall Chinook, Snake River Basin steelhead, and Snake River sockeye salmon. In general, the proposed action would improve the current condition of critical habitat at every project site. Nonetheless, construction activities would likely have small adverse impacts on critical habitat at some project sites. The critical habitat essential features associated with freshwater spawning, rearing, and migration that may be adversely affected by the action are water quality, substrate/spawning gravel, forage, riparian vegetation, and access.

Water Quality. As described in "Short-term adverse effects to salmon, steelhead, and their habitat" (Section 5.2), water quality in the action areas may be temporarily degraded due to contamination by herbicides or due to increased turbidity associated with some of the proposed activities. For chemical contamination by herbicides, the proposed weed treatment areas would be scattered in patches of various size across the action area. Potential effects of weed spraying on designated critical habitat would vary at each location depending on the size of the treatment area, the chemicals used, method of application, distance from water, and vegetative characteristics of the treatment areas. If chemicals were to reach the water in an appreciable amount, a variety of biological effects could occur, including harmful effects on listed fish or other aquatic organisms due to direct exposure to the chemicals or indirectly from changes in the biotic community. In general, most instream effects of herbicides are short-lived, discreet events associated with spills, drift, or runoff events. Following the events causing contamination, critical habitat elements are likely to return to normal within a few hours to a few days. None of the chemicals proposed for use would result in long-term alteration of critical habitat through water contamination.

For turbidity, conservation measures included in the action will minimize sediment delivery, so NMFS expects that no individual sediment plume would exceed 1000 feet in length and all sediment plumes would dissipate within a few hours. Therefore, the proposed action should not reduce the conservation values associated with water quality parameters for any streams in the action area, other than temporarily.

Substrate/Spawning Gravel. As described in "Short-term adverse effects to salmon, steelhead, and their habitat" (Section 5.2), temporary pulses of sediment and turbidity plumes are expected to cause small increases in downstream fine sediment deposition and thus negatively affect some substrates in the short term. However, because the amount of deposited fine sediments generated from an individual project will be extremely small, the next high-flow event is likely to wash these fine sediment downstream. Increased surface fines are not likely to persist beyond 6 months. Due to design criteria to avoid redds and limit the sediment introduced and deposited, NMFS expects these temporary increases to be small, especially in comparison to the annual sediment load during peak discharge. Therefore, the proposed action should not reduce the conservation values associated with substrate and spawning gravels for any streams in the action area, other than temporarily.

Forage. Increases in turbidity and sediment deposition and potential herbicide contamination may temporarily reduce macroinvertebrate communities downstream from some project sites. Noise from heavy machinery will temporary alter the levels of hydro-acoustics, altering juvenile salmonids' ability to utilize forage within the action area. However, the proposed in-stream work windows, de-watered construction sites, and conservation measures to prevent herbicides from entering surface water are expected to minimize both the magnitude and duration of downstream effects to salmonid food sources. Thus, the proposed action should have no lasting effect on forage levels.

Riparian Vegetation. In instances where riparian shrubs are removed during construction, vegetation will be replanted. Individual projects conducted under this program would increase riparian vegetation over the long term. Because actions completed under this programmatic consultation would occur at sites where habitat is currently degraded, riparian vegetation removal is expected to be minimal and would not reduce the conservation value associated with riparian vegetation for any streams in the action area.

Access. For projects requiring de-watering of the entire width of stream channel, upstream and downstream passage for ESA-listed species could be temporarily be blocked. Over the long term, however, access would be improved by culvert replacements, which will be designed to allow fish passage for all fish-bearing streams, thus increasing the extent of usable critical habitat.

Bull trout

The potential effects to bull trout critical habitat would be similar to the potential effects to salmon and steelhead habitat described above. Table 18 summarizes the impacts of the proposed action on the primary constituent elements (PCEs) of bull trout critical habitat.

Table 18. Summary of Potential Effects to bull trout PCEs.

#	PCE Description	Watershed Indicators	Indicators Degraded by Program	Anticipated Effect to PCE
1	Springs, seeps, groundwater sources, and subsurface water connectivity (hyporehic flows) to contribute to water quality and quantity and provide thermal refugia.	Chemical contaminants, physical barriers, substrate embeddedness, channel conditions and dynamics (streambank condition, floodplain connectivity), Flow/hydrology, road density and location, riparian conservation areas.	Channel dynamics and conditions will be impacted during construction. There will be a temporary increase in turbidity and minor bank disturbance.	The increase in turbidity and streambank disturbance will not have significant effects to this PCE.
2	Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including, but not limited to permanent, partial, intermittent or seasonal barriers.	Water quality (temperature, sediment, chemical and nutrient contaminants), physical barriers, change in peak/base flow, width/depth ratio, refugia	There will be a temporary increase in sediment/turbidity and temporary barriers during projects requiring dewatering, with overall beneficial effects to refugia and migration habitats.	Upstream migration habitat will be blocked during dewatering for some projects, although it was likely already blocked in some cases. **Significant temporary effect.**
3	An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.	Water quality (temperature, sediment, chemical and nutrient contaminants), physical barriers, substrate embeddedness, pool frequency and quality, floodplain connectivity, riparian conservation areas	Sediment and substrate embeddedness may be slightly increased temporarily (less than a year). Streambank condition will be negatively impacted by removal of vegetation.	The aquatic food base may be adversely affected by dewatering and deposited sediment downstream of project site. In the long term, due to restored channel dynamics, this PCE should be improved.

#	PCE Description	Watershed Indicators	Indicators Degraded by Program	Anticipated Effect to PCE
				Significant temporary effect.
4	Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates, to provide a variety of depths, gradients, velocities, and structure.	Large woody debris, pools frequency and quality, large pools, off-channel habitat, channel conditions and dynamics (width/depth ratio, streambank condition, floodplain connectivity), disturbance history, riparian conservation areas, disturbance regime.	Habitat elements will be improved over the long term.	This PCE will be positively affected over the long-term.
5	Water temperatures ranging from 2 to 15 C (36 to 59 F), with adequate thermal refugia available for temperatures at the upper end of this range.	Temperature, large pools, refugia, channel conditions and dynamics (width/depth ratio, streambank condition, floodplain connectivity), change in peak/base flows, road density and location, riparian conservation areas.	Temperature will not be affected by the project.	This PCE will be maintained. Stream temperature will not be affected by the Project.
6	In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence; and young of the year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.	Sediment, substrate embeddedness, large woody debris, pool frequency and quality, streambank condition.	See discussion above regarding sediment/turbidity, embeddedness.	Spawning areas within 600 feet downstream of projects may be temporarily adversely affected by fine sediment released during implementation. Conservation measures to capture sediment will be employed, but the potential for increased sediment will not be completely removed. Short- and long-term improvements are expected to this PCE. **Significant temporary effect**.
7	A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, they minimize departures from a natural hydrograph.	Floodplain connectivity, flow/ hydrology (changes in peak /base flows and drainage network increase), watershed conditions (road density	No effects to these habitat features	This PCE will be maintained.

#	PCE Description	Watershed Indicators	Indicators Degraded by Program	Anticipated Effect to PCE
		and location, disturbance history, riparian conservation areas, disturbance regime).		
8	Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.	Floodplain connectivity, flow/ hydrology (changes in peak /base flows and drainage network increase), water quality (Temperature, sediment/turbidity, Chemical Contaminants and Nutrients), disturbance history, disturbance regime.	Sediment/turbidity may be temporarily increased during project implementation.	Water quantity at some project sites may be temporarily affected, but the short-term (a few hours) reduction in water quality is not likely to adversely affect reproduction, growth or survival of bull trout.
9	Sufficiently low levels of occurrence of nonnative predatory (e.g. lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.	Physical barriers, refugia, persistence and genetic integrity.	Projects that would facilitate the expansion of brook trout into occupied bull trout habitat require approval from a FWS biologist. There may be effects to persistence and genetic integrity.	Due to FWS review, the action agencies to not expect adverse effects to this PCE.

5.3 Determination of Effects to Salmonids

The habitat improvement actions addressed by this programmatic BA would all have long-term beneficial effects to salmon, steelhead, bull trout, and their habitats. However, the implementation of many activities will have some minor, unavoidable, short-term adverse effects such as increased stream turbidity, in order to gain more long-term habitat improvements. NMFS has incorporated minimization measures into the proposed action to reduce these adverse effects, but short-term effects are not completely avoidable. Therefore the proposed action is likely to adversely affect Snake River sockeye salmon, Snake River fall Chinook salmon, Snake River spring/summer Chinook salmon, and Snake River Basin steelhead, bull trout, and their critical habitats, in the short-term.

5.4 Effects to Wildlife and Plants

The effects of programmatic actions on wildlife and plants will be relatively minor compared to the effects on fish. Project design criteria and design features will minimize any potential effects to these species. None of the programmatic actions are expected to move baseline conditions towards a more degraded condition, even in the short term, or result in a "Likely to Adversely Affect" determination for these species. Environmental baseline information and general descriptions for other species are provided in Appendix F.

5.4.1.Canada Lynx

The primary potential effects on lynx from programmatic projects could be associated with direct disturbance. However, most habitat restoration activities will occur in stream and riparian areas where vegetation has been previous degraded or removed. Activities may temporarily displace lynx if they are present in proximity to project areas when activities are occurring. Current research indicates lynx may tolerate limited disturbance, even around active dens, but the level of tolerance is unknown. Projects may affect, but are not likely to adversely affect lynx if design features for this species are implemented.

5.4.2. Northern Idaho Ground Squirrel

Northern Idaho ground squirrel does not make significant use of riparian areas; therefore short term adverse impacts from habitat restoration activities will be minor but may include impacts to meadow habitat at project sites. Project activities during the months of March to early August could trigger avoidance behavior and make squirrels more susceptible to predation. Projects may affect, but are not likely to adversely affect Northern Idaho ground squirrels if the design features for this species are implemented.

5.4.3. Yellow-Billed Cuckoo

Disturbance of the riparian vegetation is the primary potential effect that could be associated with programmatic projects. Yellow-billed cuckoo populations depend upon large expanses of specific types of riparian habitat for successfully nesting. There is not an approved conservation strategy for the Yellow-Billed Cuckoo. The design features will avoid potential adverse effects, and implementation of programmatic actions may affect but are not likely to adversely affect yellow-billed cuckoo.

5.4.4. Plants

Projects located in the vicinity of suitable habitat for threatened or endangered plant species may affect, but are not likely to adversely those species. Design features minimize any potential effect of project activities on these species.

6.0 Magnuson-Stevens Fishery Conservation and Management Act

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions, or proposed actions that may adversely affect EFH. Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that may be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council (PFMC) designated EFH for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Chinook salmon, coho salmon, and Puget Sound pink salmon (PFMC 1999). The proposed action and action area for this consultation are described above in this document. The action area includes areas designated as EFH for various life-history stages of Snake River spring/summer Chinook salmon and Snake River fall Chinook salmon, and coho salmon. The effects of the proposed action on EFH are largely related to the minor water quality related effects due to temporary increases in turbidity, localized sediment deposition, and temporary water quality contamination from herbicides.

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8.0 Appendices

Appendix A. Project Information Form

Appendix B. Project Completion Form

Appendix C. Instream work windows.

Appendix D. Fish Screen Design Plans Checklist

Appendix E. Toxicological Effects of Herbicides Proposed for Use under the Idaho Habitat Restoration Program

Appendix F. Spec ies Descriptions for Wildlife and Plants.

Appendix A.

Programmatic Consultation for Habitat Restoration Projects in Idaho
Project Information Form

I. GENERAL INFORMATION

Date: ____________________

Project Sponsor: ____

Address: ____

____

____

Lead Action Agency Contact: ____

Address: ____

____

____

Othe Participating Action Agency Contact: ___________________________________

Address: ____

____

____

Othe Participating Action Agency Contact: ___________________________________

Address: ____

____

____

Describe any coordination with NMFS and FWS (including any correspondence). Specify contact personnel and dates:

____
____
____
____

Location(s) of activity:

Latitude: __xx° xx' xx.x"__ Longitude: __xxx° xx' xx.x"__

Or UTM: ____________________ (GPS x:y coordinates)

Watershed/Stream: ______________________________________ County:______________

____

ESA-listed species present: ______________________________________

In the table below, identify the specific action(s).

Action Category	Specific Actions Included in This BA
• **Fish Screening**	• Install, upgrade, or maintain fish screens *(NMFS engineering review required for installation or upgrading of screens)*
• **Fish Passage**	• Install or improve fish passage facilities (e.g. fish ladders or other fishways) at diversion structures and other passage barriers *(NMFS engineering review required)* • Remove or modify water control structures • Upgrade or replace culverts and bridges to provide fish passage and/or to reduce risk of culvert failure and chronic sedimentation
• **Instream Flow**	• Lease or purchase water rights to improve instream flows • Change or consolidate points of diversion *(NMFS engineering review required for new diversion structures)* • Increase efficiency of irrigation practices (e.g. convert open ditches to pipes, or convert surface water diversion to ground water well)

Action Category	Specific Actions Included in This BA

• **Instream Structures**	• Install instream habitat structures including
	  • Rootwads, large woody debris (LWD), and log jams
	  • Boulders
	  • Spawning gravels
	
	• Provide grade control with boulder weirs or roughened channels *(NMFS engineering review required for installation of structures with greater than 3 feet height)*

• **Side Channels and Floodplain Function**	• Reconnect and restore historic side channels • Remove or modify sediment bars or terraces that block fish passage to side channels • Modify or remove levees, dikes, and berms
• **Channel Reconstruction**	• Reconstruction of existing stream channels into historic or newly constructed channels *(NMFS engineering review required).*

• **Riparian Habitat**	• Plant riparian vegetation
	
	• Reduce riparian impacts from livestock:
	  • Install fencing
	  • Develop livestock watering facilities away from streams
	  • Install livestock stream crossings (culverts, bridges, or hardened fords)
	
	• Control invasive weeds through physical removal or with herbicides
	
	• Stabilize stream banks through bioengineering; bank barbs may also be acceptable in some cases, in conjunction with bioengineering methods, and with approval from a NMFS and FWS biologist.

Action Category	Specific Actions Included in This BA

• **Road and Trail Erosion Control, Maintenance, and Decommissioning**	• Decommission or obliterate unneeded roads
	• Relocate portions of roads and trails away from riparian buffer areas
	• When part of a larger restoration project, reduce sediment from existing roads:
	  • Improve and maintain road drainage features
	  • Reduce road access and usage through gates, fences, boulders, logs, tank traps, and signs
	  • Remove or stabilize pre-existing cut and fill or slide material
	• Reduce sediment delivery to streams from other man-made sources

• **Surveying and Monitoring**	• Survey project sites:
	  o Take physical measurements
	  o Install recording devices
	  o Determine fish presence (*electroshocking for research purposes is not included under this consultation*)
	• Monitor project site and stream habitat after project completion
	• Installation of the PIT tag detection arrays

Description of the proposed work

Describe your project by filling in the following list. You may expand the space below to provide this information or attach additional pages. Attach maps or drawings to clearly illustrate the location, nature, and extent of the proposed work. **Some categories of projects require additional information (e.g. Channel Reconstruction), as noted in *Section 2.5 Description of Action Categories and Associated Conservation Measures.* Please attach additional required information to this form.**

1. Project purpose:

2. Project Timing
    a. Start Date:

    b. Start Date (in-water work):

    c. End Date:

    d. End date (in-water work):

3. Number and type of structures to be installed or constructed (if rock structure, estimated amount of rock, including size; if wood, estimated number of pieces and size):

4. Proposed construction machinery to be used:

5. Anticipated construction techniques proposed (please include best management practices (BMPs)):

6. Anticipated stream flow at time of construction (cubic ft/sec):

7. How many temporary stream crossings do you propose? List all BMPs proposed to avoid and minimize impacts from stream crossings.

8. Attach maps and design drawings.

9. You may request minor deviations from the project criteria and conservation measures described in this assessment, if the effects of the project will be within the range of the effects analyzed in this assessment. Describe any minor deviations here. NMFS may ask for further information in order to determine whether your project falls under this programmatic action.

Appendix B

Project Completion Form

Project Sponsor: ________________________________ Date: ____________________

Name of Project: ____

Date Project Completed: _________________

Location of Project: ____

Objective of Project: ____

Was project completed as designed (including reclamation of work areas)? (Yes/No): __________

If No, please explain:

____

____

____

Were the objectives of the project met (i.e., how was *success* defined?) – explain:

____

____

____

What indicators were used to determine success of the project (e.g., visual inspection, photo points, amount of area rehabilitated, etc.) Attach photos which document compliance with project implementation measures:

____

____

How long will information on indicators be collected (e.g., if the objective of the project was to reestablish a riparian area, how long will plants be monitored for viability?):

____

Explain any "lessons learned" from implementing this project that could assist in similar projects:

____

____

Document all fish handling undertaken during the project (record here or attach survey sheet):

Methods of fish collection during project implementation			Date
Electrofishing	ESA-listed species present	Number of fish by species	Life stages
Handled			
Injured			
Killed			
Seining/Netting	ESA-listed species present	Number of fish by species	Life stages
Handled			
Injured			
Killed			

List all herbicides used, including amount, acreage, and conservation measures:

____

____

If project included turbidity monitoring, report results:

____

____

APPENDIX C. Instream work windows.

(1) Instream work windows for streams in the Salmon River basin, upstream from the Middle Fork Salmon River.

Recommended Work Windows

The abbreviation "q" will be used in the following summary of work windows to indicate "quarter." For example, "q2" will be used for "quarter 2." Quarters roughly coincide with weeks.

River Reach or Tributary	Preferred Work Window
Main Salmon River tributaries - Middle Fork to North Fork	July q2 - August q2
Camas Creek	July q3
Panther Creek	July q3 – August q2
North Fork Salmon River	July q2 – August q2
Main Salmon River - Horse Creek to the Pahsimeroi River	July q2 – March q2
Main Salmon River Tributaries-Horse Cr. to Pahsimeroi R.	July q1 – August q2
Lemhi River – Mouth to Agency Creek	July q2 – March q2
Lemhi River – Agency Creek to Hayden Creek	July q2 – August q3
Hayden Creek (Lemhi River drainage)	July q1 – August q2
Lemhi River – Hayden Creek to Leadore	July q1 – August q3
Big Springs Creek (Lemhi River drainage)	July q1 – August q4
Main Salmon River - Pahsimeroi River to Valley Creek	July q2 – August q3
Main Salmon River Tributaries - Pahsimeroi R. to Valley Cr.	July q2 – August q2
Pahsimeroi River – mouth to Hooper Lane	July q1 – August q3
Big Springs Creek (Pahsimeroi River drainage)	July q2 – August q3
Challis Creek (mouth to public land boundary)	July q2 – March q2
East Fork Salmon River – Mouth to Herd Creek	July q2 – August q3
Herd Creek (East Fork Salmon River drainage)	July q2 – August q2
East Fork Salmon River – Herd Creek to Germania Creek	July q2 – August q2
East Fork Salmon River – Germania Creek to Headwaters	July q2 – July q3
Yankee Fork River	July q2 – August q2
Main Salmon River - Valley Creek to Headwaters	July q2 – August q2
Valley Creek	July q2 – August q2

From: USBWP (Upper Salmon Basin Watershed Project Technical Team). 2005. Upper Salmon River Recommended Instream Work Windows and Fish Periodicity. For River Reaches and Tributaries Above the Middle Fork Salmon River Including the Middle Fork Salmon River Drainage. Revised November 30, 2005.

(2) Instream work windows for all other streams in the project area (Lower Salmon River, Lower Snake River, and Clearwater River Basins).

Stream type	**Instream work window**
Perennial, no listed fish	Base the timing on the nearest listed fish found downstream from the project area
Perennial, listed steelhead only	Preferred window is August 1 through October 30; exceptions may be made on a project-specific basis to begin work as early as July 15.
Perennial, listed steelhead and unlisted salmon	August 1 through October 30 when Chinook and coho spawning habitats are not present in the action area; July 15 through August 15 when Chinook spawning habitat is present in action area; August 1 through September 15 when coho spawning habitat is present in the action area.
Perennial, listed steelhead as well as listed salmon or bull trout	July 15 through August 15
Intermittent	August 1 to October 30, or any time work can be completed while the stream is not flowing

Appendix D. Fish Screen Design Plans Checklist

Checklist for NMFS Review of Fish Screen Projects p 1 of 7

To be completed by Fish Screen Design Engineer

Juvenile Fish Screen Design Summary

Provided by: Date:
Contact information:

I. Description of site including name of diverted stream, type of diversion, type of headgate, metering device, site name.

II. Water Surface Elevation (WSE) Data. Generally indicate method used to determine and estimate flows and elevations. Elevations can be relative to local benchmark, and period of record should be limited to the downstream juvenile migration season when flow is being actively diverted.

1. River WSE and streamflow near site of bypass return (open channel diversions only)

a. 5% exceedence flow = CFS, WSE =

b. 95% exceedence flow = CFS, WSE =

2. River WSE and streamflow at point of diversion

a. 5% exceedence flow = CFS, WSE =

b. 95% exceedence flow = CFS, WSE =

3. Diverted flow and associated canal WSE at screen site

a. Maximum diversion = CFS, WSE =
b. Normal diversion = CFS, WSE =
c. Minimum diversion = CFS, WSE =

Checklist for NMFS Review of Fish Screen Projects p 2 of 7

To be completed by Fish Screen Design Engineer

III. Screen structure

1. Type of screen (rotary drum, fixed vertical, etc.):

2. Angle of screen relative to ditch flow:

3. Screen cleaning mechanism (drum rotation, backspray, brushes etc.):

4. Screen cleaner powered by (electric motor, paddlewheel, hydraulic motor etc.):

5. Minimum submerged screen area:

6. Length of screen:

7. Bottom and top elevation of screen (canal screens):

8. Screen diameter (drum or cylindrical screens):

9. For pump intake screens, list brand, model, cleaning mechanism:

10. Describe inspection, operations and maintenance program.

Checklist for NMFS Review of Fish Screen Projects **p 3 of 7**

To be completed by Fish Screen Design Engineer

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IV. Recommended bypass return pipe (if applicable)

1. Pipe diameter =
2. Length required (to preferred outfall site) =
3. Pipe slope (rise/run) =
4. Bypass flow and flow control device (weir length or orifice size):
5. Outfall type (submerged, free-fall, open channel):
6. Approximate river velocity at outfall =
7. Minimum outfall depth =
8. Pipe invert elevation at ditch =

Checklist for NMFS Review of Fish Screen Projects **p 4 of 7**

To be completed by Fish Screen Design Engineer

V. Other site constraints (examples: access problems, stream characteristics at bypass outfall site, construction site problems, excessive cut/fill, land owner constraints (eg. access route, livestock, crop harvests etc.), irrigation season, river flow, construction window, ice jam problems, sedimentation potential, winter operation required (stock water, hydropower, etc.), consolidation potential, irrigation methods that impact indicated water surface elevations, screen location constraints, road/bridge construction required, excessive debris load etc.). Indicate method of coping with constraints.

Checklist for NMFS Review of Fish Screen Projects **p 5 of 7**

To be completed by Fish Screen Design Engineer

VI. Site sketch. Include screen/bypass layout, river near screen site, and construction constraints.

Checklist for NMFS Review of Fish Screen Projects **p 6 of 7**

To be completed by Fish Screen Design Engineer

VII. Ditch cross sections (if applicable). Include invert elevations relative to benchmark, distance between cross-sections, and water surface elevation.

Checklist for NMFS Review of Fish Screen Projects **p 7 of 7**

To be completed by Fish Screen Design Engineer

VIII. Flow measurement data, water surface elevations and other available flow information. Indicate river and/or canal water surface elevations pertinent to screen installation relative to local benchmark used in the site survey.

Appendix E. Toxicological Effects of Herbicides Proposed for Use Under the Idaho Habitat Restoration Program

2,4-D (amine salt only)

Exposure. The herbicide 2,4-D is highly soluble in water, but it rapidly degenerates in most soils, and is rapidly taken up in plants. 2,4-D ranges from being mobile to highly mobile in sand, silt, loam, clay loam, and sandy loam (EPA 2005a). Consequently, 2,4-D may readily contaminate surface waters when rains occur shortly after application, but is unlikely to be a ground-water contaminant due to the rapid degradation of 2,4-D in most soils and rapid uptake by plants. Most reported 2,4-D ground-water contamination has been associated with spills or other large sources of 2,4-D release. 2,4-D may remain active for 1 to 6 weeks in the soil and will degrade to half of its original concentration in several days. Soils high in organic matter will bind 2,4-D the most readily. 2,4-D is degraded in soil by microorganisms and degradation is more rapid under warm, moist conditions. Some forms of 2,4-D evaporate from the soil.

Transport of 2,4-D into rivers by storm runoff is likely to occur from rain events within or shortly following the spray season, based on documented studies. The Washington Department of Ecology (WDOE) collected 32 stream samples downstream from a helicopter application of 2,4-D conducted according to Washington State BMPs. 2,4-D was found in all samples collected and in highest concentrations following a rainstorm the day after the spraying (Rashin and Graber 1993). In a national study of surface water quality, 2,4-D was found in 19 of 20 basins sampled throughout the United States (USGS 1998). In the USGS (1998) study, 2,4-D was found in 12% of agricultural stream samples, 13.5% of urban stream samples, and in 9.5% of the samples from rivers draining a variety of land uses.

SERA (2006a) identified a peak estimated rate of contamination of ambient water associated with the normal application of 2,4-D as 0.44 mg a.e./L at an application rate of 1 lb a.e./acre. Typical application rates for 2,4-D by the Salmon-Challis National Forest in Idaho range from 0.5 to 1.5 lb a.e./acre (NMFS 2012), and the maximum label application rate is 4 lb a.e./acre. At the maximum application rate of 4 lb. a.e./acre, the peak concentrations of 2,4-D in ambient water, using the modeled water contamination rate in SERA (2006a), would be 1.76 mg a.e./L. Considering the BMPs that will be implemented, it is likely that water concentrations of 2,4-D will be far less than that estimated from modeling performed by SERA.

End-Use Products. The herbicide 2,4-D is available in a variety of chemical forms (e.g., esters, amine salts, and acids) with different toxicities to fish. This BA is proposing to use only the amine salt forms of 2,4-D, specifically Amine 4 (various manufacturers), Weedar 64, and Weedestroy. The active ingredient in these products is the 2,4-D dimethylamine salt (DMA).

Both Weedar 64 and Weedestroy (and their substantially similar products as identified on the Pesticide Action Network [PAN] pesticide database) consist of approximately 47% 2,4-D DMA. Unspecified, inert ingredients comprise the remaining 53% of the product. 2,4-D Amine 4 and its substantially similar products include 47.3% 2,4-D DMA and 52.3% of unspecified inert ingredients. The most recent SERA risk assessment (2006a) included these products in the effects analysis.

Toxicity: Fish. This BA does not propose use the ester formulation, which is more toxic to fish than the other forms. Instead, this program would use only the amine form of 2,4-D, which has the lowest toxicity among the various 2,4-D formulations. Toxicities for the acid and amine salts of 2,4-D indicated that both forms are practically non-toxic to freshwater or marine fish, with LC_{50}s ranging from more than 80.24 mg a.e./L to 2,244 mg a.e./L (EPA 2005a). Of the EPA-required studies, the most sensitive results were obtained for rainbow trout exposed to the TIPA salt (96-hour LC_{50} of 162 mg a.e./L). The comparable most tolerant results of the EPA-required studies were obtained with rainbow trout exposed to the DMA salt (96-hour LC_{50} of 830 mg a.e./L). These values are similar to the LC_{50} values of 362 mg a.e./L (Martinez-Tabache *et al.* 2004) and 358 mg a.e./L (Alexander *et al.* 1985) obtained when rainbow trout (*Oncorhynchus mykiss*) were exposed to 2,4-D acid.

Most of the potential sublethal effects from exposure to 2,4-D have not been investigated for endpoints important to the overall health and fitness of salmonids. Exposure to 2,4-D has been reported to cause changes in schooling behavior, red blood cells, reduced growth, impaired ability to capture prey, and physiological stress (NLM 2012; Gomez 1998). Tierney *et al.* (2006) found modifications in electro-olfactogram response when exposing juvenile coho salmon (*O. kisutch*) to 100 mg a.e./L of 2,4-D. Little *et al.* (1990) examined behavior of rainbow trout exposed for 96 hours to sublethal concentrations of 2,4-D acid and observed inhibited spontaneous swimming activity (at 5 mg/L), swimming stamina (at 50 mg/L), predator avoidance (50 mg/L), and prey capture (5 mg/L).

Early life-state tests evaluating the effects of various forms of 2,4-D on growth and larval survival of the fathead minnow (*Pimphales promelas*) were submitted to EPA as part of the registration process. For the acid and salts, the reported NOECs for survival and reproduction ranged from 14.2 mg a.e./L (DMA) to 63.4 mg a.e./L (2,4-D acid). The LOEC values associated with these results are 23.6 mg a.e./L (length) and 102 mg a.e./L (larval survival), respectively (SERA 2006a).

Toxicity: Other Aquatic Organisms. EPA (2005a) classifies the acid and amine salts of 2,4-D as slightly toxic to practically non-toxic to aquatic invertebrates. *Daphnia* was the most sensitive species of freshwater species exposed to the 2,4-D acid, with a 48-hour LC_{50} of 25 mg a.e./L (Alexander *et al.* 1985). When *Daphnia* were exposed to the DMA of 2,4-D, the reported 48-hour LC_{50} values range from 153[10] mg a.e./L (Alexander *et al.* 1985) to 642.8 mg a.e./L (EPA 2005a). Some chronic studies (21-day) have been conducted to evaluate the effects of 2,4-D formulations on survival and reproduction. Ward (1991) reported a 21-day LC_{50} of 75.7 mg a.e./L for *Daphnia* from exposure to the DMA form of 2,4-D. A NOEC was not reported.

2,4-D is an effective herbicide that adversely affects aquatic plants. Based on the data available, it appears that the vascular plants are more than two orders of magnitude more sensitive than the non-vascular plants (EPA 2005a). SERA (2006a) reported the 5-day effect concentration where 50% of the organisms exhibited toxic effects (EC_{50}s) (algal cell growth) for 2,4-D acids and salts as ranging from

[10] The SERA risk assessment (2006) reports a LC_{50} of 184 mg a.e./L; however, the Alexander *et al.* (1985) paper specifically states that results are reported as the technical product and not as acid equivalents. NMFS used a conversion factor of 0.831 to convert from technical product to acid equivalents.

3.88 mg a.e./L (a corresponding NOEC of 1.41 mg a.e./L) to 156 mg a.e./L (a corresponding NOEC of 56.32 mg a.e./L). The most sensitive species was *Navicula pelliculosa* (a freshwater diatom), and the least sensitive species was a freshwater blue-green alga, *Anabaena flos-aquae*. Aquatic macrophytes appear to have a greater range of toxicity values, with target species having lower tolerances. Roshen *et al.* (1999) reported 14-day EC_{50} toxicity values for common water milfoil (*Myriophyllum sibiricum*), a target species, of 0.018 mg/L (shoot growth) and 0.013 mg/L (root length). Sprecher *et al.* (1998) report no effects on sago pondweed (*Potamogeton pectinatus*), a non-target species, at concentrations of up to 2 mg/L of WEEDAR 64.

NMFS Pesticide Registration Opinion. Chemical concentrations examined in the 2011 registration Opinion (NMFS Tracking # 2004/02673) did not vary drastically from those summarized here. The 2,4-D registration Opinion reported acute toxicity data for rainbow trout ranging from 162 mg a.e./L (2,4-D triisopropanolamine salt) to 2,244 mg a.e./L (2,4-D isoproylamine). For the 2,4-D DMA, the acute toxicity information ranged from >100 mg a.e./L to 807 mg a.e./L. Information presented in the 2011 Opinion for EPAs registration of 2,4-D does not suggest a different endpoint as being more appropriate than that which was used in this BA.

The registration Opinion concluded there was no overlap between the EECs for forestry uses and the fish and invertebrate toxicity endpoints for amine, salt, and acid forms of 2,4-D. Generally, the toxicity endpoints were several orders of magnitude higher than the EECs. There was some overlap with the algal and aquatic vascular plant endpoints with the floodplain estimate EEC. The registration Opinion concluded that use of 2,4-D in terrestrial applications was not likely to result in mortality of fish; however, it may result in some sublethal effects.

AMINOPYRALID

Exposure. The half-life of aminopyralid in soils ranges from 32 to 533 days, with a typical time of 103 days (EPA 2005b). Microbes and sunlight break it down and, in aquatic systems, the primary route of degradation is through sunlight (photolysis), with laboratory experiments yielding a product half-life of 0.6 days. In another experiment, aminopyralid photolyzed moderately slowly on a soil surface, with a half-life of 72 days. A laboratory Freundlich absorption isotherm study with eight United States and European soils yielded absorption values at 1.05 to 24.3 mL/g, which shows that aminopyralid is weakly sorbed to soil. This also represents moderate mobility in the environment with a moderate potential to leach through soils and into groundwater. Aminopyralid is "rainfast" within 2 hours, leaving less potential for runoff during a rain event. Aminopyralid does not bioaccumulate through the food chain and is absorbed through the leaves and the roots where it is transported to other parts of the plant. Fish and aquatic insect exposure to aminopyralid occurs primarily through direct contact with contaminated surface waters.

SERA (2007) identified a peak estimated rate of contamination of ambient water associated with the normal application of aminopyralid as 0.6 mg a.e./L at an application rate of 1lb a.e./acre. Typical application rates for aminopyralid in the action area range from 0.078 to 0.11 lb a.e./acre (NMFS 2012b), and the maximum label application rate is 0.11 lb a.e./acre. At the maximum application rate of 0.1 1 lb. a. e./acre, the peak concentrations of aminopyralid in ambient water, using the modeled water contamination rate in SERA (2007), would be 0.066 mg a.e./L.

Considering the BMPs that will be implemented, it is likely that water concentrations of aminopyralid will be far less than that estimated from modeling performed by SERA.

End Use Products: Aminopyralid is a pyridine carboxylic acid herbicide and the current market products containing it include Milestone and Milestone VM. Both of these formulations contain the TIPA salt of aminopyralid (21.1% a.e.). These formulations contain no inert ingredients other than water and TIP A.

Toxicity: Fish. Because aminopyralid is a relatively new pesticide, very little information available regarding its ecological risks to aquatic species and toxicological effects to ESA-listed fish is available in the open literature. The information on the toxicity of aminopyralid comes from studies that have been submitted to EPA as part ofthe registration package for the chemical. The toxicity studies performed to date have used the technical grade aminopyralid; no toxicity studies in fish are available for the TIP A formulation of aminopyralid. In the available studies, aminopyralid has been shown to be practically non-toxic to fish and aquatic invertebrates, and slightly toxic to algae and aquatic vascular plants (EPA 2005b). Aminopyralid is not expected to bioaccumulate in fish tissue (EPA 2005b).

SERA (2007) summarized several acute exposure studies that reported no mortality to organisms exposed to aminopyralid in concentrations up to 100 mg/L. Aminopyralid has a low order of acute toxicity to aquatic animals, with acute NOEC values falling within a narrow range of 50 mg a.e./L to 100 mg a.e.IL, depending on the fish species. Only one ofthe studies documented sublethal effects in trout. In the study conducted by Marino *et al.* (200la), approximately 7% of rainbow trout exposed to 100 mg a.e./L for 96 hours experienced a partial loss of equilibrium. However, this result was not statistically significant relative to the control group using the Fisher Exact test ($p = 0.2457$). As such, the Environmental Fate and Effects Division of EPA classified the 100 mg/L exposure as a NOEC.

Only one chronic toxicity study is available for aminopyralid, and it involves the fathead minnow (Marino *et al.* 2003a). The lowest aquatic toxicity value is 1.36 mg a.e.IL from an egg-and-fry study in fathead minnow. In this study, the percent larval survival and growth (wet weight and length) were significantly ($p < 0.05$) reduced at 2.44 mg a.e./L relative to controls. Sublethal effects such as pale coloration, immobility, deformed or underdeveloped bodies, and scoliosis (curvature of the spine) were also observed at concentrations at or exceeding 2.44 mg a.e./L. EPA (2005b) classified the LOEC as 2.44 mg a.e.IL.

The sublethal effects of aminopyralid and its end use products on ESA-listed fish are unknown. Due to the relatively low toxicity and low application rates for aminopyralid, the estimated risks to fish and aquatic invertebrates from this programmatic action are estimated to be low. However, due to this chemical's fairly new emergence on the market, the overall effects whether sublethal or lethal are uncertain. Future research may reveal additional effects associated with the use of this herbicide.

Toxicity: Other Aquatic Organisms. Aminopyralid has been shown to be practically non-toxic to aquatic invertebrates, and slightly toxic to algae and aquatic vascular plants (EPA 2005b). Similar to fish, acute toxicity values for amphibians and aquatic invertebrates fall within 50 mg a.e./L to 100 mg a.e./L. *Daphnia magna* did not exhibit mortality or sublethal effects when exposed to a measured 98.6 mg a.e.IL concentration for a 48-hour exposure period (Marino *et al.* 2001b). Aquatic invertebrates are much less sensitive to chronic exposures to aminopyralid than fish. In a daphnid study, no adverse effects on adults, offspring, or reproductive parameters were observed in concentrations up to 102 mg a.e.IL. As such, EPA (2005b) classified 102 mg a.e.IL as the NOEC. In a separate study using midges, the NOEC was 130 mg a.e.IL based on mean measured water column test concentrations and 82 mg a.e./L based on pore water concentrations.

Algae and aquatic macrophytes are only somewhat more sensitive than fish and aquatic invertebrates with NOEC values for algae in the range of 6 mg a.e.IL to 23 mg a.e./L and a single NOEC of 44 mg a.e.IL for an aquatic macrophyte. No chronic toxicity tests were reported (SERA 2007).

CHLORSULFURON

Exposure. Chlorsulfuron has a soil half-life of 1 to 3 months, with a typical half-life of 40 days. Soil microbes break down chlorsulfuron and can break it down faster in warm, moist soils (Washington Department of Transportation [WSDOT] 2006). Alternatively, EPA (2005c) describes soil half-life ranging from 14 to 320 days. The WSDOT reported that chlorsulfuron has a high potential to contaminate groundwater, with contamination potentially resulting from application drift, surface runoff, and/or leaching through soil into groundwater (WSDOT 2006). EPA (2005c) also describes chlorsulfuron as likely to be persistent and highly mobile in the environment, transported to non-target areas by surface runoff and/or spray drift.

SERA (2004a) identified a peak estimated rate of contamination of ambient water associated with the normal application of chlorsulfuron at 0.2 mg a.e./L at an application rate of 1 lb a.e./acre. The maximum application rate listed in the proposed action is 2.6 ounces/acre, which is equivalent to 0.12 lbs a.e./acre; consequently, maximum peak exposure would be approximately 0.024 mg a.e./L. For longer-term exposures, average estimated rate of contamination of ambient water associated with the normal application of chlorsulfuron is 0.0006 (0.0001 to 0.0009) mg a.e./L at an application rate of 1 lb a.e./acre.

End-Use Products. The product formulation of chlorsulfuron proposed for use is Telar XP. Telar XP contains 25% inert ingredients that have not been disclosed publicly. None of the inert ingredients are classified as toxic by the EPA (SERA 2004a).

Toxicity: Fish. EPA (2005c) describe chlorsulfuron as “practically non-toxic” to fish, and it does not bioaccumulate in fish (WSDOT 2006). The 96-hour LC_{50} value for rainbow trout has been reported as greater than 250 parts per million (Smith et al 1979). Although full dose-response curves have not been generated (due to limited water solubility of chlorsulfuron), fish do not appear to be susceptible to chlorsulfuron toxicity. The LC_{50} values in most species exceed the limit of solubility for chlorsulfuron (SERA 2004a). Grande *et al.* (1994) exposed brown trout (*Salmo trutta*) to Glean (a product formulation consisting of 75% chlorsulfuron) and reported a 96-hour LC_{50} of 40 mg/L. Because the formulated product was tested, we cannot rule out the possibility that some of the toxicity may be due to the inert ingredients. There was not a paired study done on chlorsulfuron alone.

Pierson (1991) is the only study available regarding the toxicity of long-term (77 days) exposure of chlorsulfuron to fish or fry. Survival of rainbow trout embryos and alevins was not affected at concentrations up to 900 mg/L. However, fingerlings experienced 40% mortality at 900 mg/L. No mortality of fingerlings occurred in groups that were exposed to concentrations less than 900 mg/L (Pierson 1991). The NOEC for growth (as measured at the end of the study) was determined to be 32 mg/L and the LOEC was reported as 66 mg/L (Pierson 1991).

These studies indicate that outright mortality from exposure to the active ingredient is unlikely from the proposed action since peak estimated exposure from SERA (2004a) is about three orders of magnitude lower than the reported LC_{50} for brown trout and approximately four orders of magnitude lower than the reported LC_{50} for rainbow trout. Because there are limited studies available, there is substantial uncertainty surrounding potential sublethal effects of chlorsulfuron and Telar XP. There is no assurance that the proposed action will not cause lethal or sublethal effects to ESA-listed fish if the fish are exposed to the product in any appreciable amount.

Toxicity: Other Aquatic Organisms. The effects of chlorsulfuron on aquatic plants and invertebrates are limited to assays reported for *Daphnia* and several species of plants. Chlorsulfuron is described by EPA (2005c) as “practically non-toxic” to aquatic invertebrates, with 48-hour LC_{50} values for *Daphnia* greater than 100 mg/L. Chlorsulfuron does not bioaccumulate in aquatic invertebrates (WSDOT 2006).

SERA (2004a) summarized standard toxicity bioassays in *Daphnia* (Goodman 1979; Ward and Boeri 1989) and mysids (Ward and Boeri 1991) to assess the effects of chlorsulfuron on aquatic invertebrates. Mysids and daphnia had similar LC_{50} values. The 96-hour LC_{50} and NOEC (for lethality) values for *Mysidopsis bahia* were reported as 89 mg/L and 35 mg/L, respectively (Ward and Boeri 1991). The reported 48-hour LC_{50} value in *Daphnia pulex* ranged between 32 and 100 mg/L, and the reported NOEC (for lethality) was 32 mg/L (Hessen *et al.* 1994). *D. magna* appear to be more resistant to chlorsulfuron toxicity based on a 48-hour LC_{50} value range of > 100 to 370.9 mg/L. The reported NOEC for lethality was 10 mg/L (Goodman 1979). For reproductive effects, a NOEC of 20 mg/L was reported in a 21-day exposure study in *D. magna* (Ward and Boeri 1989).

Studies have demonstrated that aquatic plants are far more sensitive than aquatic animals to chlorsulfuron, with studies occurring for both algae and aquatic macrophytes. Study results summarized by SERA (2004a) revealed substantial differences in the response of algae and various cyanobacteria to chlorsulfuron. However, due to the many variations in experimental protocols, including the duration of exposure and the specific variables used to determine EC_{50} values, identifying the species most sensitive and most resistant to chlorsulfuron is difficult. *Selenastrum capricornutum* is fairly sensitive to chlorsulfuron toxicity, with reported EC_{50} values ranging from 0.05 mg/L to 0.8 mg/L (Abdel-Hamid 1996; Blasberg *et al.* 1991; Fairchild *et al.* 1997; Kallqvist and Romstad 1994). *Selenastrum* is an algal species that occurs in lakes and ponds, and it is used as a toxicity test species because it is sensitive to toxins. *Selanstrum* is generally not found in mountain streams and rivers, but it is a general indicator of potential algal responses in freshwater habitats. Results of a standard toxicity bioassay in *S. capricornutum* yield a NOEC of 0.01 mg/L (exposure duration of 120 hours) (Blasberg *et al.* 1991), which is consistent with the NOEC of < 0.019 mg/L reported by Fairchild *et al.* (1997). Fairchild *et al.* 1997 also reported an LOEC in *S. capricornutum* of 0.019 mg/L. *Cryptomonas pyrenoidifera*, another freshwater algal species, has an EC_{50} of 213 mg/L (Nystrom *et al.* 1999). The longest chlorsulfuron exposure duration for laboratory studies in algae was 92 hours; with no laboratory studies with longer exposure durations identified.

Chlorsulfuron can cause changes in phytoplankton communities at concentrations as low as 0.010 mg/L (Kallqvist et al 1994). A decrease in biomass development was observed following exposure to chlorsulfuron concentrations of 0.010 mg/L for 13 days. A dose-dependent decrease in species diversity (based on the Shannon-Weiner diversity index) was also observed, with the lowest values recorded on the second and last days of the exposure period. With these low concentrations where changes have been observed, the proposed use of chlorsulfuron is likely to alter the algal communities in locations where it reaches water. However, any community effect is likely to be transient, and localized, since exposure is likely to occur through discrete runoff events or spillage with limited duration, and any such incidents are likely to be widely scattered.

Only three studies were identified by SERA (2004a) regarding the toxicity of chlorsulfuron to aquatic macrophytes: a 96-hour exposure study and a 7-day exposure study in duckweed (Fairchild *et al.* 1997; Peterson *et al.* 1994); and a 4-week exposure study in sago pondweed (Coyner *et al.* 2001). The 96-hour EC_{50} value for growth inhibition based on biomass in duckweed is reported as 0.0007 mg /L, with an NOEC value of 0.0004 mg/L and an LOEC of 0.0007 mg/L (Fairchild *et al.* 1997). Exposure of duckweed to 0.02 mg/L for 7 days resulted in 86% inhibition of growth (Peterson *et al.* 1994). Results of the 4-week exposure in sago pondweed yield an LC_{50} value of 0.001 mg/L, with 100% plant death following a 96-hour exposure to 0.002 mg/L (Coyner *et al.* 2001). No field studies assessing the effects of chlorsulfuron in aquatic plants have been identified.

Very little information is available regarding the toxicity of chlorsulfuron degradation products to aquatic plants or algae. Based on a single study described by SERA (2004a), comparing chlorsulfuron and two chlorsulfuron degradation products in *Chlorella pyrenoidosa*, chlorsulfuron breakdown products appear to be considerably less toxic than chlorsulfuron; EC_{50} values for the degradation products are at least 100-fold greater than for chlorsulfuron (Wei *et al.* 1998).

CLOPYRALID

Exposure. Clopyralid's half-life in the environment averages 1 to 2 months and ranges up to 1 year. It is degraded almost entirely by microbial metabolism in soils and aquatic sediments, and is not degraded by sunlight or hydrolysis. Clopyralid is highly soluble in water, does not adsorb to soil particles, is not readily decomposed in some soils, and may leach into ground water. Clopyralid is extremely stable in anaerobic sediments, with no significant decay noted over a 1 year period (Hawes and Erhardt-Zabik 1995; Tu *et al.* 2001). Because clopyralid does not bind with sediments readily, it can be persistent in an aquatic environment, where clopyralid half-life ranges from 8 to 40 days (Tu *et al.* 2001). Clopyralid is stable in water over a pH range of five to nine (Woodburn 1987), and the rate of hydrolysis in water is extremely slow with a half-life of 261 days (Concha and Shepler 1994).

Clopyralid does not bind tightly to soil and has a high potential for leaching. While clopyralid will leach under conditions that favor leaching (e.g., sandy soil, a sparse microbial population, and high rainfall), the potential for leaching or runoff is functionally reduced by the relatively rapid microbial degradation of clopyralid in soil (Baloch-Haq *et al.* 1993; Bergstrom *et al.* 1991; Bovey and Richardson 1991). A number of field lysimeter studies and the long-term field study by Rice *et al.* (1997) indicate that leaching and subsequent contamination of groundwater are likely to be minimal. This conclusion is also consistent with a short-term monitoring study of clopyralid in surface water after aerial application (Leitch and Fagg 1985).

SERA (2004b) estimated peak rates of contamination of ambient water associated with the normal application of clopyralid to be 0.07 mg a.e./L at an application rate of 1 lb a.e./ac. For longer-term exposures, average estimated rate of contamination of ambient water associated with the normal application of clopyralid is 0.007 (0.001 to 0.013) mg a.e./L at an application rate of 1 lb a.e./ac.

End-Use Products. Clopyralid is available in two forms (acid and amine salt). This BA only proposes to use Transline, which contains 40.9% clopyralid as the monoethanolamine salt. It also contains 59.1% inert ingredients. Two of the inert ingredients include: isopropyl alchohol (5%) and a polyglycol (1%), neither of which are classified by EPA as toxic. Transline is currently produced by DowAgroSciences.

Toxicity: Fish. Little information is reported for toxic effects of clopyralid. The acid and amine forms of clopyralid have different toxicities to fish. The monoethanolamine salt of clopyralid appears to have lower toxicity compared to the acid formulation present in some other products. Toxicity of the acid formulation of clopyralid for a 96-hour LC_{50} is reported in SERA (2004b) to be 103.5 mg a.e./L, using an unspecified life stage of rainbow trout. For the monoethanolamine salt form used in the proposed action, SERA (2004b) reported a 96-hour LC_{50} of 700 mg a.e./L. Fairchild *et al.* (2008) exposed rainbow trout and bull trout to chlopyralid and reported 96-hour LC_{50} values of 700 mg a.e./L and 802 mg a.e./L, respectively. The authors also used accelerated life testing procedures in EPA's Acute-to-Chronic Estimation with Time-Concentration-Effect Models program to estimate chronic lethal concentrations resulting in 1% mortality (LC_1) at 30-days. The reported chronic LC_1 was 477 mg a.e./L, with a 95% confidence interval of 53 mg a.e./L to 900 mg a.e./L.

Only one longer-term toxicity study for clopyralid was available. Fairchild *et al.* (2009) conducted 30-day chronic toxicity tests with juvenile rainbow trout. No mortality was observed at the highest concentrations tests (273 mg a.e./L). They found no significant effects on growth of juvenile trout after 15 days of exposure to clopyralid at concentrations up to 256 mg a.e./L. However, both length and weight of trout were significantly affected after exposure to clopyralid for 30-days, with a calculated LOEC of 136 mg a.e./L. The 30-day NOEC value was reported as 68 mg a.e./L. No other longer-term toxicity studies are available on the toxicity of clopyralid.

Toxicity: Other Aquatic Organisms. Toxic effects on aquatic invertebrates are reported only for *Daphnia*, which has an LC_{50} of 350 mg a.e./L for the monoamine salt and 225 mg a.e./L for the acid LC_{50} (SERA 2004b). Results from a single, standard chronic reproduction bioassay exposing *Daphnia* to the monoethanolamine salt of clopyralid indicate a NOEC value of 23.1 mg a.e./L (SERA 2004b).

If other invertebrates respond similarly to *Daphnia*, then lethal effects on aquatic invertebrates are unlikely.

Aquatic plants are more sensitive to clopyralid than fish or aquatic invertebrates (SERA 2004b). The EC_{50} for growth inhibition in duckweed, an aquatic macrophyte, is 89 mg/L. However, at lower concentrations, in the range of 0.01 to 0.1 mg/L, growth of other aquatic macrophytes is stimulated (Forsyth *et al.* 1997). From information reported in SERA (2004b) it appears that there could be potential losses in primary productivity from algae killed by clopyralid, based on an EC_{50} for algae of 6.9 mg/L. However, concentrations lethal to algae are unlikely to occur unless clopyralid is directly added to water, or if a rainfall washes the chemical into a stream shortly after it is applied.

DICAMBA

Exposure. Dicamba is highly mobile in and poorly adsorbed by most soil types. It is also highly soluble in water, so its transport is influenced by precipitation. At low rainfall rates, dicamba dissipation had a half-life of about 20 days. At high rainfall rates using modeled runs, virtually all the dicamba was washed from the soil. The environmental fate of dicamba has been extensively studied. In general, dicamba is very mobile in most soil types, with the only reported exception being peat, to which dicamba is strongly adsorbed (Grover and Smith 1974). For many soil types, the extent of soil adsorption is positively correlated with and can be predicted from the organic matter content and exchangeable acidity of the soil (Johnson and Sims 1993). In a monitoring study by Scifres and Allen (1973), dicamba levels in the top 6 inches of soil dissipated at a rate of about 0.22 day-1 (t1/2=3.3 days) over the first 2 weeks following application. After 14 days no dicamba was detected, with the limit of detection of 0.01 mg/kg, in the top 6 inches of soils. The rates of dissipation in clay and loam were essentially identical.

Available monitoring data indicate that ambient water may be contaminated with dicamba after standard applications of the product. The range of average to maximum dicamba levels in water, reported in a monitoring study by Waite *et al.* (1992), are from approximately 0.1 to 0.4 µg/L. SERA (2004c) estimated peak rates of contamination of ambient water associated with the normal application of dicamba to range from less than 0.00001 mg a.e./L to 0.0005 mg a.e./L at an application rate of 1 lb a.e./ac. The estimated water contamination rate for an accidental direct spray of a stream was reported as 0.01 mg a.e./L. Because dicamba has been detected in surface water at concentrations higher than those modeled by GLEAMS, SERA (2004c) opted to use the 0.01 mg a.e./L as the peak water contamination rate in their risk assessment.

End-Use Products. Dicamba is available as a diglycolamine (DGA) salt and DMA. The products proposed for use include Banvel and Vanquish. Banvel is formulated with the DMA of dicamba, with roughly 52% inert ingredients. Vanquish is the DGA salt of dicamba, and contains approximately 43% inert ingredients.

Toxicity: Fish. There is wide variation in the reported acute toxicity of dicamba to fish, with 96-hour LC_{50} values ranging from 28 mg/L (rainbow trout) to 465 mg/L (mosquito fish [*Gambusia affinis*]). Although limited data are available, salmonids appear to be more sensitive to dicamba than other freshwater fish. Rainbow trout had the lowest reported 96-hour LC_{50} value. The reported 96-hour LC_{50} value for cutthroat trout (*O. clarki*) was more than 50 mg/L (Woodward 1982). For coho salmon, reported 48- and 144-hour LC_{50} values were 120 mg/L and more than 109 mg/L, respectively (Bond *et al.* 1965; Lorz *et al.* 1979). In a study by Lorz *et al.* (1979), yearling coho mortality was observed at 0.25 mg/L during a seawater challenge test which simulates their migration from rivers to the ocean.

There are limited studies on sublethal effects from acute or chronic exposures. The only study providing histopathologic evaluation is that of Lorz *et al.* (1979) using coho salmon. In this study, non-lethal concentrations of dicamba at a concentration of 100 mg/L were associated with histopathological changes in the liver but not in the kidneys or gills. Acute NOEC values have been reported for bluegill sunfish (*Lepomis macrochirus*) (56 mg/L in Vilkas 1977a; 100 mg/L in McAllister *et al.* 1985a), rainbow trout (56 mg/L in McAllister *et al.* 1985b), and sheepshead minnow (*Cyprinodon variegatus*) (>180 mg/L from Vilkas 1977b). However, these NOEC values are based on relatively gross endpoints – i.e., no mortality and no behavioral changes. A significant issue with these values is the fact that some reported NOEC values are greater than values reported to cause an adverse effect. For example, as noted above, McAllister *et al.* (1985b) report an NOEC of 56 mg/L in rainbow trout. While this is consistent with the LC_{50} value of 320 mg/L reported by Bond *et al.* (1965) in rainbow trout, Johnson and Finley (1980) report an LC_{50} of 28 mg/L in rainbow trout. These sorts of discrepancies are not uncommon with compounds for which many studies are conducted at different times by several different laboratories. The reported NOEC values for dicamba will not be used directly in this BA because they may not fully encompass sublethal toxicity and because some of the reported NOEC values exceed other reports of concentrations that are associated with lethality.

Toxicity: Other Aquatic Organisms. The range of toxicity values of dicamba to aquatic invertebrates suggests wide variation among species. The lowest reported 48-hour LC_{50} is 5.8 mg/L for *Gammarus lacustris* (Sanders 1969). While *Daphnia magna*, a common test species, appears to be relatively tolerant to dicamba with reported 48-hour LC_{50} values from 100 mg/L to >1000 mg/L (Johnson and Finley 1980; Forbis *et al.* 1985). *Daphnia pulex* is much more sensitive with a 48-hour LC_{50} value of 11 mg/L (Hurlbert 1975). As with fish, no longer-term studies are available on the lethal and sublethal toxicity of dicamba to aquatic invertebrates.

Algae species are more sensitive to dicamba than aquatic animals (SERA 2004c). The most sensitive species on which data are available is the freshwater algae, *Anabaene flos-aquae,* with a 5-day EC_{50} of 0.061 mg/L (Hoberg 1993a). The aquatic macrophyte, *Lemna gibba,* had reported 14-day NOEC and LOEC values of 0.25 mg/L and 0.51 mg/L, respectively (Hoberg 1993b). A higher 4-day NOEC of 100 mg/L was reported for *Lemna minor* (Fairchild *et al.* 1997). Whether this value reflects a true difference in species sensitivity or whether is simply reflects a shorter duration of exposure is unknown.

GLYPHOSATE

Exposure. Glyphosate strongly binds to most soils, but dissolves easily in water. Glyphosate remains unchanged in the soil for varying lengths of time, depending on soil texture and organic matter content. The half-life of glyphosate can range from 3 to 249 days in soil and from 35 to 63 days in water (USFS 2000a). Soil microorganisms break down glyphosate and the potential for leaching is low due to the soil adsorption. However, glyphosate can move into surface water when the soil particles to which it is bound are washed into streams or rivers (EPA 1993). Studies examined glyphosate residues in surface water after forest application in British Columbia with and without no-spray streamside zones. With a no-spray streamside zone, very low concentrations were sometimes found in water and sediment after the first heavy rain (USFS 2000a). Although glyphosate is chemically stable in pure aqueous solutions, it is degraded relatively fast by microbial activity, and water levels are further reduced by the binding of glyphosate to suspended soil particulates in water and dispersal (SERA 2011a).

Biodegradation represents the major dissipation process. After glyphosate was sprayed over two streams in the rainy coastal watershed of British Columbia, glyphosate levels in the streams rose dramatically after the first rain event, 27 hours after application, and fell to undetectable levels in 96 hours (NLM 2012). The highest residues were associated with sediments, indicating that they were the major sink for glyphosate. Residues persisted throughout the 171 day monitoring period. Suspended sediment is not a major mechanism for glyphosate transport in rivers, but glyphosate sprayed in roadside ditches could readily be transported as suspended sediment and cause acute exposures following rain events.

SERA (2011a) estimated peak rates of contamination of ambient water associated with the normal application of glyphosate to be 0.083 mg a.e./L at an application rate of 1 lb a.e./acre. For longer-term exposures, average estimated rate of contamination of ambient water associated with the normal application of glyphosate is 0.00019 (0.000088 to 0.0058) mg a.e./L at an application rate of 1 lb a.e./acre. Peak contamination rates in a stream after a direct spray were modeled to be 0.091 mg a.e/L.

End-Use Products. Glyphosate is available in a variety of formulations that contain the ammonium, DMA, isopropylamine (IPA), or potassium salts of glyphosate. Some formulations contain only one of these salts as an aqueous solution (e.g., Accord, AquaNeat, and Rodeo), and other formulations (e.g., Roundup) contain surfactants. This BA proposes to use products that are formulated as salts in water with no added surfactants. Products that appear to fit these criteria include: Rodeo, Accord Concentrate, GlyPro, AquaMaster, AquaNeat Aquatic Herbicide, and Foresters. All of these end use products (EUPs) have the same proportion of the IPA salt of glyphosate. Manufacturers of these EUPs recommend that a surfactant be added to the formulation in a tank mix prior to application. Use of Round-up is not included in this program.

Toxicity: Fish. EPA (1993) classified glyphosate (technical grade) as slightly toxic to practically non-toxic to fish. The rainbow trout 96-hour LC_{50} values for glyphosate acid and the IPA salt of glyphosate range from 10 mg a.e./L to 240 mg a.e/L. Wan *et al.* (1989) found the toxicity of glyphosate is affected by pH. The authors tested the toxicity of glyphosate to various salmonids (rainbow trout, coho salmon, chum salmon, Chinook salmon, and pink salmon) in water with pH values ranging from 6.3 to 8.2. Rainbow trout were the most sensitive to pH variance, with 96-hour LC_{50} values ranging from 10 mg a.e./L (pH 6.3) to 197 mg a.e./L (pH 8.2).

The various formulations of glyphosate have different toxicities to fish (rainbow trout 96-hour LC_{50} values ranging from 1.3 mg a.e./L to 429 mg a.e./L), which highlights the role of inert ingredients in toxicity (SERA 2011a). Of the glyphosate formulations tested, both Rodeo and Accord (and other equivalent formulations) are the least toxic. These formulations consist of only the active ingredient and water; however, the manufacturer recommends the EUP be mixed with a surfactant prior to applying the herbicides. Mitchell *et al.* (1987) tested the toxicity of Rodeo with and without a surfactant. Without the surfactant, the 96-hour LC_{50} for rainbow trout was 429 mg a.e./L. With the surfactant X-77, the 96-hour LC_{50} ranged from 96.4 mg a.e./L (rainbow trout) to 180.2 mg a.e./L (Chinook salmon).

The most toxic formulation tested was Roundup Original and its apparently equivalent formulations (Honcho, Gly Star Plus, and Cornerstone). These Roundup formulations contain glyphosate IPA and the polyoxyethyleneamine (POEA) surfactant MON 0818. The reported range of 96-hour LC_{50} values for Roundup formulations that appear to contain this POEA surfactant is 0.96 mg a.e./L to 10 mg a.e./L (SERA 2011a). Other formulations with the trade name of Roundup have been found to be much less toxic (i.e., rainbow trout LC_{50} of 800 mg a.e./L for Roundup Biactive) than standard Roundup formulations (SERA 2011a). The decreased toxicity of these formulations is likely due to the use of different surfactants. Regardless, this BA proposes to use products that are formulated as salts in water with no added surfactants, so none of these formulations are included. Specific surfactants may be added, however, to the end-use product.

As noted previously, surfactants can substantially alter the toxicity of a formulation (e.g., toxicity increased 4 times when X-77 was added to Rodeo). There are some surfactants that are considered slightly toxic (LC_{50} values ranging from >10 to 100 mg/L) to practically non-toxic (LC_{50} values greater than 100 mg/L). The surfactants Agri-Dex, LI 700 and Geronol CF/AR have LC_{50} values greater than 100 mg/L (McLaren/Hart 1995). The following surfactants may be used under this program: Activator

90, Spread 90, L1700, Sylatac, R11, MSO, and Agri-Dex. Three of these surfactants have reported rainbow trout 96-hour LC_{50} values: Activator 90 (2.0 mg/L); R-11 (3.8 mg/L); LI700 (130 mg/L). The toxicity of X-77 is reported to be similar to that of R-11. As such, we will assume that the Rodeo/R-11 mixture has a similar toxicity to that of the Rodeo/X-77 (LC_{50} of 96.4 mg a.e./L) mixture for this BA.

Information on sublethal effects of glyphosate and glyphosate formulations is extremely limited and not available for many of the endpoints important to the overall health and fitness of salmonids. Xie *et al.* (2005) exposed juvenile rainbow trout to 0.11 mg a.e./L[11] glyphosate for 7 days and did not observe any significant increase in vitellogenin concentrations. The authors also exposed juvenile trout to mixtures of glyphosate (0.11 mg a.e./L) and either the surfactant R-11 (0.06 mg/L) or TPA (0.02 mg/L) for 7 days and observed some increases in vitellogenin concentrations. However, those increases were not statistically significant. No other studies evaluating sublethal effects to salmonids from acute exposures to technical grade glyphosate were found.

There have been some acute studies performed using Roundup formulations. Morgan *et al.* (1991) reported that trout do not exhibit avoidance responses to glyphosate formulations (Vision with 15% surfactant and Vision with 10% surfactant) at concentrations less than the 96-hour LC_{50}. However, behavioral changes such as changes in coughing and ventilation rates, changes in swimming, loss of equilibrium, and changes in coloration were observed at concentrations as low as 50% of the LC_{50} over exposures of up to 96 hours (some erratic swimming behavior was observed after just 24 hours). In this study, rainbow trout exposed to concentrations of up to 6.75 mg a.e./L of Vision (with 15% surfactant) did not exhibit abnormal behavior during the exposure period. Similarly, no abnormal behavior was observed in fish exposed to concentrations of up to 18.75 mg a.e./L of Vision (with 10% surfactant). Tierney *et al.* (2007) reported that rainbow trout may be able to sense glyphosate (Roundup formulation) at about 0.076 mg a.e./L (as measured by olfactory-mediated behavioral and neurophysiological responses) during 30 minute exposure periods, but will not exhibit an avoidance response at this concentration. Rather, avoidance responses were exhibited at concentrations that were close to those causing acute lethality.

One full life-cycle study assessing the chronic toxicity of technical grade glyphosate has been performed using the fathead minnow (*P. promelas*). In this study, no adverse effects to survival or reproduction occurred at exposures up to 25.7 mg a.e./L (the highest concentrations tested). Morgan and Kiceniuk (1992) conducted a long-term study (2 months) exposing rainbow trout to Vision at concentrations up to 0.046 mg a.e./L. No mortality or signs of toxicity were observed during the exposure period, and the authors did not find any evidence or pathology or changes in growth. The authors noted a decrease in the frequency of wigwag behavior in exposed trout at 0.0045 mg a.e./L; however, this effect was not observed at higher exposure concentrations

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[11] SERA (2011a), reported the exposure concentration as 1.25 mg a.e./L; however, following review of the original publication (Xie *et al.* 2005), it appears as though 0.11 mg a.e./L glyphosate was measured, and the 1.25 mg a.e./L concentration was applicable to the chemical triclopyr.

(0.043 mg a.e./L). Because the change in wigwag behavior did not have a clear dose-response relationship, the authors were uncertain about its biological significance. No other chronic studies using salmonids were located.

Toxicity: Other Aquatic Organisms. EPA (1993) classified glyphosate (technical grade) as slightly toxic to practically non-toxic to aquatic invertebrates. The 48-hour EC_{50} values for aquatic invertebrates exposed to glyphosate or glyphosate IPA generally range from 50 to 650 mg a.e./L (SERA 2011a). For *Daphnia magna*, studies provided to EPA in support of the registration for glyphosate reported EC50 values ranging from 128 – 647 mg a.e./L. Pereira *et al.* (2009) reported an extremely high acute EC_{50} (more than 2,000 mg a.e./L). Even though this result is much higher than any previously reported EC_{50} values, the test protocol used appeared to be relatively standard (SERA 2011a).

As expected, Rodeo has similar toxicities to the active ingredient and is much less toxic than formulations that contain surfactants. For aquatic invertebrates, the LC_{50} values for Rodeo range from 86 mg a.e./L[12] to more than 2,000 mg a.e./L. Simenstad *et al.* (1996) found no significant differences in the short term (28 days post treatment) or long term (119 days post treatment) between benthic communities of algae and invertebrates on untreated mudflats and mudflats treated with Rodeo® and the surfactant X-77 spreader.

Similar to fish, Roundup and similar formulations of glyphosate are much more toxic to aquatic invertebrates than glyphosate, glyphosate IPA, and Rodeo. Toxicity values for most Roundup formulations range from approximately 1.5 to 62 mg a.e./L. In a study of avoidance behavior, Folmar (1978) noted that mayflies avoided Roundup at concentrations of 10 mg/L; however, no effect was noted at concentrations of 1 mg/L. Hildebrand *et al.* (1980) found that Roundup® treatments of an experimental pond at concentrations up to 196 lbs/acre did not significantly affect the survival of *Daphnia*.

Glyphosate is highly toxic to all types of terrestrial plants and is used to kill floating and emergent aquatic vegetation. Differences in species sensitivities to glyphosate acid are apparent for both algae (EC_{50} values from about 2 to 600 mg a.e./L) and aquatic macrophytes (EC_{50} values from 10 to near 200 mg a.e./L). The toxicity of Rodeo (no surfactant) to the algae *Ankistrodesmus* sp. was reported to be 29 mg a.e./L (Gardner *et al.* 1997). Perkins (1997) found Rodeo to be much more toxic to the aquatic macrophyte watermilfoil (14-day EC_{50} of 0.84 mg a.e./L) and *Lemna gibba* (7.6 mg a.e./L).

[12] Henry *et al.* (1994) reported an LC_{50} value of 218 mg formulation/L for *Daphnia magna*. It appears as though SERA (2011a) erroneously reported this value as mg a.e./L. The formulation used contained 53.5% IPA salt of glyphosate. The ratio of glyphosate acid to the IPA salt in the formulation is 0.74. Thus, a toxicity value of 218 mg formulation/L equates to 86.3 mg a.e./L (218 * 0.535 * 0.74).

IMAZAPIC

Exposure. Imazapic has an average soil half-life of 120 days, with degradation primarily occurring through soil microbial metabolism (Tu *et al.* 2001). Imazapic is moderately persistent in soils, and has not been found to move laterally with surface water (generally moving only 6 to 12 inches laterally but can leach to depths of 18 inches in sandy soils). Although the extent to which imazapic is degraded by sunlight is believed to be minimal when applied to terrestrial plants, it is rapidly degraded by sunlight in aqueous solutions (half-life of 1 to 2 days). Imazapic is water soluble and is not degraded hydrolytically in aqueous solution (Tu *et al.* 2001).

Simulations of imazapic runoff were conducted for both clay, loam, and sand at annual rainfall rates from 5 to 250 inches and the typical application rate of 0.1 lb a.e./acre (SERA 2004d). Based on the modeling, under arid conditions (i.e., annual rainfall of about 10 inches or less), no runoff is expected and degradation, not dispersion, accounts for the decrease of imazapic concentrations in soil. At higher rainfall rates, plausible offsite movement of imazapic may reach up to 3.5% of the applied amounts in clay soils. In very arid environments substantial contamination of water is unlikely. In areas with increasing levels of rainfall, exposures to aquatic organisms are more likely to occur. Thus, the anticipated water contamination rates (WCRs) (concentration of imazapic in ambient water per lb a.e./acre applied) associated with runoff encompass a very broad range, from 0 to 0.002 mg/L, depending on rainfall rates and soil type (SERA 2004d).

In their risk assessment, SERA (2004d) utilized a peak estimated rate of contamination of ambient water associated with the normal application of imazapic of 0.01 mg a.e./L at an application rate of 1 lb a.e./acre. Typical application rates for imazapic by the Salmon-Challis National Forest (NMFS 2012), for example, range from 0.1 to 0.19 lb a.e./acre, and the maximum label application rate is 0.19 lb a.e./acre. At the maximum application rate of 0.19 lb. a.e./acre, the peak concentrations of imazapic in ambient water, using the modeled water contamination rate in SERA (2004d), would be 0.002 mg a.e./L. Considering the BMPs that will be implemented, it is likely that water concentrations of imazapic will be far less than that estimated here.

End-Use Products. Imazapic is available in acid and ammonium salt forms. This BA proposes to use only one end-use product, Plateau, which is formulated with 23.6% of the ammonium salt of imazapic.

Toxicity: Fish. The ammonium salt form of imazapic is less toxic than the acid form. Fish appear to be relatively insensitive to imazapic exposures, with LC_{50} values >100 mg/L for both acute toxicity and reproductive effects (SERA 2004d). In acute toxicity studies, all tested species (channel catfish, bluegill, sunfish, trout, and sheepshead minnow) evidenced 96-hour LC_{50} values of >100 mg/L. The low toxicity of imazapic to fish is probably related to a very low rate of uptake of this compound by fish. In a 28-day flow-through assay, the bioconcentration of imazapic was measured at 0.11 L/kg (Barker *et al.* 1998) indicating that the concentration of imazapic in the water was greater than the concentration of the compound in fish. No studies are reported in the SERA assessment (2004d) for sublethal effects of imazapic to listed fish. Barker *et al.* (1998) observed no effects on reproductive parameters in a 32-day egg and fry study using fathead minnow.

Even though imazapic itself appears to be only moderately toxic to fish, based on the LC_{50}, Plateau contains roughly 76% inert ingredients that are not identified by the manufacturer. With many herbicides, the inert ingredients may be more toxic to fish and other aquatic organisms than the active ingredient. While toxicity tests are reported for imazapic, there is no apparent information regarding the toxicity to salmon and trout for the product formulation in Plateau, which includes imazapic and unspecified inert ingredients. Although none of the inert ingredients contained in Plateau are classified as toxic by the EPA (SERA 2004d), no studies are available lending insight into how the inerts may affect the toxicity of Plateau. Consequently the toxic effects of salmon or trout exposure to Plateau are unknown.

Toxicity: Other Aquatic Organisms. Similar to fish, there is relatively little information about the effects of imazapic on aquatic organisms in the natural environment. No adverse effects to *Daphnia* or mysid shrimp were observed at nominal concentrations of imazapic of up to 100 mg/L in 96-hour studies (SERA 2004d); however, the report did not specify if the analysis included any sublethal endpoints. Additionally, no adverse effects were noted in a life-cycle study that exposed *Daphnia* to concentrations up to 100 mg/L.

Effects of imazapic on aquatic plants is highly variable. *Lemna gibba*, a freshwater macrophyte, is the most sensitive aquatic plant reported in the literature, with an EC_{50} value based on decreased frond counts of 0.0061 mg/L. Algae were less sensitive than macrophytes (reported LC_{50} values > 0.045 mg/L), and responses included both growth inhibition and growth stimulation (SERA 2004d).

METSULFURON-METHYL

Exposure. The persistence of metsulfuron-methyl in soil is highly variable; reported soil half-lives range from a 14 to 180 days, with an overall average of 30 days. The rate of metsulfuron-methyl degradation depends on factors like temperature, rainfall, pH, organic matter, and soil depth. Metsulfuron-methyl in the soil is broken down to non-toxic and non-herbicidal products by soil microorganisms and chemical hydrolysis. Degradation will occur more rapidly under acidic conditions, and in soils with higher moisture content and higher temperature (Extoxnet 1996).

The mobility of metsulfuron methyl ranges from moderate to highly mobile (NLM 2012). Off-site movement of metsulfuron-methyl is governed by the binding of metsulfuron-methyl to soil, the persistence in soil, as well as site-specific topographical, climatic, and hydrological conditions. The adsorption of metsulfuron-methyl to soil varies with the amount of organic matter present in the soil, soil texture, and pH. Adsorption to clay is low. In general, metsulfuron-methyl absorption to a variety of different soil types will increase as the pH decreases. Metsulfuron-methyl dissolves easily in water. There is a potential for metsulfuron-methyl to contaminate ground waters at very low concentrations. Metsulfuron-methyl readily leaches through silt loam and sand soils.

Fate and transport simulations reported in SERA (2004e) were conducted for clay, loam, and sand at annual rainfall rates ranging from 5 to 250 inches and the typical application rate of 0.03 lb a.e./acre. In all soil types under arid conditions (i.e., annual rainfall of about 10 inches or less), substantial contamination of surface water is unlikely. In areas with increasing levels of rainfall, peak WCRs of about 0.0001 to 0.002 mg a.e./L (per application of 1 lb a.e./acre) can be anticipated, under worst case conditions, at rainfall rates ranging from 15 to 250 inches per year. SERA (2004e) also estimated the water contamination rate associated with an accidental direct spray to be 0.010 mg/L at an application rate of 1 lb a.e./acre. For this BA, the higher water contamination rate was multiplied by the maximum label application rate to estimate the EEC (i.e., 0.010 mg a.e./L x 0.15 lb a.e./acre = 0.002 mg a.e./L).

End-Use Products. There are several formulations of metsulfuron-methyl registered for use; however, this BA proposes to only use the formulation Escort XP. Escort XP is manufactured by DuPont and is comprised of 60% metsulfuron methyl and 40% inert ingredients (SERA 2004e). The inert ingredients include sodium naphthalene sulfonate-formaldehyde condensate, a mixture of a sulfate of alkyl carboxylate and sulfonated alkyl naphthalene (sodium salt), polyvinyl pyrrolidone, trisodium phosphate, and sucrose.

Both trisodium phosphate and sucrose are generally recognized as safe compounds and are approved as food additives. Although none of the remaining inerts are categorized by EPA as being of toxicological concern (List 1) or as being potentially toxic or as having a high priority for testing (List 2), there is insufficient information available to assess their potential toxicity to fish. Polyvinyl pyrrolidone is marketed as a disinfectant for fish aquaria and treatment of certain fish infections; consequently, the product is not likely to be toxic to listed trout at environmental concentrations encountered in the proposed action.

The label for Escort XP recommends the use of a non-ionic surfactant, except in certain circumstances. There is limited information on the toxicity of surfactants.

Toxicity: Fish. Based on available studies, metsulfuron-methyl appears to have a low toxicity to and does not bioaccumulate in fish. The reported rainbow trout 96-hour LC_{50} values for metsulfuron-methyl range from more than 150 mg a.e./L to more than 1,000 mg a.e/L (SERA 2004e). The lowest concentration at which rainbow trout mortality was observed is 100 mg/L; however, in the same study, no mortality was observed in rainbow trout exposed to 1,000 mg/L (Hall 1984). Because of the lack of a dose-response relationship, Hall (1984) asserts that the mortality in the 100 mg/L exposure group was probably incidental rather than treatment related. This BA uses a LC_{50} of 150 mg a.e./L to evaluate the potential for use of metsulfuron-methyl to adversely affect ESA-listed fish.

Debilitating sublethal effects (i.e., erratic swimming, rapid breathing, and lying on the bottom of the test container) were observed by Muska and Hall (1982) after exposure to 150 mg/L for 24 hours. In tests with rainbow trout, no significant long-term effects (90-day exposure) were observed by Kreamer (1996) on hatch rate, last day of hatching, first day of swim-up, larval survival, and larval growth at concentrations up to 4.7 mg/L. However, concentrations greater than 8 mg/L resulted in small but significant decreases in hatching and survival of fry.

Indirect Effects on Aquatic Organisms. Toxicity studies on aquatic invertebrates are reported only for *Daphnia*. For acute exposures, the range of EC_{50} values for immobility ranges from more than 150 mg/L to 720 mg/L. For chronic exposures, the NOEC of 17 mg/L for growth inhibition is used, although higher chronic NOECs, ranging from 100 to150 mg/L, have been reported for survival, reproduction and immobility (SERA 2004e). The only effect reported by Hutton (1989) in a 21-day *Daphnia* study was a decrease in growth at concentrations as low as 5.1 mg/L, but decreased growth at concentrations less than 30 mg/L was not statistically significant. In aquatic invertebrates, decreased growth appears to be the most sensitive endpoint. Wei *et al.* (1999) report that neither metsulfuron-methyl nor its degradation products are acutely toxic to *Daphnia* at concentrations that approach the solubility of the compounds in water at pH 7.

The available data suggest that metsulfuron-methyl, like other herbicides, is much more toxic to aquatic plants than to aquatic animals. Macrophytes appear more sensitive to metsulfuron-methyl than algae (SERA 2004e). There are substantial differences in sensitivity to effects of metsulfuron-methyl among algal species, but all EC_{50} values reported in SERA (2004e) are above 0.01 mg/L, and some values are substantially higher. Toxicity in algae increases with lower pH, most probably because of decreased ionization leading to more rapid uptake. At a concentration of 0.003 mg/L, metsulfuron-methyl was associated with a 6% to 16% inhibition (not statistically significant) in algal growth rates for three species but stimulation of growth was observed in *Selenastrum capricornutum* and the aquatic macrophyte, duckweed (SERA 2004e). Wei *et al.* (1998; 1999) assayed the toxicity of metsulfuron-methyl degradation products in *Chlorella pyrenoidosa* and found that the acute toxicity of the degradation products was about two to three times less than that of metsulfuron-methyl itself in a 96-hour assay. One field study cited in SERA (2004c) on the effects of metsulfuron-methyl in algal species found that concentrations of metsulfuron-methyl as high as 1 mg/L are associated with only slight and transient effects on plankton communities in a forest lake.

PICLORAM

Exposure. Picloram is relatively persistent and can remain effective in the soil for up to 3 years after application. Picloram is resistant to biotic and abiotic degradation processes and has a field half-life of 20 to 300 days. Picloram is highly soluble in water and can readily leach through some soil types. Ismail and Kalithasan (1997) found that picloram moves rapidly out of the top 2 inches of soil with a half-life of about 4 to 10 days. Somewhat longer half-lives of 13 to 23 days have been reported by Krzyszowska *et al.* (1994), who also noted that picloram is degraded more rapidly under anaerobic than aerobic conditions and also degrades more rapidly at lower application rates.

SERA (2011b) identified a peak estimated rate of contamination of ambient water associated with the normal application of picloram as 0.011 (0.001 to 0.18) mg a.e./L at an application rate of 1 lb a.e./acre. Typical application rates for picloram by the Salmon-Challis National Forest (NMFS 2012), for example, range from 0.5 to 0.75 lb a.e./acre, and the maximum application rate is 1 lb a.e./acre. The estimated peak water contamination rate of picloram in ambient water normalized to an application rate of 1 lb a.e./acre is 0.18 mg a.e./L (SERA 2011b).

Multiplying the maximum application rate by the peak water contamination rate results in an EEC of 0.18 mg a.e./L. Considering the BMPs that will be implemented (e.g., no application of picloram within 50 feet of water), it is likely that water concentrations of picloram will be far less than that modeled by SERA. The most likely scenario where picloram will enter the stream is where weeds are treated on floodplains with a high water table and highly permeable soils.

End-Use Products. The proposed action includes the use of Tordon 22K and Tordon K, both of which contain the potassium salt of picloram (24.4% weight per volume). The remaining 75.6% of the formulations consist of inert ingredients. One inert is listed as a polymer of ethylene oxide, propylene oxide, and di-sec-butyl-phenol (CAS No. 69029-39-6). According to SERA (2011b), Tordon K and Tordon 22K do not appear to differ substantially.

Toxicity: Fish. EPA (1995) classified picloram acid and picloram potassium salt as moderately toxic to freshwater fish with reported rainbow trout LC_{50}s of 5.5 mg a.e./L and 13 mg a.e./L, respectively. SERA (2011b) reported a variety of 96-hour LC_{50} values for rainbow trout, which ranged from 5.5 mg a.e./L to 41 mg a.e./L. These tests used either technical grade picloram, picloram acid, or the picloram potassium salt. The 96-hour LC_{50} of 5.5 mg a.e./L was obtained by Batchelder (1974) in a test of the technical grade picloram. Earlier production of picloram contained impurities, which have been minimized in more recent production of picloram. As such, the 5.5 mg a.e./L might not be representative of current toxicity. Fairchild *et al.* (2009) reported an 96-hour LC_{50} of 36 mg a.e./L for juvenile rainbow trout. The authors did not observe any mortality at a concentration of 12 mg a.e./L.

Fish size or life stage can sometimes be an important factor in the toxicity of pesticides. Mayer and Ellersieck (1986) studied the toxicity of picloram on yolk sac rainbow trout fry, swim up fry, and advanced fry. They found LC_{50}s of 8 mg a.e./L, 8 mg a.e./L, and 11 mg a.e./L (yolk sac fry, swim up fry, and advanced fry, respectively), which demonstrates little difference in sensitivity among the various stages tested.

Most of the potential sublethal effects for picloram have not been investigated in regard to toxicological endpoints that are important to the overall health and fitness of salmonids (e.g., growth, life history, mortality, reproduction, adaptability to environment, migration, disease, predation, or population viability). Of the very little research that has been conducted on the potential sublethal effects of picloram on aquatic life, the focus has primarily been on growth. Woodward (1979) found that picloram concentrations greater than 0.61 mg/L decreased growth of cutthroat trout, and a similar finding was reported by Mayes (1984). Exposure regimes where the maximum exposure concentration did not exceed 0.29 mg a.e./L had no adverse effects on the survival and growth of cutthroat trout fry (Woodward 1979). In a study of lake trout, picloram concentrations of 0.04 mg a.e./L reduced the rate of yolk sac absorption, as well as fry survival, weight, and length (Woodward 1976). Mayes *et al.*

(1987) reported that picloram concentrations of 0.9 mg a.e./L reduced the length and weight of rainbow trout larvae and concentrations of 2 mg a.e./L reduced survival of the larval fish. The authors reported the lowest NOEC as 0.55 mg a.e./L. Fairchild *et al.* (2009) reported a LOEC for growth of juvenile rainbow trout of 2.37 mg a.e./L, and a NOEC of 1.18 mg a.e./L. For juvenile bull trout, Fairchild *et al.* (2009) reported a LOEC for growth of 1.18 mg a.e./L and a NOEC of 0.6 mg a.e./L. Yearling coho salmon exposed to nominal concentrations of 5 mg a.e./L for 6 days suffered "extensive degenerative changes" in the liver and wrinkling of cells in the gills (Lorz *et al.* 1979).

Toxicity: Other Aquatic Organisms. Although picloram is toxic to salmonids, it is not as toxic to *Daphnia* or algae at the same concentrations. For *Daphnia*, the reported acute (48-hour) LC_{50} values range from 48 mg a.e./L to 173 mg a.e./L (SERA 2011b). Chronic studies using reproductive or developmental parameters in *Daphnia* reported a NOEC of 11.8 mg a.e./L and a LOEC of 18.1 mg a.e./L (Gersich *et al.* 1984). Boeri *et al.* (2002) studied the effects of picloram acid on *Daphnia* reproductive endpoints and reported a NOEC of 6.79 mg a.e./L and a LOEC of 13.5 mg a.e./L. No toxicity studies involving the exposure of *Daphnia* to Tordon 22K are readily available.

The toxicity of picloram to aquatic plants varies substantially among different species. Based on the available toxicity bioassays, the most sensitive species is *Navicula pelliculosa*, a freshwater diatom, with an EC_{50} (i.e., the concentration causing 50% inhibition of a process for growth) of 0.93 mg a.e./L and a NOEC of 0.23 mg a.e./L. The least sensitive aquatic plants appear to be from the genus *Chlorella* (another group of freshwater algae), with EC_{50} values greater than 160 mg a.e./L (Baarschers *et al.* 1988). The macrophyte *Lemna gibba* (duckweed) has a reported 14-day EC_{50} of 47.8 mg a.e./L and a 14-day NOEC of 12.2 mg a.e./L (Kirk *et al.* 1994). Other studies on the toxicity of picloram to macrophytes were not used in the 2011 risk assessment (SERA) because the test agent wasn't specified, the reporting units were not clear, or the test agent was a formulation of picloram not used by the Forest Service.

Effects on Non-Target Plants. While most grasses are resistant to picloram, it is highly toxic to many broad-leafed plants. Crop damage from irrigation water contaminated by picloram has been documented by the EPA (EPA 1995; USFS 2000b). Picloram is persistent in the environment, and may exist at levels toxic to plants for more than a year after application at normal rates. In normal applications, non-target plants may be exposed to chemical concentrations many times the levels that have been associated with toxic effects. Picloram's mobility allows it to pass from the soil to nearby, non-target plants. It can also move from target plants, through roots, down into the soil, and into nearby non-target plants. Given this capability, an applicator does not have to spray the buffer zone in order to affect the riparian vegetation. Spray drift may also kill plants some distance away from the area being treated. The proposed 50 foot no-spray buffer for picloram should reduce the unintended mortality of streamside trees, shrubs and other broadleaf plants.

SULFOMETURON-METHYL

Exposure. Sulfometuron-methyl can be moderately persistent in soils, with reported half-lives ranging from 10 to 170 days (SERA 2004f). Sulfometuron-methyl readily biodegrades in aerobic soil conditions, with reported half-lives of 12-25 days for various soil conditions (e.g., pH levels and moisture content). Sulfometuron-methyl does not bind strongly to soils and it is slightly soluble in water. Depending on soil conditions, sulfometuron-methyl can be mobile and may be transported to off-site soil by runoff or percolation. The potential for leaching depends on soil conditions such as organic matter content, moisture, and soil pH. Under acid conditions, sulfometuron-methyl hydrolyzes quickly and has less potential for movement.

At least 1% of the applied sulfometuron-methyl applied to an area could run off from the application site to adjoining areas after a moderate rain, based on studies of runoff from 3.3 in. of total rainfall (1.7 in./hour for 2 hours) by Hubbard *et al.* (1989) and from 0.47 to 1.18 in. of rainfall by Wauchope *et al.* (1990). Losses could be much greater and might approach 50% in cases of extremely heavy rain and a steep soil slope (SERA 2004f).

Using the root zone model GLEAMS, SERA (2004f) estimated the peak WCRs of streams associated with the normal application (1 lb a.e./acre) of sulfometuron-methyl as ranging from 0.00006 to 0.02 mg a.e./L. Neary and Michael (1989) applied sulfometuron methyl in the form of dispersible granules at a rate of 0.36 lbs/acre to a study site in Florida. They monitored nearby surface water for chemical contamination for up to 203 days after treatment. The maximum concentration of sulfometuron methyl was reported as 0.07 mg/L. Normalizing this water concentration to an application rate of 1 lb/acre gives a water contamination rate of 0.02 mg a.e./L. At the proposed maximum application rate of 0.378 lbs a.e./acre, the expected levels of sulfometuron methyl (under conditions similar to those in the Neary and Michael [1989] study) in surface water would be 0.008 mg a.e./L.

End-Use Products. The only commercial formulation of sulfometuron-methyl that is proposed for use under this action is Oust XP. Oust XP is manufactured by DuPont and is comprised of 75% sulfometuron-methyl and 25% inert ingredients (SERA 2004f). The inert ingredients include sucrose, sodium salt of naphthalene-sulfonic acid formaldehyde condensate, polyvinyl pyrrolidone, sodium salt of sulfated alkyl carboxylated and sulfated alkyl naphthalene, and hydroxypropyl methylcellulose. None of these inert ingredients are classified by EPA as toxic. The toxicity of Oust XP appears to be similar to that of technical grade sulfometuron methyl; providing further support that the inerts are not very toxic.

Toxicity: Fish. Sulfometuron-methyl does not appear to be highly toxic to fish; however, investigations of acute toxicity have been hampered by the limited water solubility of sulfometuron-methyl. Furthermore, the available studies have focused on lethal endpoints rather than sublethal ones. In the available studies, none of the fish died from acute exposure to sulfometuron-methyl, even at the highest concentrations tests. As such, NOEC values (based on lethality) were placed at the highest concentrations tested: 7.3 mg a.e./L for fathead minnow (Muska and Driscoll 1982) and 148 mg a.e./L for rainbow trout (Brown 1994). Only one study regarding chronic toxicity of sulfometuron-methyl to fish has been performed. Muska and Driscoll (1982) did not observe any effects on fathead minnow embryo hatch, larval survival, or larval growth over 30-day exposure periods where concentrations of sulfometuron ranged up to 1.17 mg a.e./L.

Toxicity: Other Aquatic Organisms. Sulfometuron-methyl also appears to be relatively non-toxic to aquatic invertebrates, based on acute bioassays in daphnids, crayfish, and field-collected species of *Diaptomus*, *Eucyclops*, *Alonella*, and *Cypria*. The absolute LC_{50} values reported in SERA (2004f) for daphnids, crayfish, and the aquatic invertebrates are above 601 mg a.e./L, some by more than a factor of 10. A couple of studies using daphnids as the test species did not test concentrations high enough to cause lethality (i.e., 48-hour LC_{50} values of >12.5 mg/L and >150 mg/L). One daphnid reproduction study noted a reduction in the number of neonates at 24 mg/L, but not at 97 mg/L or at any of the lower concentrations tested (Baer 1990). This study did not have a clear dose-response effect.

Aquatic plants appear more sensitive than aquatic animals to the effects of sulfometuron-methyl, although there appear to be substantial differences in sensitivity among species of macrophytes and unicellular algae. The macrophytes, however, appear to be generally more sensitive. The 14-day NOEC (growth inhibition as measured by frond count) for duckweed exposed to technical grade sulfometuron-methyl was reported as 0.00021 mg a.e./L (Kannuck and Sloman 1995). For algae, the most sensitive algal species tested was *Selenastrum capricornutum*, with a 72-hour NOEC of 0.0025 mg/L and a 72-hour EC_{50} of 0.0046 mg a.e./L, based on a reduction in cell density relative to controls (Hoberg 1990). The most tolerant algal species tested was *Navicula pelliculosa*, with a 120-hour NOEC of 0.37 mg/L (Thompson 1994). The EC_{50} values for other freshwater algal species are generally greater than 10 µg/L, depending on the endpoint assayed (Landstein *et al.* 1993), but still fall in a range of concentrations that are likely to occur after a rainfall.

Effects on Non-Target Plants. The toxicity of sulfometuron-methyl to terrestrial plants was studied extensively and is well characterized. Assays using an application rate of 0.00892 lbs a.i./acre show high toxicity to seedlings of several broadleaf plants and grasses, either pre-emergence or post-emergence. Moreover, adverse effects were observed in most plants tested at application rates of 0.00089 lbs a.i./acre (SERA 2004f). This application rate is a factor of about 100- to 300-fold less than the application rate that the USFS would typically use. Concern for the sensitivity of non-target plant species is further increased by field reports of substantial and prolonged damage to crops or ornamentals after the application of sulfometuron methyl in both an arid region, presumably due to the transport of soil contaminated with sulfometuron methyl by wind, and in a region with heavy rainfall, presumably due to the wash-off of sulfometuron methyl contaminated soil (SERA 2004f).

TRICLOPYR

Exposure. Triclopyr herbicides in the proposed action contain one of two forms of triclopyr, either the triethylamine salt (TEA) or the butoxyethyl ester (BEE). In both soil and aquatic environments, both the ester and amine salt formulations of triclopyr rapidly convert to the triclopyr acid and other degradates. In various soil types, the half-life of BEE has been reported to be three hours, and the half-life of TEA has been reported to range from 6 to 14 days. Triclopyr acid is further degraded by soil microorganisms to the metabolites trichloropyridinol (TCP) and trichloromethoxypyridine (TMP). In aerobic soils, triclopyr acid has a half-life of
8 to 18 days. The TCP is more persistent than triclopyr acid, with a soil half-life ranging from 40 to 95 days (Knuteson 1999).

In water, triclopyr TEA dissociates to the acid very rapidly (i.e., within one minute), and triclopyr BEE hydrolyzes to the acid in less than a day in natural waters with a pH of 6.7 (EPA 1998). The primary degradation mechanism for triclopyr acid in water is photolysis, with a
half-life of 1 day. TCP is more persistent in aquatic environments, having a half-life of 4 to

10 days (Petty *et al.* 2003). Triclopyr and TCP are not strongly adsorbed to soil particles and have the potential to be mobile, thus there is a chance that application of triclopyr near aquatic environments can result in surface water contamination.

SERA (2011c) estimated peak WCRs (normalized to an application rate of 1 lb/acre) for three forms of triclopyr in stream water using a variety of methods. The WCRs were derived from various modeling efforts and from field studies pairing triclopyr application with surface water monitoring. For triclopyr BEE, stream WCRs ranged from 0.00 to 0.03 mg a.e./L. The upper bound of the peak WCR (i.e., 0.03 mg a.e./L) was the water concentration documented in a stream by Smith and McCormack (1988) after an application of triclopyr BEE. While this concentration may have been due to an accidental spray, this concentration was close to that estimated by SERA (2011c) due to drift. Thus, it has been selected as the appropriate peak WCR for this Opinion. For triclopyr acid, stream WCRs ranged from 0.00 to 0.24 mg a.e./L. The upper bound of the peak WCR (i.e., 0.24 mg a.e./L) was derived from EPA modeling efforts using PRZM/EXAMS (EPA 2009). For the metabolite TCP, modeled WCRs ranged from 0.00 to 0.03 mg TCP/L after application of triclopyr BEE and from 0.00 to 0.02 mg TCP/L after application of triclopyr TEA.

Maximum application rates in the proposed action are 9.0 lbs/acre for triclopyr TEA and 8.0 lbs/acre for triclopyr BEE, respectively. Multiplying the maximum application rate by the WCRs gives EECs of: 0.24 mg a.e./L for triclopyr BEE; 1.92 mg a.e./L for triclopyr acid after application of the BEE formulation; 2.16 mg a.e./L for triclopyr acid after application of the TEA formulation; 0.24 mg TCP/L after application of the BEE formulation; and 0.18 mg TCP/L after application of the TEA formulation. Because triclopyr TEA near instantaneously dissolves to the acid, SERA (2011c) did not determine an EEC for that form of triclopyr.

End-Use Products. Triclopyr herbicides included in the proposed action contain one of two forms of triclopyr, either the TEA, or the BEE. Although all of the triclopyr TEA EUPs proposed for use are equivalent to one another in that they contain 44.4% triclopyr TEA, their overall formulations may be different. The liquid formulations of 44.4% triclopyr TEA specify other ingredients as either ethanol (Garlon 3A, Renovate 3, and Tahoe 3A) or ethylenediaminetetraacetic acid (EDTA), which is a chelating agent (Triclopyr 3A, Triclopyr 3SL). Triclopyr 3SL also contains ethylene glycol. Renovate 3 is identical to Garlon 3A, so its toxicity is expected to be the same as those reported for Garlon 3A and triclopyr TEA.

The EUPs proposed for use in this BA contain varying types and amounts of inert ingredients. Identified inert ingredients include ethylene glycol, ethanol, and EDTA. Wan *et al.* (1987) determined that both Garlon 3A and Garlon 4 (not proposed for use under this BA) were significantly less toxic ($p<0.01$) to salmonids than their respective active ingredients triclopyr TEA and triclopyr BEE, suggesting that inert ingredients used in formulating these products do not increase toxicity. The product labels recommend that a surfactant be added to the product prior to most applications. Some surfactants are more toxic than others, as described in the BA.

Toxicity: Fish. Both forms of triclopyr degrade into triclopyr acid and other degradates in the environment. Triclopyr acid is further degraded into TCP and other metabolites. The other metabolites (e.g., butoxyethanol and triethanolamine) are not being evaluated further because they are rapidly dissipated by microbial degradation. TCP is of concern because it has been shown to be more toxic than the other forms of triclopyr to many groups of non-target organisms (SERA 2011c).

Lethal Effects. Data on the toxicity of triclopyr and its various forms has been collected since as early as 1973. Wan *et al.* (1987) completed the most extensive comparative study on the toxicity of the various forms and metabolites of triclopyr. This study summarizes a series of static bioassays on several species of salmonids that were conducted over a 4-month period in 1986 and a 2-month period in 1987. Wan *et al.* (1987) reported 96-hour LC_{50} values for triclopyr acid, triclopyr ester (BEE), Garlon 3A, Garlon 4, and TCP, which are summarized in Table E-1. The authors found triclopyr ester (BEE) was the most toxic chemical tested, followed in decreasing toxicity to salmonids by Garlon 4, TCP, triclopyr acid, and Garlon 3A. Garlon 4 is not proposed for use under this program.

Table E-1. Acute Toxicity of Triclopyr and Related Compounds to Various Species of Salmonids[1]. Results are expressed as mg a.e./L, unless otherwise noted.

Fish Species	Triclopyr TEA (Garlon 3A)	Triclopyr BEE (Garlon 4)	Triclopyr BEE (technical grade)	Triclopyr Acid	TCP (mg TCP/L)
Coho salmon	167	1.0	1.0	9.6	1.8
Chum salmon	96.1	0.82	0.3	7.5	1.8
Sockeye salmon	112	0.67	0.4	7.5	2.5
Rainbow trout	151	1.3	1.1	7.5	1.5
Chinook salmon	99	1.3	1.1	9.7	2.1
Pink salmon	-	0.58	0.5	5.3	2.7

[1] Source: Wan *et al.* 1987. All bioassays conducted at 46.4 - 50°F, 10 fish/concentration. Static with aeration. LC_{50} based on measured, rather than nominal concentrations. Photoperiod and lighting conditions not specified.

The BEE form of triclopyr is exponentially more toxic to fish when compared to the TEA form. The salmonid LC_{50} values for triclopyr BEE (technical grade and as formulated Garlon 4) ranged from 0.19 mg a.e./L to 1.9 mg a.e./L (SERA 2011c). The lowest LC_{50} value was for coho salmon alevins (Mayes *et al.* 1986). The Wan *et al.* (1987) study is supported by more recent flow-through toxicity assays on Garlon 4 with reported acute LC_{50} values for salmonids of 0.79 to 1.76 mg/L (Kreutzweiser *et al.* 1994) and 0.84 mg/L (Johansen and Geen 1990).

Wan *et al.* (1987) found that Garlon 3A, a formulation of triclopyr TEA, was about 170 times less toxic (significant at $p<0.01$) to salmonids than the Garlon 4 formulation. Triclopyr TEA LC_{50} values for salmonids reportedly range from 75.4 mg a.e./L to 273.7 mg a.e./L (SERA 2011c; Patrick Durkin, SERA, personal communication). EPA classified triclopyr TEA as practically non-toxic to freshwater fishes (EPA 1998).

Based upon available information, the triclopyr acid appears to be approximately 11 times less toxic to salmonids than the triclopyr BEE. Based upon information in all available literature, the salmonid LC_{50} values for triclopyr acid range from 5.3 mg a.e./L to 117 mg a.e./L (SERA 2011c; Patrick Durkin, personal communication). Six of the seven LC_{50} values included in this range came from the Wan *et al.* (1987) study, and they appear to be outliers not only with respect to the higher LC_{50} value from Batchelder (1973), but also with respect to all 17 LC_{50} values on triclopyr TEA. According to SERA, the results from Wan *et al.* (1987) cannot be attributed to experimental factors or methods, and the study cannot be dismissed as irrelevant. While one would expect the acid form to be more toxic than the salt form, the extreme difference (more than an order of magnitude) noted above is suspect (Patrick Durkin, personal communication). Because of this, neither SERA (2011c) nor EPA (2009) included the data in their assessments. Giving deference to toxicological experts, this BA utilizes 117 mg a.e./L as the lethal concentration for triclopyr acid.

The TCP (an environmental metabolite of triclopyr acid), is substantially more toxic in fish than either triclopyr acid or triclopyr TEA, and is similar to the toxicity of triclopyr BEE. Salmonid TCP LC_{50} values from two separate studies (Wan *et al.* 1987; Gorzinski *et al.* 1991) range from 1.5 mg TCP/L to 12.6 mg TCP/L. Six of the seven salmonid LC_{50} values for TCP are from Wan *et al.* (1987), and all are approximately five times lower than the value obtained by Gorzinski *et al.* (1991). There is no clear explanation as to why these two experiments had such vastly different results. It may reflect experimental variability or other unknown factors rather than any differences in species sensitivity (SERA 2011c). This BA uses the lowest value (i.e., 1.5 mg TCP/L) as the lethal concentration for TCP.

Sublethal Effects. A few acute and chronic studies examining sublethal effects have been performed on triclopyr BEE, triclopyr TEA, and the metabolite TCP. Similar to the lethality studies, results from the sublethal effects studies indicate that triclopyr BEE was the most toxic and triclopyr TEA was the least toxic.

An early life-stage study conducted with triclopyr BEE in rainbow trout yielded an NOEC of 0.017 mg a.e./L and a LOEC (based on larval length and weight) of 0.035 mg a.e./L (Weinberg *et al.* 1994). Johansen and Geen (1990) studied the sublethal effects of Garlon 4 on rainbow trout using flow-through systems. The authors noted fish were more docile (than the controls) at concentrations of 0.32 to 0.43 mg a.e./L, which are about a factor of 2 below the 96-hour LC_{50} determined in this study. At levels ≤0.1 mg a.e./L, rainbow trout were hypersensitive to photoperiod changes over 4-day periods of exposure. This is reasonably consistent with the threshold for behavioral changes in rainbow trout for Garlon 4 of 0.26 mg a.e./L reported by Morgan *et al.* (1991).

For triclopyr TEA, a 28 day egg-to-fry study was performed using fathead minnows (Mayes *et al.* 1984; Mayes 1990). In these studies, fathead minnow eggs were exposed to concentrations of 26, 43, 65, 104, 162, and 253 mg a.i./L. The survival of fathead minnows (embryo-larval stages) was significantly reduced at 253 mg/L compared with control animals. At 162 mg/L, there was a slight decrease in body length. The authors reported a NOEC of 32.2 mg a.e./L and a LOEC (length) of 50.2 mg a.e./L. Morgan *et al.* (1991) examined behavior changes in rainbow trout after a 0.5 hour exposure to Garlon 3A. The authors reported a threshold for behavioral changes of 63.6 mg a.e./L and a threshold for avoidance response of 254 mg a.e./L.

Marino *et al.* (2003b) conducted an egg-to-fry study, exposing rainbow trout to TCP. The authors exposed rainbow trout to 0.586, 0.106, 0.178, 0.278, 0.479, and 0.825 mg TCP/L in a flow-through system. Observations were made for 33 days post-hatch of the water control embryos. The authors reported a NOEC for fry weight and growth of 0.178 mg TCP/L, and a LOEC of 0.278 mg TCP/L.

Although TCP is much more toxic than triclopyr TEA, field monitoring cited in SERA (2003d) indicates that TCP residues in soil and water occur at concentrations much lower than the application rate of the active ingredient. Given the high toxicity of TCP and the uncertainty of exposure risk to this metabolite, the potential for adverse effects to listed fish is uncertain.

Toxicity: Other Aquatic Organisms. Based on acute lethality, aquatic invertebrates appear to be about equally or somewhat less sensitive than fish to the various forms of triclopyr. Acute LC_{50} values for triclopyr acid and triclopyr TEA range from about 100 to about 6,400 mg a.e./L. Gersich *et al.* (1982) conducted a chronic daphnid study and reported a NOEC of 25.95 mg a.e./L. Triclopyr BEE was substantially more toxic to aquatic invertebrates, with LC_{50} values ranging from 0.19 to 20 mg a.e./L (SERA 2011c). Some of the studies reported NOEC (for lethality), and those ranged from 0.12 mg a.e./L to 1.2 mg a.e./L. Increases in invertebrate drift have been documented at triclopyr BEE concentrations of 0.6 to 0.95 mg/L (Kreutzweiser *et al.* 1995; Thompson *et al.* 1995), but no other effects such as changes in stream invertebrate abundance were noted. In a chronic study, Chen *et al.* (2008) reported concentration-related decreases in *Simocephalus vetulus* (a cladoceran) at triclopyr BEE concentration of 0.25 mg a.e./L and 0.5 mg a.e./L. Only two studies examining the toxicity of TCP on aquatic invertebrates were available. One study reported an acute LC_{50} of 10.9 mg TCP/L (EPA 2009). The second study reported a NOEC of 0.058 mg TCP/L, based on a decrease in mean number of young/adult (Machado 2003).

Similar to aquatic organisms, algae are more sensitive to triclopyr BEE than to triclopyr TEA. For triclopyr BEE, the EC_{50} values for growth inhibition in algae range from about 0.073 to 5.9 mg a.e./L. For triclopyr TEA and triclopyr acid, the EC_{50} values for the same endpoint in algae range from about 0.49 to 80 mg a.e./L. The TCP toxicity falls between the other forms, with a reported EC_{50} value of 1.8 mg TCP/L.

For aquatic macrophytes, triclopyr TEA is more toxic to dicots than to monocots, with EC_{50} values ranging from 0.04 to 0.56 mg a.e./L and 6.06 to 15.8 mg a.e./L, respectively. In fact, triclopyr TEA appears to be more toxic to dicots than triclopyr BEE (EC_{50} values ranging from 1.49 to 4.62 mg a.e./L). No studies were available regarding the toxicity of TCP.

NMFS Pesticide Registration Opinion. Chemical concentrations examined in the in the 2011 registration Opinion (NMFS Tracking # 2004/02673) did not vary drastically from those summarized here. The triclopyr registration Opinion used the following rainbow trout LC_{50} values as assessment endpoints for triclopyr: 0.470 mg a.e./L for BEE, 79.2 mg a.e./L for TEA, and 177 mg a.e./L for triclopyr acid. Information presented in the 2011 Opinion for EPAs registration of triclopyr does not suggest a different endpoint as being more appropriate than that which was used in this BA.

The registration Opinion concluded there was no overlap between the peak farm pond EECs for forestry uses (at 6 lb a.e./acre) and the fish and invertebrate toxicity endpoints for triclopyr BEE. Floodplain estimates for triclopyr BEE overlapped with all acute assessment endpoints at the application rate of 8 lb a.e./acre. For triclopyr TEA, none of the peak concentrations and assessment endpoints overlapped.

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Appendix F. Species Descriptions for Wildlife and Plants.

YELLOW-BILLED CUCKOO (Cocyzus americanus)

Status

The USFWS received a petition dated February 2, 1998, to list the yellow-billed cuckoo as an endangered species. The petitioners stated that "habitat loss, overgrazing, tamarisk invasion of riparian areas, river management, logging, and pesticides have caused declines in yellow-billed cuckoo." The 90-day finding dated February 17, 2000 (65 FR 33), found that the petition presented substantial scientific and commercial information to indicate that the listing of the yellow-billed cuckoo may be warranted. In that finding, USFWS indicated that the factors noted by the petitioners may have caused loss, degradation, and fragmentation of riparian habitat in the western U.S., and that loss of wintering habitat may be adversely affecting the cuckoo. In July 2001, the USFWS announced a 12-month finding for a petition to list the yellow-billed cuckoo as threatened or endangered in the western U.S. They determined that listing the yellow-billed cuckoo was warranted but precluded by higher priority species. The Western Distinct Population Segment (DPS) of the yellow-billed cuckoo was given status as a candidate species by the USFWS.

Distribution/Abundance

The yellow-billed cuckoo is a secretive, robin-sized songbird that lives in the western United States in willow and cottonwood forests along rivers and streams. The birds are generally absent from heavily forested areas and large urban areas. Yellow-billed cuckoos breed from southern Canada south to the Greater Antilles and Mexico. While the yellow-billed cuckoo is common east of the Continental Divide, biologists estimate that more than 90 percent of the bird's riparian habitat in the West has been lost or degraded as a result of conversion to agriculture, dams and river flow management, bank protection, overgrazing, pesticide use, and competition from exotic plants such as tamarisk. Populations have declined rapidly throughout the western U.S. in the twentieth century, and are extirpated from British Columbia, Washington, and possibly Nevada. At one time, this cuckoo numbered more than 15,000 pairs, but has been reduced to about 30 pairs in less than 100 years. The largest cuckoo population west of the Rocky Mountains continues to be found in Arizona. The bird is designated as threatened in Utah. In Idaho, the species is considered a rare and local summer resident, breeding in the Snake River Valley.

Current data suggests that the yellow-billed cuckoo's range and population numbers have declined substantially across much of the western United States during the past 50 years. Analysis of population trends is difficult because quantitative data, including historical population estimates, are lacking. However, historic and recent data are sufficient to allow an evaluation of changes in the species' range in the western United States. Detailed information about the distribution and status of the yellow-billed cuckoo throughout the western United States can be found in the 2001 Proposed Rule (66 FR 38611, July 25, 2001).

Research indicates that large, localized influxes of yellow-billed cuckoos are linked to changes in food supply and increased insect abundance (Groschupf 1987). Populations seem to fluctuate dramatically in response to fluctuations in caterpillar abundance. Erratic population fluctuations mean that population estimates made over short-term periods (1 to 2 years) are not particularly reliable (Groschupf 1987), but even population densities based on long-term data may be underestimates.

Habitat Requirements

This species may go unnoticed because it is slow-moving and prefers dense vegetation. In the West, it favors areas with a dense understory of willow (Salix spp.) combined with mature cottonwoods (Populus spp.) and generally within 325 feet of slow or standing water (Gaines 1974; Gaines 1977; Gaines and Laymon 1984). It feeds on insects, mostly caterpillars, but also beetles, fall webworms, cicadas, and fruit (especially berries). Breeding often coincides with the appearance of massive numbers of cicadas, caterpillars, or other large insects (Ehrlich et al. 1992). This is attributable to this bird's quiet demeanor and furtive behavior, which makes this species relatively easy to overlook when it is not singing. In California, Gaines (1974) defined habitat as willow and cottonwood forests below 4,265 feet elevation, greater than 25 acres in extent, and wider than 325 feet.

Factors of Decline/Threats

The primary cause for the decline of yellow-billed cuckoo populations in the western United States is riparian habitat loss, degradation, and fragmentation. Yellow-billed cuckoos are believed to be more sensitive to habitat loss than other riparian obligate species because of specific factors that influence successful nesting. Most successful nesting territories have a combination of dense willow understory where the nest is placed and a cottonwood overstory that is used for foraging.

CANADA LYNX *(Lynx canadensis)*

Status

In 1998, the lynx was proposed for listing as a threatened species under the Endangered Species Act (63 FR, July 8, 1998). The lynx in the contiguous United States was listed as threatened effective April 23, 2000 (65 FR 16052, March 24, 2000). FWS identified one distinct population segment in the lower 48 States. No critical habitat has been designated for the threatened population of lynx in the contiguous United States. The sole factor for listing the lynx as threatened was inadequacy of existing regulatory mechanisms, specifically the lack of Forest Land and Resource Management Plans guidance to address the needs of lynx.

Distribution/Abundance of the Species

The historical and present range of the lynx north of the contiguous United States includes Alaska and that part of Canada that extends from the Yukon and Northwest Territories south across the United States border and east to New Brunswick and Nova Scotia. In the contiguous United States, lynx historically occurred in the Cascades Range of Washington and Oregon; the Rocky Mountain Range in Montana, Wyoming, Idaho, eastern Washington, eastern Oregon, northern Utah, and Colorado; the western Great Lakes Region; and the northeastern United States region from Maine southwest to New York (65 FR 16052).

Habitat Requirements

Habitat requirements for lynx have been addressed in detail in several publications (Ruggerio et al. 1994, Ruediger et al. 2000). Canada lynx are associated with conifer forests that are southern extensions of northern boreal forest, a pattern that conforms to our biological understanding of lynx habitat (Ruediger et al. 2000). Lynx habitat quality is believed to be lower in the southern periphery of its range, because landscapes are more heterogeneous in terms of topography, climate and vegetation (Buskirk et al. 2000). In Oregon and Washington, lynx habitat is correlated very closely with subalpine fir vegetation types. Canada lynx are specialized predators and their distribution coincides with the snowshoe hare. Two vegetation conditions—young, dense conifer and older, multi-storied stands—are very important to lynx because they support conditions suitable to higher densities of snowshoe hare. Lynx require late-successional forests that contain cover for kittens (especially deadfalls) and for den sites (Koehler and Brittell 1990). Breeding occurs in late March to early April, and young are born in late May or early June.

Factors of Decline/Threats

Major risk factors for lynx include direct human threat (shooting, trapping, vehicle collisions), as well as forage and denning cover habitat modifications (USDI FWS 2000). Lynx have evolved a competitive advantage in deep snow environments due to their large paws that allow them to hunt prey where other predators cannot because of snow conditions. However, snow trails compacted by human activity may allow other predators to access prey in deep snow conditions where historically they were excluded. Advances in snowmobile capabilities have raised concerns about intrusion into previously isolated areas. Human access into lynx habitat during winter can also increase threats, because lynx tracks can be detected by traversing vast forest areas in a short period of time by snowmobile. The legal harvest of lynx was closed in Idaho in 1996.

Building new roads in lynx habitat can result in more routes that can be accessed during winter. These routes could be used by snowmobiles even if new roads are designated as closed to motorized public travel during other seasons. Lynx use roads for travel, which may make them more vulnerable to human-caused mortality.

NORTHERN IDAHO GROUND SQUIRREL *(Spermophilus brunneus brunneus)*

Status

The northern Idaho ground squirrel was federally listed as a threatened species on April 2000 (65 FR 17779). This subspecies is known to exist only in Adams and Valley counties of western Idaho. The ground squirrel has largely been documented in the Upper Weiser watershed.

Distribution/Abundance

For this Federal Action and species, the action area is comprised of specific lands administered only by the Payette and Boise National Forests. These areas are located in Adams and Valley Counties of west central Idaho. The ground squirrel has largely been documented in the Upper Weiser watershed.

The entire range of this subspecies of ground squirrel is about 32 by 108 kilometers (20 by 61 miles), and as of 2002, 34 of 40 known population sites were extant. The subspecies declined from an estimated 5,000 individuals in 1985, to less than 1,000 by 1998, when it was proposed for listing (USDI FWS 2002). By the year 2000, preliminary surveys indicated that only about 350 individuals remained at known population sites. Based on more extensive census data collected in the spring of 2002, the population was estimated to be 450 to 500 animals (USDI FWS 2002). Delisting may be considered when recovery criteria have been met. I.e., when 10 of the 17 potential metapopulations have been identified within the probable historical distribution and with each metapopulation maintaining an average effective population size of greater than 500 individuals, for 5 consecutive years (USDI FWS 2002).

Habitat Requirements

The northern Idaho ground squirrel is known to occur in shallow, dry rocky meadows usually associated with deeper, well-drained soils and surrounded by ponderosa pine and Douglas-fir forests at elevations of about 915 to 1,650 meters (3,000 to 5,400 feet). Similar habitat occurs up to at least 1,830 meters (6,000 feet). Consequently, ponderosa pine/shrub-steppe habitat association with south-facing slopes less than 30 percent at elevations below 1,830 meters (6,000 feet) is considered to be potentially suitable habitat (USDI FWS 2002). Northern Idaho ground squirrels are considered specialists but capable of adapting to changes in their environment.

Factors of Decline and Threats

The northern Idaho ground squirrel is primarily threatened by habitat loss due to forest encroachment into former suitable meadow habitats. Forest encroachment results in habitat fragmentation, eliminates dispersal corridors, and confines the northern Idaho ground squirrel populations into small isolated habitat islands. The subspecies is also threatened by land-use changes, recreational shooting, poisoning, genetic isolation and genetic drift, random naturally occurring events, and competition from the larger Columbian ground squirrel (*S. columbianus*) (USDI FWS 2002).

In 1996, a Conservation Agreement between the U.S. Fish and Wildlife Service and the Forest Service was signed and implemented. Various aspects of this agreement continue to be implemented in the hopes of expanding the availability of habitat, thereby helping increase the population of NIDGS. Currently, the largest known population of NIDGS still occurs on private land, and the Nature Conservancy continues to work with the landowner(s) in managing the species.

SPALDING'S CATCHFLY *(Silene spaldingii)*

Status

Spalding's catchfly, a member of the pink or carnation family, was listed as a Threatened species on October 10, 2001 (66 FR 51598). In Idaho, Critical Habitat was not included in the proposed rule.

Distribution and Abundance

Spalding's catchfly is currently known to occur within three counties: Nez Perce, Idaho, and Lewis. However, 98% of the plants known in Idaho occur within Canyon Grasslands, while the remaining Spalding's catchfly occurrences in Idaho are small and isolated to the Palouse Grassland remnants (Hill and Gray 2004). The second largest population of Spalding's catchfly rangewide occurs within Idaho Canyon Grasslands strongly suggests the species may be found in other portions of the Canyon Grasslands. Four of the most recent observations in 2001 and 2002 occur in Canyon Grasslands and on other areas of Craig Mountain. Two most recent occurrences in 2002 and 2003 are located in Canyon Grasslands within the Salmon River drainage.

Silene spaldingii is distributed within two distinct areas of occurrence: a larger tri-state area in northeastern Oregon, eastern Washington, and adjoining north-central Idaho, and a smaller disjunct area in northwestern Montana which extends slightly into British Columbia, Canada. These areas include five distinct physiographic areas: 1) Palouse Grasslands of southeastern Washington and adjacent Idaho, 2) Canyon Grasslands along major river systems of the Snake, Salmon, Clearwater, in the tristate area of Washington, Idaho and Oregon, 3) Channeled Scablands of east-central Washington, 4) Wallowa Plateau in northeastern Oregon, and 5) Intermontane Valleys of northwestern Montana and British Columbia

Spalding's catchfly is typically associated with grasslands dominated by native perennial grasses such as Idaho fescue (*Festuca idahoensis*) or rough fescue (*F. scabrella*). Scattered individuals of ponderosa pine may also be found in or adjacent to Spalding's catchfly *Silene spaldingii* occurs at a wide range of elevations and percent slopes. The extremes in elevation rangewide occur within the tri-state area near the Idaho-Oregon border spanning the Hells Canyon area. Here, *S. spaldingii* occurs at the lowest known elevation, 1,380 feet on northerly aspects in Canyon Grasslands on the lower Salmon River and the highest known elevation, 5,100 feet on the Wallowa Plateau in northeastern Oregon.

Factors of Decline and Threats
Significant historic threats to this species include agricultural land conversions and the disruption of the native fire regime. Today, threats to the viability of this species stem from continued habitat conversion, livestock grazing, a lack of fire, the invasion of exotic plant species, and herbicide spray and drift. Since most populations of Spalding's catchfly are reproductively isolated, the viability of the species is at risk from genetic and demographic stochasticity.

MACFARLANE'S FOUR O' CLOCK *(Mirabilis macfarlanei)*

Status
MacFarlane's four-o'clock, *Mirabilis macfarlanei,* was originally listed as endangered in October 1979 (44 FR 61912) and a recovery plan was developed and approved in March 1985. The species was reclassified as threatened in March 1996 (50 CFR part 424). At the time of reclassification, the FWS found that designation of critical habitat was not prudent.

The MacFarlane's four o'clock is a long-lived herbaceous perennial. Only three populations were known at the time of the listing, with a total of 20 to 25 individual plants. The species was threatened by several factors, including trampling, collecting, livestock grazing, disease, and insect damage. Afterward, additional populations were discovered and populations on public lands were actively managed and monitored. Consequently, the plant was downlisted to a threatened status on March 15, 1996 (61 FR 10692).

Distribution and Abundance
Mirabilis macfarlanei is currently known from a total of 11 populations in Idaho County, Idaho and Wallowa County, Oregon. Three of the populations occur in the Snake River canyon, six along the Salmon River, and two in the Imnaha River corridor. The total geographic range of the populations is approximately 29 by 18 miles (Kaye1992).

All populations along the Snake River occur on the Nez Perce and Wallowa/Whitman NF lands. Within the Salmon River drainage approximately one-half of the populations occur on private lands, with the remaining populations occurring on Coeur d' Alene District of the BLM.

Historical distribution data for *M. macfarlanei* is limited. Records refer to a Hell's Canyon collection in 1939 and Salmon River collections in 1947. By the mid 1970s unsuccessful attempts to relocate historic populations ―led botanists to consider the plant possibly extinct (USDI FWS 1996). From1983 to 1996, rediscoveries and new discoveries of populations brought the total number of known stems to 7,212 on 163 acres (USDI FWS 1996).

Habitat Requirements
Known only from Oregon and Idaho, *M. macfarlanei*, is primarily restricted to dry, river canyon grasslands between 1,000 and 3,000 feet in elevation along the Snake, Salmon and Imnaha Rivers. The river canyon lands have long growing seasons and mild winters with precipitation occurring mostly in the winter and spring. Populations usually occur as scattered plants on open steep slopes to nearly flat benches. Soils vary from sands, gravel, to large rock substrate.

Mirabilis macfarlanei occurs in river canyon habitats characterized by regionally warm and dry conditions. Precipitation occurs mostly as rain during the winter and spring. Sites are dry and open, or with scattered shrubs. Plants can be found on all aspects, but most often on southeast to western exposures. Slopes are often steep, but range to nearly flat. Plants can occur along any slope position. Soils vary from sandy to rocky. Talus rock often underlies the soil substrate and several sites are relatively unstable and prone to erosion. The associated vegetation is usually in early to mid-seral condition, and the grasslands are typically grazing modified versions of *Agropyron spicatum* communities. *Sporobolus cryptandrus*, *Aristida longiseta*, and *Poa secunda* are other common native bunchgrass associates. Other commonly associated species include *Bromus tectorum, Bromus mollis, Alyssum alyssoides, Hypericum perforatum, Phacelia heterophylla, Achillea millefolium, Oenothera ceaspitosa, Astragalus inflexus, Rhus glabra, Chrysothamnus nauseosus*, and *Celtis reticulata*.

In a habitat analysis study conducted at a site in Oregon, the vegetation associated with a population of *M. macfarlanei* appeared to be influenced by aspect, soil development and topographic position, at least on a local scale (Kaye 1992). Nearby sites without *M. macfarlanei* had a higher number of weedy annual species, and tended to occupy gentler slopes with deeper, more stable soils.

Factors of Decline/Threats
Mirabilis macfarlanei is threatened by a variety of factors including herbicide and pesticide spraying, landslides and flood damage, insect damage and disease, non-native plant invasion, livestock grazing, fire suppression, off-road vehicles, road and trail construction and maintenance, trampling, collecting, mining, competition of pollinators, and inbreeding depression (USDI FWS 1996).

WATER HOWELLIA *(*Howellia aquatilus)

Status
Howellia aquatilis, a wetland plant, was listed as a threatened species in July 1994 (USDI FWS1994). The historic range of this species included California, Idaho, Montana, Oregon and Washington, but the range has subsequently been reduced to Idaho, Montana and Washington (USDI FWS 1994).

Distribution and Abundance

Water howellia historically occurred over a large area of the Pacific Northwest region of the United States, but today the species is found only in specific habitats within the Pacific Northwest (Shelly and Moseley 1988). In Idaho, the distribution is known from a single extant population in Latah County near the town of Harvard. There is also a historical collection reputedly from the Spirit Lake area in Kootenai County.

Habitat Requirements

Small, vernal, freshwater pothole ponds or the quiet water of abandoned river oxbow sloughs in the valley zone. The ponds are typically filled by snowmelt and spring rains, but dry out to varying degrees by the end of the growing season. They are generally less than 1 m deep, but plants occasionally occur in water up to approximately 2 m in depth. Bottom surfaces usually consist of firm clay and organic sediments. The ponds typically occur in a matrix of forest vegetation. Howellia grows in firm consolidated clay and organic sediments that occur in wetlands associated with ephemeral glacial pothole ponds and former river oxbows (Shelly and Moseley 1988). These wetland habitats are filled by spring rains and snowmelt run-off; and depending on temperature and precipitation, exhibit some drying during the growing season. This plant's microhabitats include shallow water, and the edges of deep ponds that are partially surrounded by deciduous trees (Shelly and Moseley 1988).

Factors of Decline and Threats

Howellia aquatilus has narrow ecological requirements and subtle changes in its habitat could affect a population. Threats to the populations include loss of wetland habitat and habitat changes due to timber harvest and road building, livestock grazing, residential and agricultural development, alteration of the surface or subsurface hydrology, and competition from introduced plant species such as reed canary grass *(Phalaris arundinacea)* and purple loosestrife *(Lythrum salicaria)* (USDI FWS 1994).

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