United States Department of the Interior

U.S. Fish and Wildlife Service

Idaho Fish and Wildlife Office
1387 S. Vinnell Way, Room 368
Boise, Idaho 83709
Telephone (208) 378-5243
http://www.fws.gov/idaho

Faye Krueger
Regional Forester
Northern Region/R1
USDA Forest Service
200 East Broadway
Missoula, Montana 59802

Harv Forsgren
Regional Forester
Intermountain Region/R4
USDA Forest Service
324 25th Street
Ogden, Utah 84401

Steven A. Ellis
State Director
Idaho State
Bureau of Land Management
1387 South Vinnell Way
Boise, Idaho 83709

David B. Barrows
Chief, Regulatory Division
Walla Walla District
Corps of Engineers
201 North Third Avenue
Walla Walla, Washington 99362

JUN 15 2012

Subject: Restoration Activities at Stream Crossings (Stream Crossing Programmatic) — Idaho and Nevada —Biological Opinion
In Reply Refer to: 01EIFW00-2012-F-0015 Internal Use: CONS-100b

Dear Ms. Krueger, Mr. Forsgren, Mr. Ellis, and Mr. Barrows:

Enclosed are the U.S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) and concurrence with the Forest Service's, Bureau of Land Management's, and Corps of Engineers' (Agencies) determinations of effect on species listed under the Endangered Species Act (Act) of 1973, as amended, for the proposed Restoration Activities at Stream Crossings in the state of Idaho and a portion of Nevada. In letters dated December 6 (Forest Service), 15 (Bureau of Land Management), and 13 (Corps of Engineers), 2011, and received by the Service on December 12, 19, and 16, 2011, respectively, the Agencies requested formal consultation on the determination under section 7 of the Act that the proposed program is likely to adversely affect bull trout (*Salvelinus confluentus*) and bull trout critical habitat. The Agencies determined that the proposed program is not likely to adversely affect the grizzly bear (*Ursus arctos horribilis*), the Canada lynx (*Lynx canadensis*), the northern Idaho ground squirrel (*Urocitellus brunneus brunneus*), *Mirabilis macfarlenei* (MacFarlane's four-o'clock), *Silene spaldingii* (Spalding's catchfly), *Howellia aquatilis* (water howellia), and *Lepidium papilliferum* (slickspot peppergrass), listed species in Idaho, and requested our concurrence with these determinations. The Agencies also determined that the proposed project will have no effect on the woodland caribou (*Rangifer tarandus caribou*) and the Kootenai River white sturgeon (*Acipenser transmontanus*); the Service acknowledges these determinations.

The enclosed Opinion and concurrence are based primarily on our review of the proposed action, as described in your November 5, 2011, Biological Assessment (Assessment), and the anticipated effects of the action on listed species, and were prepared in accordance with section 7 of the Act. Our Opinion concludes that the proposed project will not jeopardize the survival and recovery of bull trout nor result in adverse modification of its critical habitat. A complete record of this consultation is on file at this office.

Thank you for your continued interest in the conservation of threatened and endangered species. Please contact Pam Druliner at (208) 378-5348 if you have questions concerning this Opinion.

Sincerely,

Russell L. Holder

for Brian T. Kelly
State Supervisor

Enclosure

cc: BLM, Boise (Seidlitz, Hoefer)
BLM, Twin Falls (Arnold)
BLM, Idaho Falls (Kraayenbrink)
BLM, Coeur d'Alene (Cooper)
Corps, Walla Walla (Mitchell)
Corps, Boise (Phillips)
FWS, Spokane (Conard, Holt)
FWS, Chubbuck (Kampwerth)
NOAA, Boise (Lind, Leonard)
NOAA, Grangeville (Brege)
USFS, Missoula (Spaulding)
USFS, Ogden (Duffield)
USFS, Boise (Seesholtz)
USFS, McCall (Lannom)
USFS, Twin Falls (Nourse)
USFS, Salmon (Guzman)
USFS, Coeur d'Alene (Farnsworth, Scaife)
USFS, Orofino (Brazell)
USFS, Hamilton, MT (King)
USFS, Libby, MT (Bradford)

BIOLOGICAL OPINION
FOR THE
RESTORATION ACTIVITIES AT STREAM CROSSINGS (STREAM CROSSING PROGRAMMATIC)

01EIFW00-2012-F-0015

U.S. FISH AND WILDLIFE SERVICE
IDAHO FISH AND WILDLIFE OFFICE
BOISE, IDAHO

Supervisor Russell R. Holden for Brian T. Kelly

Date JUN 15 2012

Table of Contents

List of Tables

List of Figures

1. BACKGROUND AND INFORMAL CONSULTATION

1.1 Introduction

The U.S. Fish and Wildlife Service (Service) has prepared this Biological Opinion (Opinion) of the effects of the programmatic Restoration Activities at Stream Crossings in Idaho/Nevada (Program) on bull trout (*Salvelinus confluentus*) and bull trout critical habitat. Letters from the Forest Service, Bureau of Land Management (Bureau), and Army Corps of Engineers (Corps) requesting formal consultation with the Service under section 7 of the Endangered Species Act (Act) of 1973, as amended, for its proposal to implement a program to address fish passage problems associated with stream crossings in Idaho, were received by the Service on December 12, December 16 and December 19, 2012, respectively. The Forest Service, Bureau, and Corps (Action Agencies) determined that the proposed action is likely to adversely affect bull trout and bull trout critical habitat. As described in this Opinion, and based on the Biological Assessment (USFS and BLM 2011, entire) developed by the Action Agencies and other information, the Service has concluded that the program, as proposed, is not likely to jeopardize the continued existence of bull trout nor result in adverse modification of its critical habitat.

The Action Agencies have also determined the Program is not likely to adversely affect grizzly bear (*Ursus arctos horribilis*), Canada lynx (*Lynx canadensis*), northern Idaho ground squirrel (*Urocitellus brunneus brunneus)*, Macfarlane's four-o'clock (*Mirabilis macfarlanei*), Spalding's catchfly (*Silene spaldingii*), water howellia (*Howellia aquatilis*) and slickspot peppergrass (*Lepidium papilliferum*). In this document, the Service is providing concurrence with those determinations. You also determined that there would be no effect to woodland caribou (*Rangifer tarandus caribou*) and Kootenai River white sturgeon (*Acipenser transmontanus*), or the candidate species yellow-billed cuckoo (*Coccyzus americanus*) and Columbia spotted frog (*Rana luteiventris*); we acknowledge these determinations.

The Program is expected to last 10 years from issuance of this Opinion. Actions covered by this consultation are those restoration projects (as described below) at stream crossings proposed by the Forest Service and the Bureau, and the associated permits issued by the Corps under section 404 of the Clean Water Act required for project implementation.

1.2 Consultation History

This stream crossing programmatic renews a similar effort completed in 2006 (Stream Crossing Structure Replacement and Removal Program, reference number 2006-F-0206) which recently expired. This 2012 effort builds on what we have learned during the that time, includes all of Idaho (and that portion of northern Nevada managed by the Twin Falls District of the Bureau), and includes the Army Corps of Engineers (Corps) as one of the Action Agencies in order to fulfill their consultation needs for any project-related permits. Under the previous stream crossing programmatic effort, nearly 70 stream crossings were replaced or removed, opening up or improving habitat for listed fish in Idaho. The previous effort reduced workloads and improved efficiencies for all involved agencies, and resulted in on-the-ground restoration actions which benefitted listed fishes and their associated habitats. The new, updated Program will continue the efficiencies afforded by this programmatic action, will broaden the breadth and scope of authorized activities to allow for additional restoration work to occur in a timely and effective manner, and will result in the incremental conservation of bull trout and other aquatic resources.

The Service and Action Agencies have been engaged for over two years in the renewal of this programmatic action. During that time, numerous conference calls and email conversations have taken place. The following is a summary list of the most important correspondence relative to this consultation.

January 26, 2010	The Forest Service, Bureau, and Service had a conference call to discuss the status of the 2005 Stream Crossing Structure Replacement and Removal Program and to begin the process of renewing the Program consultation.
December 16, 2010	Participating agencies (the Forest Service, Bureau, NOAA Fisheries, Army Corps of Engineers, and the Service) had a conference call to discuss the process for initiating consultation and to discuss what to change from the previous programmatic.
March 1, 2011	The Forest Service and the Service met in Boise at the American Fisheries Society Meeting to discuss the proposed action.
May 23, 2011	The Service received an e-mail from the Forest with an initial draft Assessment attached.
July 29, 2011	Participating agencies and the Service had a conference call to discuss the draft Assessment and provide comments.
August – October 2011	Several draft Assessments were distributed among the agencies, reviewed, and commented upon.
October 20, 2011	Agencies agreed that the Assessment was ready for submittal for formal consultation.
December 12, 2011	The Service received the Forest Service's request for consultation.
December 16, 2011	The Service received the Corps request for consultation.
December 19, 2011	The Service received the Bureau's request for consultation. '
April 23, 2011	The Service, Forest Service, Bureau and Corps agreed to extend the deadline for the Opinion.
May 9, 2012	The Service sent a draft Opinion to the Action Agencies for review.
May 14 – 21, 2012	The Service received comments back from the Action Agencies.

1.3 Informal Consultations

The Action Agencies determined that for grizzly bear, Canada lynx, northern Idaho ground squirrel, Macfarlane's four-o'clock, Spalding's catchfly, water howellia, and slickspot peppergrass, the Program may affect, but is not likely to adversely affect these species. The Service concurs with these determinations; our rationales for concurrence are listed below for each species that occur in some or all of the action area. Please refer to section 2.1 below for a description of the action.

1.3.1 Grizzly Bear

Grizzly bear occur in northern and east-central Idaho and therefore have the potential to be affected by project activities. Program activities have the potential to displace grizzly bears from habitats due to construction noise, activities and general disturbance. If present, short-term avoidance of the construction area by animals may occur, but activities are not expected to influence occupancy or survival. The Assessment, p. 24 lists mandatory project design features to avoid effects to grizzly bear, including avoiding work during the spring season in denning habitat; limiting the number of work days allowed within certain categories of grizzly bear habitat, and adheres to the Grizzly Bear Management and Protection Plan (Appendix G of the Assessment). Activities using high impact equipment within core habitat will not be covered by this Program and will require separate consultation. Direct impact to streams, soils and vegetation will only occur within existing disturbance areas or small areas of new disturbance near the stream crossing to be replaced. Given the design features, minimal overlap between grizzly bears and bull trout habitat or crossings that would be updated, short time frame of projects (most work would be done within three weeks) and small footprint of projects, effects to individual animals are expected to be discountable. Habitat effects are expected to be insignificant.

1.3.2 Canada Lynx

Canada lynx may occur in forested habitats within the action area, although the extent of their distribution is largely unknown. All Program activities will occur either within or near existing roads and trails in the action area where vegetation has been previously degraded or removed. Project design features (Assessment p. 25) will ensure protection of suitable lynx habitat and minimize disturbance to Canada lynx. Program activities will not be implemented within 270 yards of known active lynx dens and no suitable habitat will be degraded or removed. Impacts of Program implementation are expected to be insignificant, and will not likely adversely affect the species.

1.3.3 Northern Idaho Ground Squirrel

Northern Idaho ground squirrel (NIDGS) occurs in Adams, Valley and Washington counties of southwest Idaho. The species is not likely to be present in riparian areas that may be impacted by Program activities. Populations of NIDGS, however, do exist within meadow habitats that may be used for staging, equipment parking, storage and camps for construction and/or action agency employees. In areas where NIDGS may occur, prior to using any meadow area for Program activities, a qualified biologist will survey the site to ensure that NIDGS are not present. Any NIDGS activity sites, dens or burrows at the work site will be flagged and avoided during Program activities. NIDGS activity within 200 feet of work sites will be reported to the Level 1 Team, which will recommend a course of action, which could include site specific consultation and/or additional minimization measures. Because of these project design features (Assessment p. 25) the Service anticipates that the impacts of Program implementation will be insignificant and will not likely adversely affect the species.

1.3.4 Threatened and Endangered Plants

The four listed plant species, Macfarlane's four-o'clock, Spalding's catchfly, water howellia, and, although very unlikely, slickspot peppergrass, may occur within areas affected by projects carried out under the Program and some Program activities may have the potential to affect one or more of these species. The proposed action includes project design features, the same for each plant, on page 25 of the Assessment, for avoidance of effects to listed plants. Under these features, within the range of the species a qualified botanist will review each project site, and will determine whether a listed plant species occurs within a ¼ mile of the site, and whether project activities have the potential to affect the plant. If the botanist determines that a project carried out under the Program has the potential to adversely affect listed plants species, the Level 1 team will be notified and a separate section 7 consultation with the Service will be initiated. Any action with potential to adversely affect one of these plant species would be inconsistent with the terms of the proposed action and would not fall within the Program considered in this Opinion.

2. BIOLOGICAL OPINION

2.1 Description of the Proposed Action

This section describes the proposed Federal action, including any measures that may avoid, minimize, or mitigate adverse effects to listed species or critical habitat, and the extent of the geographic area affected by the action (i.e., the action area). The term "action" is defined in the implementing regulations for section 7 as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The term "action area" is defined in the regulations as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action."

2.1.1 Action Area

The action area is defined as all areas to be affected directly or indirectly by the proposed Federal action. Implementation of the Program may occur anywhere listed fish species and designated critical habitat for fish exist within the following administrative land management units: Payette, Boise, Sawtooth, Salmon-Challis, Nez Perce-Clearwater, Kootenai, Bitterroot, and Idaho Panhandle National Forests (including those portions located in Washington and Montana); and Bruneau, Challis, Cottonwood, Coeur d'Alene, Four Rivers, Jarbidge (including those portions located in Nevada), Salmon, and Upper Snake Field Offices of the Bureau of Land Management, as displayed in Figures 1 and 2. Each Forest or Bureau Field Office is considered an "administrative unit" for purposes of this consultation. These public lands contain waters that are part of the Salmon, Snake, Kootenai, Pend Oreille, Spokane, and Clearwater Basins. Subbasins (fourth-level hydrologic units) in the action area potentially affected by the Program are displayed in Figures 1 and 2 and listed in Table 2 (p. 35).

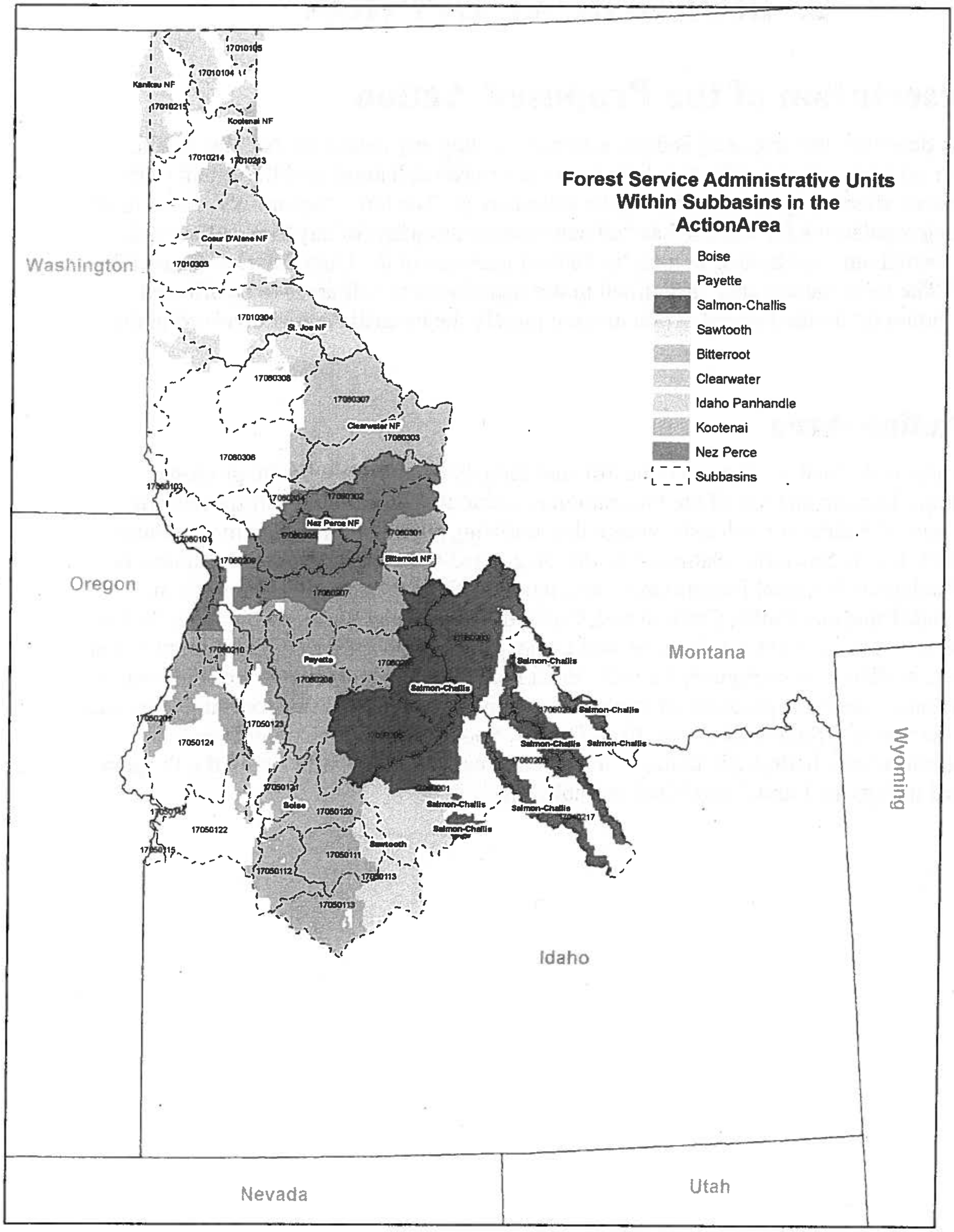

Figure 1. Forest Service Administrative Units and Subbasins in the Action Area.

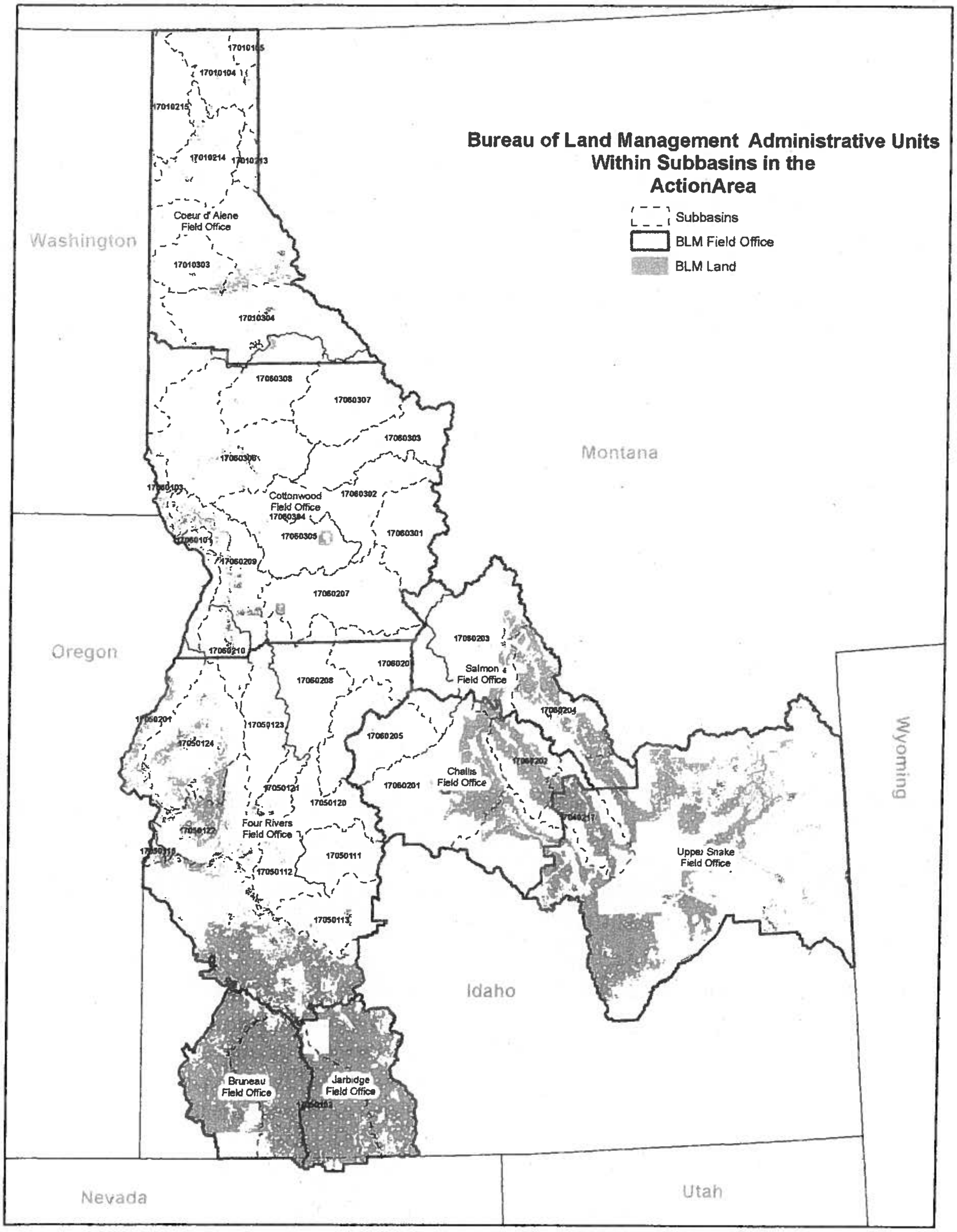

Figure 2. Bureau Administrative Units and Subbasins within the Action Area.

2.1.2 Proposed Action

The purpose of this Program is to restore physical and biological connectivity, including fish passage, in streams and subbasins within Idaho. The Program will reduce the impacts of existing road crossing structures which currently block fish migration and provide a means to decommission or close existing roads intermittently or fully if road crossings are removed. Overall Program goals are consistent with the goals of other regional plans and strategies outlined in Section I of the Assessment. The duration of the Program is ten years following issuance of this Opinion, after which all agencies may consider an extension of the Program.

2.1.2.1 Program Activities

The Action Agencies anticipate that up to 156 crossing improvement projects per year may be completed under the programmatic. As described in the Assessment, each of the administrative units proposes to complete up to 10 projects per year in occupied and/or critical habitat. Each individual stream crossing is considered one project under this Program. If an administrative unit wishes to conduct more than 10 projects in a given year, the appropriate Level 1 team must be consulted to ensure that the potential aggregate effects are within those anticipated in this Opinion. For this consultation, "occupied habitat" is a perennial or intermittent stream that is occupied, or suspected to be occupied, by listed fish species. If a project site is not occupied by listed fish, but will occur within 600 feet upstream of occupied habitat, then the project site is considered "occupied" because potential impacts would affect the area downstream that is occupied. Individual projects implemented under the Program may affect bull trout or critical habitat differently. Action effects may range from "no effect", to significant "adverse effects" that may result in take of individuals. Additionally, some projects may occur in streams which are not critical habitat or where bull trout are not known to occur.

Activities under the Program fall into the following categories, and are described fully in the Assessment on pages 12 to 24.

Crossing removal and associated channel rehabilitation: This activity is intended to restore physical and biological connectivity for ESA-listed fish, and is associated with closing, intermittently closing, or decommissioning roads and trails, including unauthorized routes. Following culvert removal, stream channels will be rehabilitated to the bankfull width, gradient, substrate composition, and active floodplain dimensions matching those features upstream and downstream of the project area.

Crossing replacement with a bridge: This activity will occur to re-establish physical and biological connectivity where an existing road or trail is required for National Forest or Bureau access or transportation needs; where an existing bridge is adversely affecting channel dynamics; where a bridge has been determined to pose a safety hazard or has outlived its useful life; or where expected 100-year flows and associated debris could not be accommodated with a culvert or open-bottomed arch. Multiple span bridges that require in-stream piers and projects with structure widths less than bankfull width are excluded

Culvert or ford replacement with a culvert or open-bottomed arch: This activity will occur to re-establish physical and biological connectivity where an existing road or trail is required for access or transportation needs and 100-year flows and associated debris can be accommodated by a culvert or open-bottomed arch. Culverts and/or fords will be removed and replaced with culverts or open-bottomed arches that incorporate stream simulation through the crossing. At a minimum, structure widths will accommodate bankfull dimensions. Embedded box culverts, structural plate arches, and corrugated metal pipe may be used.

Culvert replacement with trail ford: This activity is covered only if the trail ford reduces overall potential effects to aquatic habitat and assures fish passage by replacing the culvert with a trail ford. This category does not cover culvert replacement with a ford on roads open for full sized vehicle travel, even when used on an intermittent basis. This activity will occur to re-establish connectivity only where a road-to-trail conversion project is planned, or on an existing trail where a trail culvert is inadequate for fish passage and is difficult or impossible to maintain due to inaccessibility. Design features will typically include hardening the trail ford so that erosion is minimized and so that spawning is not encouraged at the improved crossing if there are indications that fish spawn in the general vicinity. This activity could be a component of a larger action that changes the travel status of a road converted to a trail.

Maintenance: Maintenance actions include removal of debris that has accumulated at stream crossing structures inlets during flood events, and that has been determined to obstruct fish passage or pose threats to the integrity of the crossing. Debris removed from the culvert inlet should be placed within the floodplain downstream in the immediate vicinity of the crossing. Maintenance also includes minor armoring around crossing structure inlets and re-vegetation. Minor armoring is intended to supplement existing armoring and not to be new armoring. Maintenance activities under this programmatic are only authorized at crossings which received consideration associated this consultation effort.

Road and trail relocation and decommissioning related to crossing replacement: In some instances, it may be necessary to move the location of a crossing to an area that provides better access or has less potential for failure. Changing the location of the crossing will include decommissioning and reclamation of approaches on existing crossing and construction of new approaches at proposed crossings, with no net increase in route density within riparian areas. If a crossing is moved to a new location, the crossing is considered "in-kind," when it is within one-quarter (1/4) mile of the existing crossing and includes no more than one half (1/2) acre of new road or trail reconstruction (~ ¼ mile of road at 14' width). If the proposed crossing location does not meet these requirements, separate consultation is required. Routes will be constructed with the application of Regional Best Management practices and built to agency standards for road or trail construction.

Bridge construction in migratory sockeye salmon habitat: Crossings removed or replaced in migratory habitat for sockeye salmon may only be replaced with a single span bridge. Bridges with in-stream piers will require separate consultation. Activities may only occur when the species is not present during migratory periods. Structures or fords will be removed and replaced with bridges and the stream channel will be restored to mimic natural conditions incorporating stream simulation design.

Projects within any of the categories listed above may be proposed as stand-alone projects, or as components of larger projects. Activities that are components of larger projects are considered in this Opinion only when no other adverse effects to listed fish species or critical habitat are anticipated from the whole action. If the other components of the larger project may have adverse effects, then the entire action, including stream crossing improvements, must be considered in a separate consultation. For example; given a large landscape type project that would only receive a "Likely to Adversely Affect" determination due to a culvert removal and restoration action, use of this programmatic is appropriate and the agencies may proceed with informal consultation (making reference to the Program to account for effects associated with the stream crossing component). Conversely, when a project receives a determination of "Likely to Adversely Affect" for other aspects of the project besides the culvert removal and restoration, formal consultation for the entire project is necessary, including the stream crossing.

2.1.2.2 Project Design Team

The design and construction of naturalized stream crossings typically requires expertise in multiple disciplines, such as engineering, hydrology, fluvial geomorphology, contract administration, and fisheries and wildlife biology. Project design teams should be comprised of individuals with this expertise.

Prior to design, the project design team will conduct a field review of a given proposed project in occupied habitats, identifying biological and physical requirements that need to be met during the design and implementation process. The project design team will evaluate existing and desired conditions, and consider alternatives that may be incorporated into the project design, in order to emulate natural conditions (i.e., stream simulation). The design should also evaluate the potential debris flows, flood flows, channel stability, and floodplain characteristics to ensure long-term objectives are met.

2.1.2.3 Project Documentation

Pre-project Documentation

As described in the Assessment, each proposed project will be documented and presented to the appropriate Level 1 Team. The project design team, or representative, will notify the area Level 1 Team of all proposed actions to be covered under this Program, and will provide documentation that the project meets the conditions described in the Assessment and this Opinion. Variations in design features will involve the Level 1 Team and project design team input to minimize adverse effects to listed species, stream channels, and aquatic habitat. The project design team is responsible for project documentation, design, review, implementation, and monitoring. They, or a representative, will provide to the Level 1 Team a completed Pre-Project Checklist (see Appendix A) with attachments for each unique, individual, stream crossing action.

Post-project Documentation and Monitoring

Post-project implementation and effectiveness monitoring will be conducted and information, including the Post-Project Checklist (see Appendix A), will be provided to the Level 1 Team. Level 1 Teams will conduct field reviews of randomly selected projects from previous years. Formats for annual field reviews will be developed by individual Level 1 Teams. Service Level 1 Team members will ensure that copies of post-project checklists are also submitted to the National Marine Fisheries Service Idaho Habitat Branch and the appropriate Service's Idaho offices.

2.1.2.4 Excluded Projects

The following types of projects would not be included in the proposed programmatic actions nor would they be covered under this consultation:

- Projects that would facilitate the expansion of brook trout into occupied bull trout habitat;
- Projects with structure widths less than bankfull width;
- Placement of any kind of baffled culvert or fish ladders within culverts;
- Multiple span bridges that require instream piers;
- Projects in areas where there are spawning ESA-listed fish or their redds;
- Projects not constructed during low flow conditions;
- Any newly proposed stream crossing that does not replace or remove an existing stream crossing;
- Actions that are parts of larger projects that have other components with potential adverse effects on listed fish or designated critical habitat.

2.1.2.5 Construction Phases and Project Design Features

The Action Agencies have included in the Program conservation activities and measures aimed at avoiding or minimizing potential adverse effects to listed, proposed, and candidate species and critical habitat that may be affected by the action. These include measures for fish, wildlife, and plants. Project design features to minimize effects to wildlife, critical habitat, and plants are described on pp. 24-25 of the Assessment. Construction methods and design features for fish and aquatic habitats begin on p. 15 of the Assessment and include important provisions for minimizing effects to listed fish associated with site preparation, fish avoidance, dewatering, construction activities, flow reintroduction, site rehabilitation, and maintenance. For a complete list of construction procedures, sequences and design features, refer to the Assessment, pp. 14-25. Listed below are key project construction methods and design features (bulleted lists) pertinent for each sequence.

2.1.2.5.1 Site Preparation

Site clearing, staging areas, access routes, and stockpile areas will be recommended by the project design team in order to minimize disturbance, reduce impacts to riparian vegetation, and to minimize the potential for sediment delivery to stream channels.

- Sediment barriers will be installed around disturbed areas (including project site, stockpile, and staging areas) to minimize the potential for sediment delivery into stream channels and road ditches.
- A supply of surplus sediment barriers will be on hand to respond to unanticipated events that have the potential to deliver sediment to the stream.
- Riparian buffers will be designated and flagged to reduce effects to streams and riparian conservation areas.
- Trees that are removed in order to facilitate structure placement, will be stockpiled for use in stream channel or floodplain rehabilitation or maintenance.

- Boundaries of staging areas, stockpile areas, and other locations where impacts might occur will be designated and flagged.
- Existing disturbed areas, such as road prisms, will be utilized whenever possible.
- Areas of minimally sufficient size will be cleared for use if existing disturbed areas for staging or stockpile use do not exist.

2.1.2.5.2 Fish Avoidance

- All projects will be conducted during low flow conditions to minimize effects to and avoid delaying movement of ESA-listed species.
- A fisheries biologist will conduct, or direct, a survey of the project location during project planning and also prior to implementation, in order to determine if ESA-listed fish species inhabit the project area.
- Conduct pre-work surveys within 1 week prior to project implementation. Should listed fish be observed at the site, or 600 feet downstream, which would be affected by project actions, determine appropriate methods (passive or active) for removing fish.
- Should migrating or spawning listed fish, or redds of listed fish species be observed within the project area during implementation, or 600 feet downstream of the project area, consult the Level 1 team for an appropriate course of action. As described above, projects in areas where there are spawning ESA-listed fish and/or redds are excluded from this Programmatic.
- Handling of fish will be conducted by or under the direction of a fisheries biologist, using methods directed by the following; NMFS Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act (Appendix E); Idaho Department of Fish and Game Scientific Collection Permit (or Montana, Washington, or Nevada equivalent); or NMFS steelhead collection permits, if applicable.

2.1.2.5.3 Stream Dewatering

In most cases, project design will call for dewatering the stream channel which typically consists of a pipe or side-channel diversion to carry diverted stream flow from a diversion point around the project site to a location downstream of the project site. The diversion structure may act as a temporary barrier to fish passage. Fish may be allowed to move downstream through the diversion when it is determined that entrapment will not occur. If a lined channel, rather than a pipe or side-channel diversion is used for dewatering, excavation would be required from the diversion point, through the floodplain, and down to a re-entry point below the project site. The length of the dewatered stream channel would vary, depending on the width of the road prism at the crossing. The access to the stream edge and diversion construction may impact a narrow cross section of riparian area, removing vegetation and exposing bare soil to erosion. Within-channel rerouting may occur when the stream channel is wide enough to accommodate rerouting within the active channel, at low flows, and the diversion path, which may include a pipe or one side of the existing channel, is essentially non-erosive. This method is typically associated with the construction of open-bottomed arches and bridges.

- Project sites will be dewatered and completely bypassed prior to excavation.
- Dewatering will be accomplished slowly to capture and move stranded fish and other aquatic organisms to the extent possible.

- Pumps will have a fish screen installed, and operated and maintained in accordance with NMFS fish screen criteria (see Appendix F of the Assessment).
- Diversion structures will not be constructed with material mined from the stream or floodplain.
- Prior to constructing a water diversion, a fisheries biologist will conduct or direct an inspection of the stream and identify the appropriate means necessary to minimize the potential for fish to enter a constructed diversion and associated dewatering conveyance.
- Flow diversion around the project site will be constructed using non-erodible material, such as a pipe, liner, or by using an existing re-vegetated abandoned stream channel of appropriate size to accommodate peak flows that may be expected during construction (including storm events).
- If streamflow is rerouted to one side of the existing channel, diversion structures, such as sandbags, cofferdams, or portable bladders constructed of non-erodible materials will be used.
- Outflow will be directed to an area that minimizes or prevents erosion.
- If appropriate, water collecting in the dewatered work areas (leakage, subsurface sources, and percolation) may be pumped to a temporary storage/treatment site, or into upland areas, and allowed to filter through vegetation prior to water reentering the stream channel.
- If a diversion channel is excavated, material will be stored at designated stockpile areas, for use in rehabilitating the excavated channel.

2.1.2.5.4 Construction and Earthmoving Activities

Stream simulation objectives mimic natural stream processes at a culvert removal site or at a stream crossing within a culvert, open-bottom arch, ford, or under a bridge. Fish passage, sediment transport, and flood and debris conveyance through the structure will imitate the stream conditions upstream and downstream of the crossing, as close to natural conditions as the structure type allows (i.e., stream simulation).

Machinery typically operates from the road fill and will only cross streams at dewatered areas, temporary bridges, or at designated temporary crossings. Earthmoving activities within the active stream channel would typically occur within a dewatered segment. In typical earthmoving activities associated with these actions, road fill is excavated around the crossing to just above the wetted perimeter in preparation for dewatering, although dewatering is sometimes conducted before excavation. Excavating equipment typically works from the road fill without disturbing water flow or side-casting material into stream channels.

Removal of culverts involves removal of road fill associated with existing culverts and is completed entirely within the dewatered work area. Road fill would be removed and stored at a designated stockpile site or hauled to a permanent waste area. At this point, the culvert would be removed, and the remaining material would be excavated down to streambed elevations. Excavation widths would vary depending on whether the culvert would be removed or replaced with a bankfull culvert, open-bottom arch, bridge footings, or trail ford. Excavating equipment would typically work from the road fill and cross the stream within the dewatered area or at a designated stream crossing. Excess groundwater may be removed from the work area by pumping to a settling area before discharging back into any water body. Headwalls may be applied to the culvert, arch, and bridge construction phases, outside of bankfull widths. Riprap placement for structure protection, and where needed to achieve passage objectives and maintenance of channel features, would be approved by the project design team. Concrete may be poured to provide bedding for squashed culverts in some instances.

Implementation of the following measures will minimize effects to ESA listed fish species.

- All projects will be conducted during low flow conditions, which typically occur from late summer through fall, to minimize effects to or delay of movement of ESA-listed fish.
- All in-stream and channel rehabilitation activities will be completed within one work season (site specific projects where in-stream construction activities take more than one season to complete are not included in this Program).
- Equipment and vehicles will have all plant parts, soil, and other materials that may carry noxious weed seeds removed prior to entry onto the project site.
- Equipment will be inspected for other undesirable aquatic organisms.
- Conduct excavation with minimal impact to the active stream channel.
- Excavated material will be stored in designated stockpile areas.
- Waste material will be staged in designated locations or end hauled to approved disposal site.
- Machinery will operate from the road fill and may cross streams at dewatered areas, temporary bridges, or at designated temporary crossings.
- Machinery, equipment, and materials will be stored in the staging areas, when not in use.
- In the event of local precipitation events or high flows, all project operations will cease, except efforts to minimize storm damage or excessive erosion.
- Native materials (e.g. substrate, riparian vegetation, rock, woody debris) excavated on-site, will be conserved and stockpiled for later use in channel reconstruction, filling of culverts, or other site rehabilitation, and will be kept separate from other stockpiled material which is not native to the site.
- Stream channels and floodplains will be reconstructed (simulated) in a manner which matches channel dimension, pattern, and profile for the stream type above and below the crossing to provide diverse avenues for passage by aquatic organisms.
- Design velocity, roughness, and slope compatible with the swimming abilities of appropriate species.
- Provide for wildlife and other aquatic organism passage as necessary, to provide for overall ecological connectivity.
- Structure width shall be greater than or equal to the bankfull channel width.
- Design crossings to accommodate at least 100-year flows, facilitate sediment and debris movement, and other valley and floodplain processes.
- Decommissioning of routes will remove the former roadway or trail (including any imported road base), re-establish natural topography and drainage to the extent possible, incorporate available organic material, and in general, apply methods that accelerate site restoration and discourage unauthorized use.

- Erosion control materials will be certified weed free in order to prevent the spread of noxious weeds.
- Culverts will be embedded at 20 percent or more, so that the stream bed at the widest part of the culvert is deep enough to account for scour, grade adjustments, footings, and bed integrity.
- For bridges, no abutments shall be placed within the bankfull channel nor will exposed riprap be placed within the bankfull channel unless necessary to achieve passage objectives, maintain channel features, and protect structures.
- Concrete footings would be built below the stream channel, but outside of bankfull widths, through excavation and placement of forms followed by pouring and curing of concrete.
- Reconstructed stream channels will be "pre-washed", into a reach equipped with sediment capture devices, prior to reintroduction of flow to the stream.
- Stream channels will be re-watered slowly to prevent loss of surface water downstream as the construction site streambed absorbs water and to minimize a sudden increase in turbidity.

Low Water Fords on Trails

- Approaches will access crossings at suitably graded stream sections to reduce the potential for accelerated erosion of stream banks and the stream channel; approaches will be designed to ensure long-term stability and to minimize the potential for sediment delivery.
- If spawning is anticipated at a crossing, given substrate characteristics of the site, then structures (e.g., concrete pads, angular rock, etc.) will be installed to eliminate the potential for spawning activity.
- Fords will be designed to prevent the creation of a low-water barrier to fish passage, by having similar grade and bankfull width as the channel while maintaining adequate flow to allow fish passage.
- Avoid existing or potential spawning locations.
- Fords will be 24 inches (foot and stock use only) to 50 inches (ATV use) in width.
- Approaches and fords will typically be hardened with rocks.
- Adequate drainage on approaches above the ford will be constructed to reduce hydrologic connectivity and minimize trail-generated sediment delivery.

Temporary Stream Crossings

- Use of temporary crossings should be minimized to the maximum extent necessary to complete a project.
- Existing roadways or travel paths will be used to access or cross streams as necessary, and temporary crossings will be reviewed by the project design team.
- Temporary crossings will not increase risks of channel re-routing under high flow conditions.
- Temporary crossings shall be constructed at right angles to the main channel where possible.

- Rubber matting, temporary bridges, or other means, will be utilized if the stream channel needs further protection.

Use of Explosives

Alternatives to blasting should be considered to the maximum extent possible.

- Instream boulders or bedrock (i.e., impenetrable rock) within occupied habitat should be broken without blasting, using non-explosive alternatives such as Betonamit (www.betonamit.net).
- If impenetrable rock, resistant to non-explosive alternatives, is discovered after excavation begins, blasting will occur in dewatered or dry channels only, and only outside of the buffer restrictions described in the Assessment (p. 21). Buffer widths apply to the distance between the blasting activity and the nearest occupied stream bypass entrance or exit.
- Buffer restrictions (Assessment p. 21) will be incorporated for dewatered or dry channels.

This Program does not cover the extension of the dewatered area for the sole purpose of increasing the available buffer in order to accommodate larger charge weights.

Pollution Control Measures

Best management practices (BMPs) will be designed, implemented, and maintained to provide full protection or maintenance of beneficial uses.

- In-channel sediment control devices will be used to capture sediment that is liberated during construction and re-watering of dewatered channels. Sediment control devices will be maintained throughout the construction period and until the site is stable. When risk of erosion has passed, the devices will be removed from the stream channel and sediment will be disposed of outside of the floodplain so that it is not transported into the stream channel.
- Storage of fuel and other toxicants within the riparian habitat conservation area is prohibited.
- Refueling, and maintenance of equipment, including power hand tools, is prohibited with the riparian habitat conservation area unless there are no other alternatives. Refueling sites within the riparian habitat conservation area must be approved by the Forest Service or Bureau and have an approved spill containment plan.
- Should stored fuel exceed 660 gallons in a single tank, or 1,320 gallons for all storage combined, operators will be required to have a standard Environmental Protection Agency (EPA) written Spill Prevention Control and Containment (SPCC) Plan onsite, which describes measures to prevent or reduce impacts from potential spills.
- All vehicles carrying fuel will have specific equipment and materials needed to contain or clean up any incidental spills at the project site. Equipment and materials will be specific to each project site, and can include spill kits appropriately sized for specific quantities of fuel, shovels, absorbent pads, straw bales, containment structures and liners, and/or booms.
- Prior to arriving on site, all equipment will be cleaned of external oil, grease, dirt, and mud, and all leaks will be repaired. Equipment will be inspected by the action agency before unloading at the site.

- Oil-absorbing floating booms, or other equipment such as pads and absorbent "peanuts," will be available on-site during all phases of construction and placed in a location that facilitates an immediate response to potential petroleum leakage.

2.1.2.5.5 Flow Reintroduction

Flow reintroduction will occur when the new structure is in place and stream simulation is complete.

- Reconstructed stream channel will be "pre-washed" prior to flow reintroduction.
- Sediment capture devices such as Sedimat will be placed downstream of the reach to capture sediment that maybe released during rewatering.
- Rewatering will be done slowly to minimize large pulses of sediment and to prevent loss of surface water downstream as the construction site streambed absorbs water.

2.1.2.5.6 Site Rehabilitation

Site rehabilitation would include establishing long-term erosion protection measures using boulder-sized riprap, plantings, erosion control fabric, seed, and mulch.

- Disturbed areas will be rehabilitated to conditions similar to pre-work conditions through spreading of stockpiled materials (large woody debris), seeding, and/or planting with native seed mixes or plants. If native stock is not available, soil-stabilizing vegetation (seed or plants) will be used that does not promote the establishment or spread of exotic species.
- No herbicide application will occur as part of the permitted action.
- When deemed necessary by the project design team or aquatic specialist, compacted access roads, staging areas, and stockpile areas will be mechanically loosened.
- Trees will be retained at project sites wherever possible. In-stream or floodplain rehabilitation materials such as large wood and boulders will mimic as much as possible those found in the project vicinity. Such materials may be salvaged from the project site or hauled in from offsite but cannot be taken from streams, wetlands, or other sensitive areas.
- Whenever possible, woody shrubs that need to be removed as part of the project will be excavated with root ball intact, retained on site, and replanted as part of the site rehabilitation.
- Trees (greater than 8 inches dbh) will not be felled in the riparian area for site rehabilitation purposes unless necessary for safety. If necessary for safety, trees may be felled toward the stream and left in place or placed in the stream channel or floodplain.
- Site rehabilitation activities will be completed prior to the end of the current field season, although subsequent seeding and re-vegetation may be necessary in following years.
- Any stockpiled woody debris would be scattered and placed outside of the active stream channel, unless necessary for channel stabilization or incorporated into stream restoration.

2.1.2.5.7 Maintenance

Maintenance of rehabilitated crossings may be necessary within the lifespan of this document. Maintenance activities may include removal of large wood that has accumulated at the inlet of a culvert, open-bottomed arch, or bridge and is determined to obstruct fish passage or pose threats to the crossing's integrity. Maintenance activities would usually be completed in two days or less; such maintenance activities may cause short term impacts to the stream channel or may increase turbidity. Minor armoring is intended to supplement existing armoring and not to be new armoring. Minor armoring of structures and re-vegetation of the construction site, necessary for long-term maintenance are included within this category.

- Debris will be removed and placed immediately downstream of the outlet.
- Machinery used to remove debris will operate from the road prism.

2.2 Analytical Framework for the Jeopardy and Adverse Modification Determinations

2.2.1 Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this Opinion relies on four components:

1. The *Status of the Species*, which evaluates the bull trout's rangewide condition, the factors responsible for that condition, and its survival and recovery needs.
2. The *Environmental Baseline*, which evaluates the condition of the bull trout in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the bull trout.
3. The *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the bull trout.
4. *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the bull trout.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the bull trout's current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the bull trout in the wild.

As discussed below under the *Status of the Species*, interim recovery units have been designated for the bull trout for purposes of recovery planning and application of the jeopardy standard. Per Service national policy (USFWS 2006, entire), it is important to recognize that the establishment of recovery units does not create a new listed entity. Jeopardy analyses must always consider the impacts of a proposed action on the survival and recovery of the species that is listed. While a proposed Federal action may have significant adverse consequences to one or more recovery units, this would only result in a jeopardy determination if these adverse consequences reduce appreciably the likelihood of both the survival and recovery of the listed entity; in this case, the coterminous U.S. population of the bull trout.

The joint Service and National Marine Fisheries Service (NMFS) *Endangered Species Consultation Handbook* (USFWS and NMFS 1998, p. 4-38), which represents national policy of both agencies, further clarifies the use of recovery units in the jeopardy analysis:

> When an action appreciably impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. When using this type of analysis, include in the biological opinion a description of how the action affects not only the recovery unit's capability, but the relationship of the recovery unit to both the survival and recovery of the listed species as a whole.

The jeopardy analysis in this Opinion conforms to the above analytical framework.

2.2.2 Adverse Modification Determination

This Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this Opinion relies on four components:

1. The *Status of Critical Habitat*, which evaluates the rangewide condition of designated critical habitat for the bull trout in terms of primary constituent elements (PCEs), the factors responsible for that condition, and the intended recovery function of the critical habitat overall.
2. The *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area.
3. The *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units.
4. *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units.

For purposes of the adverse modification determination, the effects of the proposed Federal action on bull trout critical habitat are evaluated in the context of the rangewide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat rangewide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the bull trout.

The analysis in this Opinion places an emphasis on using the intended rangewide recovery function of bull trout critical habitat and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

2.3 Status of the Species and Critical Habitat

This section presents information about the regulatory, biological and ecological status of the bull trout and its critical habitat that provides context for evaluating the significance of probable effects caused by the proposed action.

2.3.1 Bull Trout

2.3.1.1 Listing Status

The coterminous United States population of the bull trout was listed as threatened on November 1, 1999 (64 FR 58910). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon, the Jarbidge River in Idaho and Nevada, north to various coastal rivers of Washington to the Puget Sound, east throughout major rivers within the Columbia River Basin to the St. Mary-Belly River, and east of the Continental Divide in northwestern Montana (Cavender 1978, pp. 165-166; Bond 1992, p. 4; Brewin and Brewin 1997, pp. 209-216; Leary and Allendorf 1997, pp. 715-720). The Service completed a 5-year Review in 2008 and concluded that the bull trout should remain listed as threatened (USFWS 2008, p. 53).

The bull trout was initially listed as three separate Distinct Population Segments (DPSs) (63 FR 31647, 64 FR 17110). The preamble to the final listing rule for the U.S. coterminous population of the bull trout discusses the consolidation of these DPSs, plus two other population segments, into one listed taxon and the application of the jeopardy standard under Section 7 of the Act relative to this species (64 FR 58930):

> Although this rule consolidates the five bull trout DPSs into one listed taxon, based on conformance with the DPS policy for purposes of consultation under Section 7 of the Act, we intend to retain recognition of each DPS in light of available scientific information relating to their uniqueness and significance. Under this approach, these DPSs will be treated as interim recovery units with respect to application of the jeopardy standard until an approved recovery plan is developed. Formal establishment of bull trout recovery units will occur during the recovery planning process.

Thus, as discussed above under the *Analytical Framework for the Jeopardy and Adverse Modification Determinations*, the Service's jeopardy analysis for the proposed Program will involve consideration of how the Program is likely to affect the proposed interim recovery units in Idaho and Nevada for the bull trout based on their uniqueness and significance as described in the DPS final listing rule cited above, which is herein incorporated by reference. However, in accordance with Service national policy, the jeopardy determination is made at the scale of the listed species: in this case, the coterminous U.S. population of the bull trout.

2.3.1.1.1 Reasons for Listing

Though wide ranging in parts of Oregon, Washington, Idaho, and Montana, bull trout in the interior Columbia River basin presently occur in only about 45 percent of the historical range (Quigley and Arbelbide 1997, p. 1177; Rieman et al. 1997, p. 1119). Declining trends due to the combined effects of habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, angler harvest and poaching, entrainment into diversion channels and dams, and introduced nonnative species (e.g., brook trout, *Salvelinus fontinalis*) have resulted in declines in range-wide bull trout distribution and abundance (Bond 1992, p. 4; Schill 1992, p. 40; Thomas 1992, pp. 9-12; Ziller 1992, p. 28; Rieman and McIntyre 1993, pp. 1-18; Newton and Pribyl 1994, pp. 2, 4, 8-9; Idaho Department of Fish and Game 1995, pp. 1-3). Several local extirpations have been reported, beginning in the 1950s (Rode 1990, p. 1; Ratliff and Howell 1992, pp. 12-14; Donald and Alger 1993, p. 245; Goetz 1994, p. 1; Newton and Pribyl 1994, p. 2; Berg and Priest 1995, pp. 1-45; Light et al. 1996, pp. 20-38; Buchanan and Gregory 1997, p. 120).

Land and water management activities such as dams and other diversion structures, forest management practices, livestock grazing, agriculture, road construction and maintenance, mining, and urban and rural development continue to degrade bull trout habitat and depress bull trout populations (USFWS 2002a, p. 13).

2.3.1.2 Species Description

Bull trout (*Salvelinus confluentus*), member of the family Salmonidae, are char native to the Pacific Northwest and western Canada. The bull trout and the closely related Dolly Varden (*Salvelinus malma*) were not officially recognized as separate species until 1980 (Robins et al. 1980, p. 19). Bull trout historically occurred in major river drainages in the Pacific Northwest from the southern limits in the McCloud River in northern California (now extirpated), Klamath River basin of south central Oregon, and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, p. 165-169; Bond 1992, p. 2-3). To the west, the bull trout's current range includes Puget Sound, coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992, p. 2-3). East of the Continental Divide bull trout are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and British Columbia (Cavender 1978, p. 165-169; Brewin and Brewin 1997, pp. 209-216). Bull trout are wide spread throughout the Columbia River basin, including its headwaters in Montana and Canada.

2.3.1.3 Life History

Bull trout exhibit resident and migratory life history strategies throughout much of the current range (Rieman and McIntyre 1993, p. 2). 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 1 to 4 years before migrating to either a lake (adfluvial), river (fluvial), or, in certain coastal areas, to saltwater (anadromous) where they reach maturity (Fraley and Shepard 1989, p. 1; Goetz 1989, pp. 15-16). 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, p. 2).

Bull trout have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993, p. 4). Watson and Hillman (1997, p. 248) concluded that watersheds must have specific physical characteristics to provide habitat requirements for bull trout to successfully spawn and rear. It was also concluded that these characteristics are not necessarily ubiquitous throughout these watersheds, thus resulting in patchy distributions even in pristine habitats.

Bull trout are found primarily in colder streams, although individual fish are migratory in larger, warmer river systems throughout the range (Fraley and Shepard 1989, pp. 135-137; Rieman and McIntyre 1993, p. 2 and 1995, p. 288; Buchanan and Gregory 1997, pp. 121-122; Rieman et al. 1997, p. 1114). 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, p. 133; Rieman and McIntyre 1995, pp. 255-296). Spawning areas are often associated with cold water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, p. 6; Rieman and McIntyre 1993, p. 7; Rieman et al. 1997, p. 1117). Goetz (1989, pp. 22, 24) suggested optimum water temperatures for rearing of less than 10°C (50°F) and optimum water temperatures for egg incubation of 2 to 4°C (35 to 39°F).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Goetz 1989, pp. 22-25; Pratt 1992, p. 6; Thomas 1992, pp. 4-5; Rich 1996, pp. 35-38; Sexauer and James 1997, pp. 367-369; Watson and Hillman 1997, pp. 247-249). Jakober (1995, p. 42) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that suitable winter habitat may be more restrictive than summer habitat. Bull trout prefer relatively stable channel and water flow conditions (Rieman and McIntyre 1993, p. 6). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997, pp. 368-369).

The size and age of bull trout at maturity depend upon life history strategy. Growth of resident fish is generally slower than migratory fish; resident fish tend to be smaller at maturity and less fecund (Goetz 1989, p. 15). Bull trout normally reach sexual maturity in 4 to 7 years and live as long as 12 years. Bull trout are iteroparous (they spawn more than once in a lifetime), and both repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982, p. 95; Fraley and Shepard 1989, p. 135; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Migratory bull trout frequently begin spawning migrations as early as April, and have been known to move upstream as far as 250 kilometers (km) (155 miles (mi)) to spawning grounds (Fraley and Shepard 1989, p. 135). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p.1) and, after hatching, juveniles remain in the substrate. Time from egg deposition to emergence may exceed 200 days. Fry normally emerge from early April through May depending upon water temperatures and increasing stream flows (Pratt 1992, p. 1).

The iteroparous reproductive system of bull trout has important repercussions for the management of this species. Bull trout require two-way passage up and downstream, not only for repeat spawning, but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous (fishes that spawn once and then die, and therefore require only one-way passage upstream) salmonids. Therefore, even dams or other barriers with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route.

Bull trout are opportunistic feeders with food habits primarily a function of size and life history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro zooplankton and small fish (Boag 1987, p. 58; Goetz 1989, pp. 33-34; Donald and Alger 1993, pp. 239-243). Adult migratory bull trout are primarily piscivores, known to feed on various fish species (Fraley and Shepard 1989, p. 135; Donald and Alger 1993, p. 242).

2.3.1.3.1 Population Dynamics

The draft bull trout Recovery Plan (USFWS 2002a, pp. 47-48) defined core areas as groups of partially isolated local populations of bull trout with some degree of gene flow occurring between them. Based on this definition, core areas can be considered metapopulations. A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meefe and Carroll 1994, p. 188). In theory, bull trout metapopulations (core areas) can be composed of two or more local populations, but Rieman and Allendorf (2001, p. 763) suggest that for a bull trout metapopulation to function effectively, a minimum of 10 local populations are required. Bull trout core areas with fewer than 5 local populations are at increased risk of local extirpation, core areas with between 5 and 10 local populations are at intermediate risk, and core areas with more than 10 interconnected local populations are at diminished risk (USFWS 2002a, pp. 50-51).

The presence of a sufficient number of adult spawners is necessary to ensure persistence of bull trout populations. In order to avoid inbreeding depression, it is estimated that a minimum of 100 spawners are required. Inbreeding can result in increased homozygosity of deleterious recessive alleles which can in turn reduce individual fitness and population viability (Whitesel et al. 2004, p. 36). For persistence in the longer term, adult spawning fish are required in sufficient numbers to reduce the deleterious effects of genetic drift and maintain genetic variation. For bull trout, Rieman and Allendorf (2001, p. 762) estimate that approximately 1,000 spawning adults within any bull trout population are necessary for maintaining genetic variation indefinitely. Many local bull trout populations individually do not support 1,000 spawners, but this threshold may be met by the presence of smaller interconnected local populations within a core area.

For bull trout populations to remain viable (and recover), natural productivity should be sufficient for the populations to replace themselves from generation to generation. A population that consistently fails to replace itself is at an increased risk of extinction. Since estimates of population size are rarely available, the productivity or population growth rate is usually estimated from temporal trends in indices of abundance at a particular life stage. For example, redd counts are often used as an indicator of a spawning adult population. The direction and magnitude of a trend in an index can be used as a surrogate for growth rate.

Survival of bull trout populations is also dependent upon connectivity among local populations. Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution even in pristine habitats (Rieman and McIntyre 1993, p. 7). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991, p. 22). Burkey (1989, p. 76) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth of local populations may be low and probability of extinction high. Migrations also facilitate gene flow among local populations because individuals from different local populations interbreed when some stray and return to nonnatal streams. Local populations that are extirpated by catastrophic events may also become reestablished in this manner.

In summary, based on the works of Rieman and McIntyre (1993, pp. 9-15) and Rieman and Allendorf (2001, pp 756-763), the draft bull trout Recovery Plan identified four elements to consider when assessing long-term viability (extinction risk) of bull trout populations: (1) number of local populations, (2) adult abundance (defined as the number of spawning fish present in a core area in a given year), (3) productivity, or the reproductive rate of the population, and (4) connectivity (as represented by the migratory life history form).

2.3.1.4 Status and Distribution

As noted above, in recognition of available scientific information relating to their uniqueness and significance, five population segments of the coterminous United States population of the bull trout are considered essential to the survival and recovery of this species and are identified as: (1) Jarbidge River, (2) Klamath River, (3) Coastal-Puget Sound, (4) St. Mary-Belly River, and (5) Columbia River. Each of these segments is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

A summary of the current status and conservation needs of the bull trout within these units is provided below. A comprehensive discussion of these topics is found in the draft bull trout Recovery Plan (USFWS 2002a, entire; 2004a, b; entire).

Central to the survival and recovery of the bull trout is the maintenance of viable core areas (USFWS 2002a, p. 54). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat, and, in some cases, their use of spawning habitat. Each of the population segments listed below consists of one or more core areas. One hundred and twenty one core areas are recognized across the United States range of the bull trout (USFWS 2005, p. 9).

A core area assessment conducted by the Service for the 5 year bull trout status review determined that of the 121 core areas comprising the coterminous listing, 43 are at high risk of extirpation, 44 are at risk, 28 are at potential risk, 4 are at low risk and 2 are of unknown status (USFWS 2008, p. 29).

The action area for the program falls within the Jarbidge River and the Columbia River population segments.

2.3.1.4.1 Jarbidge River

This population segment currently contains a single core area with six local populations: East Fork Jarbidge River, West Fork Jarbidge River, Dave Creek, Jack Creek, Pine Creek and Slide Creek. According to the 2004 USFWS Recovery Plan, this population segment was estimated to have fewer than 500 resident and migratory adult bull trout, representing about 50 to 125 spawners. A recent study by USFWS and the U.S. Geological Survey (Allen et al. 2010) indicate that numbers of bull trout in the upper Jarbidge River basin are much higher than estimated in the recovery plan. Results from the Allen et al. 2010 study indicate that almost four times the estimated number of bull trout inhabit the core area and that these fish show substantial movements between tributaries, increased abundance with increasing altitude, and growth rates indicative of a high quality habitat (Allen et al. 2010, p. 20). The current condition of the bull trout in this segment is attributed to the effects of dams and diversions, livestock grazing, mining, roads, angler harvest, forest management practices, and the introduction of nonnative fishes (USFWS 2004a, p. iii). The draft bull trout Recovery Plan identifies the following conservation needs for this segment: (1) maintain the current distribution of the bull trout within the core area, (2) maintain stable or increasing trends in abundance of both resident and migratory bull trout in the core area, (3) restore and maintain suitable habitat conditions for all life history stages and forms, and (4) conserve genetic diversity and increase natural opportunities for genetic exchange between resident and migratory forms of the bull trout. An estimated 270 to 1,000 spawning fish per year are needed to provide for the persistence and viability of the core area and to support both resident and migratory adult bull trout (USFWS 2004a, p. 62-63). Currently this core area is at high risk of extirpation (USFWS 2005, p. 9).

2.3.1.4.2 Columbia River

The Columbia River population segment includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin, and presently occur in 45 percent of the estimated historical range (Quigley and Arbelbide 1997, p. 1177). This population segment currently contains 97 core areas and 527 local populations. About 65 percent of these core areas and local populations occur in Idaho and northwestern Montana.

The condition of the bull trout populations within these core areas varies from poor to good, but generally all have been subject to the combined effects of habitat degradation, fragmentation and alterations associated with one or more of the following activities: dewatering, road construction and maintenance, mining and grazing, blockage of migratory corridors by dams or other diversion structures, poor water quality, incidental angler harvest, entrainment into diversion channels, and introduced nonnative species.

The Service has determined that of the total 97 core areas in this population segment, 38 are at high risk of extirpation, 35 are at risk, 20 are at potential risk, 2 are at low risk, and 2 are at unknown risk (USFWS 2005, pp. 1-94).

The draft bull trout Recovery Plan (USFWS 2002a, p. v) identifies the following conservation needs for this population segment: (1) maintain or expand the current distribution of the bull trout within core areas, (2) maintain stable or increasing trends in bull trout abundance, (3) maintain and restore suitable habitat conditions for all bull trout life history stages and strategies, and (4) conserve genetic diversity and provide opportunities for genetic exchange.

2.3.1.4.5.1 Columbia River Recovery/Management Units

Achieving recovery goals within each management unit is critical to recovering the Columbia River population segment. Recovering bull trout in each management unit would maintain the overall distribution of bull trout in their native range. Individual core areas are the foundation of management units and conserving core areas and their habitats within management units preserves the genotypic and phenotypic diversity that will allow bull trout access to diverse habitats and reduce the risk of extinction from stochastic events. The continued survival and recovery of each individual core area is critical to the persistence of management units and their role in the recovery of a population segment (USFWS 2002a, p. 54).

The draft bull trout Recovery Plan (USFWS 2002a, p. 2) identified 22 recovery units within the Columbia River population segment. These units are now referred to as management units. Management units are groupings of bull trout with historical or current gene flow within them and were designated to place the scope of bull trout recovery on smaller spatial scales than the larger population segments.

The action area for this Programmatic includes Forest Service and Bureau managed lands in Idaho, which spans nine management units: Clark Fork River; Kootenai River; Imnaha-Snake River; Hells Canyon Complex; Coeur d'Alene Lake Basin; Clearwater River; Salmon River; Southwest Idaho (Boise, Payette and Weiser river basins); Little Lost River. More information regarding the management units can be found in the USFWS Bull Trout 2002 Draft Recovery Plan, chapters 3, 4, 12, 13, 15, 16, 17, 18, and 19.

2.3.1.5 Previous Consultations and Conservation Efforts

2.3.1.5.1 Consultations

Consulted-on effects are those effects that have been analyzed through section 7 consultation as reported in a biological opinion. These effects are an important component of objectively characterizing the current condition of the species. To assess consulted-on effects to bull trout, we analyzed all of the biological opinions received by the Region 1 and Region 6 Service Offices from the time of bull trout's listing until August 2003; this summed to 137 biological opinions. Of these, 124 biological opinions (91 percent) applied to activities affecting bull trout in the Columbia Basin population segment, 12 biological opinions (9 percent) applied to activities affecting bull trout in the Coastal-Puget Sound population segment, 7 biological opinions (5 percent) applied to activities affecting bull trout in the Klamath Basin population segment, and one biological opinion (< 1 percent) applied to activities affecting the Jarbidge and St. Mary-Belly population segments (Note: these percentages do not add to 100, because several biological opinions applied to more than one population segment). The geographic scale of these consultations varied from individual actions (e.g., construction of a bridge or pipeline) within one basin to multiple-project actions occurring across several basins.

Our analysis showed that we consulted on a wide array of actions which had varying levels of effect. Many of the actions resulted in only short-term adverse effects, some with long-term beneficial effects. Some of the actions resulted in long-term adverse effects. No actions that have undergone consultation were found to appreciably reduce the likelihood of survival and recovery of the bull trout. Furthermore, no actions that have undergone consultation were anticipated to result in the loss of local populations of bull trout.

2.3.1.5.2 Regulatory mechanisms

The implementation and effectiveness of regulatory mechanisms vary across the coterminous range. Forest practices rules for Montana, Idaho, Oregon, Washington, and Nevada include streamside management zones that benefit bull trout when implemented.

2.3.1.5.3 State Conservation Measures

State agencies are specifically addressing bull trout through the following initiatives:

- Washington Bull Trout and Dolly Varden Management Plan developed in 2000.
- Montana Bull Trout Restoration Plan (Bull Trout Restoration Team appointed in 1994, and plan completed in 2000).
- Oregon Native Fish Conservation Policy (developed in 2004).
- Nevada Species Management Plan for Bull Trout (developed in 2005).
- State of Idaho Bull Trout Conservation Plan (developed in 1996). The watershed advisory group drafted 21 problem assessments throughout Idaho which address all 59 key watersheds. To date, a conservation plan has been completed for one of the 21 key watersheds (Pend Oreille).

2.3.1.5.4 Habitat Conservation Plans

Habitat Conservation Plans (HCP) have resulted in land management practices that exceed State regulatory requirements. Habitat conservation plans addressing bull trout cover approximately 472 stream miles of aquatic habitat, or approximately 2.6 percent of the Key Recovery Habitat across Montana, Idaho, Oregon, Washington, and Nevada. These HCPs include: Plum Creek Native Fish HCP, Washington Department of Natural Resources HCP, City of Seattle Cedar River Watershed HCP, Tacoma Water HCP, and Green Diamond HCP.

2.3.1.5.5 Federal Land Management Plans

PACFISH is the "Interim Strategy for Managing Anadromous Fish-Producing Watersheds and includes Federal lands in Western Oregon and Washington, Idaho, and Portions of California." INFISH is the "Interim Strategy for Managing Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana, and Portions of Nevada." Each strategy amended Forest Service Land and Resource Management Plans and Bureau of Land Management Resource Management Plans. Together PACFISH and INFISH cover thousands of miles of waterways within 16 million acres and provide a system for reducing effects from land management activities to aquatic resources through riparian management goals, landscape scale interim riparian management objectives, Riparian Habitat Conservation Areas (RHCAs), riparian standards, watershed analysis, and the designation of Key and Priority watersheds. These interim strategies have been in place since 1992 and are part of the management plans for Bureau of Land Management and Forest Service lands.

The Interior Columbia Basin Ecosystem Management Plan (ICBEMP) is the strategy that replaces the PACFISH and INFISH interim strategies when federal land management plans are revised. The Southwest Idaho Land and Resource Management Plan (LRMP) is the first LRMP under the strategy and provides measures that protect and restore soil, water, riparian and aquatic resources during project implementation while providing flexibility to address both short- and long-term social and economic goals on 6.6 million acres of National Forest lands. This plan includes a long-term Aquatic Conservation Strategy that focuses restoration funding in priority subwatersheds identified as important to achieving Endangered Species Act, Tribal, and Clean Water Act goals. The Southwest Idaho LRMP replaces the interim PACFISH/INFISH strategies and adds additional conservation elements, specifically, providing an ecosystem management foundation, a prioritization for restoration integrated across multiple scales, and adaptable active, passive and conservation management strategies that address both protection and restoration of habitat and 303(d) stream segments.

The Southeast Oregon Resource Management Plan (SEORMP) and Record of Decision is the second LRMP under the ICBEMP strategy which describes the long-term (20+ years) plan for managing the public lands within the Malheur and Jordan Resource Areas of the Vale District. The SEORMP is a general resource management plan for 4.6 million acres of Bureau of Land Management administered public lands primarily in Malheur County with some acreage in Grant and Harney Counties, Oregon. The SEORMP contains resource objectives, land use allocations, management actions and direction needed to achieve program goals. Under the plan, riparian areas, floodplains, and wetlands will be managed to restore, protect, or improve their natural functions relating to water storage, groundwater recharge, water quality, and fish and wildlife values.

The Northwest Forest Plan covers 24.5 million acres in Washington, Oregon, and northern California. The Aquatic Conservation Strategy (ACS) is a component of the Northwest Forest Plan. It was developed to restore and maintain the ecological health of watersheds and the aquatic ecosystems. The four main components of the ACS (Riparian Reserves, Watershed Analysis, Key Watersheds, and Watershed Restoration) are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems.

It is the objective of the Forest Service and the Bureau of Land Management to manage and maintain habitat and, where feasible, to restore habitats that are degraded. These plans provide for the protection of areas that could contribute to the recovery of fish and, overall, improve riparian habitat and water quality throughout the basin. These objectives are accomplished through such activities as closing and rehabilitating roads, replacing culverts, changing grazing and logging practices, and re-planting native vegetation along streams and rivers.

2.3.1.6 Conservation Needs

The recovery planning process for the bull trout (USFWS 2002a, p. 49) has identified the following conservation needs (goals) for bull trout recovery: (1) maintain the current distribution of bull trout within core areas as described in recovery unit chapters, (2) maintain stable or increasing trends in abundance of bull trout as defined for individual recovery units, (3) restore and maintain suitable habitat conditions for all bull trout life history stages and strategies, and (4) conserve genetic diversity and provide opportunity for genetic exchange.

The draft bull trout Recovery Plan (USFWS 2002a, p. 62) identifies the following tasks needed for achieving recovery: (1) protect, restore, and maintain suitable habitat conditions for bull trout, (2) prevent and reduce negative effects of nonnative fishes, such as brook trout, and other nonnative taxa on bull trout, (3) establish fisheries management goals and objectives compatible with bull trout recovery, (4) characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout, (5) conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks, (6) use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats, (7) assess the implementation of bull trout recovery by management units, and (8) revise management unit plans based on evaluations.

Another threat now facing bull trout is warming temperature regimes associated with global climate change. Because air temperature affects water temperature, species at the southern margin of their range that are associated with cold water patches, such as bull trout, may become restricted to smaller, more disjunct patches or become extirpated as the climate warms (Rieman et al. 2007, p. 1560). Rieman et al. (2007, pp. 1558, 1562) concluded that climate is a primary determining factor in bull trout distribution. Some populations already at high risk may require "aggressive measures in habitat conservation or restoration" to persist (Rieman et al. 2007, p. 1560). Conservation and restoration measures that would benefit bull trout include protecting high quality habitat, reconnecting watersheds, restoring flood plains, and increasing site-specific habitat features important for bull trout, such as deep pools or large woody debris (Kinsella 2005, entire).

2.3.2 Bull Trout Critical Habitat

2.3.2.1 Legal Status

Ongoing litigation resulted in the U.S. District Court for the District of Oregon granting the Service a voluntary remand of the 2005 critical habitat designation. Subsequently the Service published a proposed critical habitat rule on January 14, 2010 (75 FR 2260) and a final rule on October 18, 2010 (75 FR 63898). The rule became effective on November 17, 2010. A justification document was also developed to support the rule and is available on our website (http://www.fws.gov/pacific/bulltrout). The scope of the designation involved the species' coterminous range, which includes the Jarbidge River, Klamath River, Coastal-Puget Sound, St. Mary-Belly River, and Columbia River population segments (also considered as interim recovery units)[1].

Rangewide, the Service designated reservoirs/lakes and stream/shoreline miles in 32 critical habitat units (CHU) as bull trout critical habitat (see Table 1). Designated bull trout critical habitat is of two primary use types: (1) spawning and rearing; and (2) foraging, migrating, and overwintering (FMO).

[1] The Service's 5 year review (USFWS 2008, p. 9) identifies six draft recovery units. Until the bull trout draft recovery plan is finalized, the current five interim recovery units are in affect for purposes of section 7 jeopardy analysis and recovery. The adverse modification analysis does not rely on recovery units.

Table 1. Stream/shoreline distance and reservoir/lake area designated as bull trout critical habitat by state.

State	Stream/Shoreline Miles	Stream/Shoreline Kilometers	Reservoir/ Lake Acres	Reservoir/ Lake Hectares
Idaho	8,771.6	14,116.5	170,217.5	68,884.9
Montana	3,056.5	4,918.9	221,470.7	89,626.4
Nevada	71.8	115.6	-	-
Oregon	2,835.9	4,563.9	30,255.5	12,244.0
Oregon/Idaho	107.7	173.3	-	-
Washington	3,793.3	6,104.8	66,308.1	26,834.0
Washington (marine)	753.8	1,213.2	-	-
Washington/Idaho	37.2	59.9	-	-
Washington/Oregon	301.3	484.8	-	-
Total	**19,729.0**	**31,750.8**	**488,251.7**	**197,589.2**

Compared to the 2005 designation, the final rule increases the amount of designated bull trout critical habitat by approximately 76 percent for miles of stream/shoreline and by approximately 71 percent for acres of lakes and reservoirs.

This rule also identifies and designates as critical habitat approximately 1,323.7 km (822.5 miles) of streams/shorelines and 6,758.8 ha (16,701.3 acres) of lakes/reservoirs of unoccupied habitat to address bull trout conservation needs in specific geographic areas in several areas not occupied at the time of listing. No unoccupied habitat was included in the 2005 designation. These unoccupied areas were determined by the Service to be essential for restoring functioning migratory bull trout populations based on currently available scientific information. These unoccupied areas often include lower mainstem river environments that can provide seasonally important migration habitat for bull trout. This type of habitat is essential in areas where bull trout habitat and population loss over time necessitates reestablishing bull trout in currently unoccupied habitat areas to achieve recovery.

The final rule continues to exclude some critical habitat segments based on a careful balancing of the benefits of inclusion versus the benefits of exclusion. Critical habitat does not include: (1) waters adjacent to non-Federal lands covered by legally operative incidental take permits for habitat conservation plans (HCPs) issued under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended, in which bull trout is a covered species on or before the publication of this final rule; (2) waters within or adjacent to Tribal lands subject to certain commitments to conserve bull trout or a conservation program that provides aquatic resource protection and restoration through collaborative efforts, and where the Tribes indicated that inclusion would impair their relationship with the Service; or (3) waters where impacts to national security have been identified (75 FR 63898). Excluded areas are approximately 10 percent of the stream/shoreline miles and 4 percent of the lakes and reservoir acreage of designated critical habitat. Each excluded area is identified in the relevant CHU text, as identified in paragraphs (e)(8) through (e)(41) of the final rule. It is important to note that the exclusion of waterbodies from designated critical habitat does not negate or diminish their importance for bull trout conservation. Because exclusions reflect the often complex pattern of land ownership, designated critical habitat is often fragmented and interspersed with excluded stream segments.

2.3.2.2 Conservation Role and Description of Critical Habitat

The conservation role of bull trout critical habitat is to support viable core area populations (75 FR 63943). The core areas reflect the metapopulation structure of bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. CHUs generally encompass one or more core areas and may include FMO areas, outside of core areas, that are important to the survival and recovery of bull trout.

As previously noted, 32 CHUs within the geographical area occupied by the species at the time of listing are designated under the final rule. Twenty-nine of the CHUs contain all of the physical or biological features identified in this final rule and support multiple life-history requirements. Three of the mainstem river units in the Columbia and Snake River basins contain most of the physical or biological features necessary to support the bull trout's particular use of that habitat, other than those physical and biological features associated with Primary Constituent Elements (PCEs) 5 and 6, which relate to breeding habitat (see list below).

The primary function of individual CHUs is to maintain and support core areas, which (1) contain bull trout populations with the demographic characteristics needed to ensure their persistence and contain the habitat needed to sustain those characteristics (Rieman and McIntyre 1993, p. 19); (2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); (3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); and (4) are distributed throughout the historic range of the species to preserve both genetic and phenotypic adaptations (MBTSG 1998, pp. 13-16; Rieman and Allendorf 2001, p. 763; Rieman and McIntyre 1993, p. 23).

The Olympic Peninsula and Puget Sound CHUs are essential to the conservation of amphidromous bull trout, which are unique to the Coastal-Puget Sound population segment. These CHUs contain marine nearshore and freshwater habitats, outside of core areas, that are used by bull trout from one or more core areas. These habitats, outside of core areas, contain PCEs that are critical to adult and subadult foraging, migrating, and overwintering.

In determining which areas to propose as critical habitat, the Service considered the physical and biological features that are essential to the conservation of bull trout and that may require special management considerations or protection. These features are the PCEs laid out in the appropriate quantity and spatial arrangement for conservation of the species. The PCEs of designated critical habitat are:

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

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.

3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and un-embedded substrates, to provide a variety of depths, gradients, velocities, and structure.

5. Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

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.

7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departures from a natural hydrograph.

8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

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.

2.3.2.3 Current Rangewide Condition of Bull Trout Critical Habitat

The condition of bull trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (67 FR 71240). This condition reflects the condition of bull trout habitat.

The primary land and water management activities impacting the physical and biological features essential to the conservation of bull trout include timber harvest and road building, agriculture and agricultural diversions, livestock grazing, dams, mining, urbanization and residential development, and nonnative species presence or introduction (75 FR 2282).

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PCEs, those which appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows:

1. Fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Dunham and Rieman 1999, p. 652; Rieman and McIntyre 1993, p. 7).

2. Degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989, p. 141; MBTSG 1998, pp. ii - v, 20-45).

3. The introduction and spread of nonnative fish species, particularly brook trout and lake trout, as a result of fish stocking and degraded habitat conditions, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary et al. 1993, p. 857; Rieman et al. 2006, pp. 73-76).

4. In the Coastal-Puget Sound region where amphidromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine nearshore foraging and migration habitat due to urban and residential development.

5. Degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

The bull trout critical habitat final rule also aimed to identify and protect those habitats that provide resiliency for bull trout use in the face of climate change. Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features described in PCEs 1, 2, 3, 5, 7, 8, and 9. Protecting bull trout strongholds and cold water refugia from disturbance and ensuring connectivity among populations were important considerations in addressing this potential impact. Additionally, climate change may exacerbate habitat degradation impacts both physically (e.g., decreased base flows, increased water temperatures) and biologically (e.g., increased competition with nonnative fishes).

2.4 Environmental Baseline of the Action Area

This section assesses the effects of past and ongoing human and natural factors that have led to the current status of the species, its habitat and ecosystem in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have already undergone section 7 consultations, and the impacts of state and private actions which are contemporaneous with this consultation. The two broad indicators most relevant to addressing effects to bull trout are those addressing sediment delivery to the stream, and physical barriers. Other indicators may be affected by the action, but effects are not considered as pertinent relative to the actions being addressed in the Program. Therefore, for the remainder of the baseline and effects sections below, discussions will focus on these two broad indicators.

2.4.1 Bull Trout

2.4.1.1 Status of the Bull Trout in the Action Area

Bull trout in the action area occur within the 38 subbasins (4th field Hydrologic Units or HU) identified in Figures 1 and 2 and listed in Table 2. Major river basins in the action area include the mainstem Snake River, Weiser, Boise, Payette, Salmon, Little Lost, Lemhi, Pahsimeroi, Clearwater, Kootenai, Clark Fork, Priest, Bruneau and Jarbidge. The status of bull trout populations within these basins varies widely, and resident, adfluvial, and fluvial migratory populations can all be found within the action area. We do not have reliable abundance data for all these basins, but we can characterize them in a qualitative way based on number of local populations and some complete abundance information. For the purposes of this document, strong populations are those that are well distributed and relatively abundant within the capability of the watersheds in which they exist. The Clearwater, Kootenai, Salmon, Pahsimeroi, and Little Lost basins have bull trout populations in a variety of conditions, including some that are relatively strong (areas with 2,500 to 5,000 adults or more). The Jarbidge, Boise, Payette, and Lemhi basins also have bull trout populations in a variety of conditions, with each basin's abundance best characterized as moderate (approximately 500 adults). Populations in the Weiser, Pend Oreille (River), Clark Fork, Priest, and the Snake River Hells Canyon basins are weak, with less than 500 adults in each basin. This is significantly lower than the numbers necessary for recovery or long-term persistence of the species in these areas (Rieman and Allendorf 2001, p. 756; USFWS 2005, p. 32). It is not practical or necessary in the context of this programmatic consultation to present detailed information regarding the status of each bull trout population within the action area. Site specific information will be made available to the Level 1 teams on a project by project basis.

During crossing replacements or removals it is possible that resident and migratory (fluvial or adfluvial) life history forms, and adult, subadult, and juvenile age classes of bull trout may be present in the area where individual actions are implemented. Presence will be evaluated during project design. Migratory adult bull trout may be moving downstream through a particular project site, resident adult bull trout may be present in or moving throughout the project site, and juvenile bull trout may be rearing in the stream near the project site. The life history stage that is present at a particular site will be determined and documented in the pre-project checklist. Some projects under the Program may be implemented in areas where bull trout are not present but where other listed fish or critical habitat exists.

2.4.1.2 Factors Affecting the Bull Trout in the Action Area

As previously described in the Status of the Species section of this Opinion, bull trout distributions, abundance, and habitat quality have declined rangewide primarily from the combined effects of habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, angler harvest, entrainment, and introduced non-native fish species such as brook trout. There are numerous natural and anthropogenic influences on bull trout throughout the state of Idaho. Although restoration actions, including culvert removals conducted under the previous consultation effort, and ongoing research efforts have positively affected bull trout, the majority of anthropogenic influences have contributed to the species decline by reducing bull trout numbers, reproduction, and distribution.

For more information regarding factors affecting specific core areas within the action area, please refer to the individual chapters in the Service's 2002 Bull Trout Draft Recovery Plan for the Columbia River (USFWS 2002a, entire) and the 2004 Jarbidge River Draft Recovery Plan (USFWS 2004a, entire; Allen et al. 2010, entire). The individual chapters in the Service's draft plans identified the categories of activities that have had the most significant adverse impacts on bull trout in recovery unit. In the Boise, Payette, and Weiser River basins (Southwest Idaho Recovery Unit), these factors include dams, forest management practices, livestock grazing, agricultural practices, transportation networks, mining, fisheries management, residential development and urbanization. In the Salmon River basin, livestock grazing, logging, roads, mining, noxious weeds, and irrigation withdrawals were identified. In the Clearwater River basin, operation and maintenance of dams and other water diversions, forest management practices, livestock grazing, agriculture, road construction and maintenance, mining and noxious weeds are factors affecting the species. The Kootenai River and Clark Fork (including Lake Pend Oreille and Priest Lake) basins have been impacted by isolation and habitat fragmentation caused by dams, forestry management practices, livestock grazing, agricultural practices, channelization, transportation networks, mining, residential development, fisheries management, and invasive species. Effects in the Hells Canyon Recovery Unit were primarily related to large hydroelectric dams, land management activities, water diversions, mining, timber harvest, road construction and crossings, grazing, and the presence of brook trout. Elevated stream temperatures, fish passage barriers, brook trout, and fish angling were identified in the Little Lost River basin. The Jarbidge is impacted by dams and diversions, increasing water temperatures, forest management practices, livestock grazing, transportation networks, mining, residential development, fisheries management, isolation and fragmentation, recreation, and naturally occurring events.

Baseline conditions for all listed fish and designated critical habitat are described using the basic concepts of the USFWS and NOAA Fisheries Service matrix of pathways and indicators (USFWS and NMFS 1998, entire). Variations of these matrices have been developed to assess ecosystem processes, depending on specific administrative units, scale, and other adaptations. Programmatic examples set by the biological assessment for the Forest Service Region 6 Fish Passage Restoration (USFS 2003b, entire); and the biological assessment for the Southwest Idaho Ecogroup Land and Resource Management Plan Revisions (USFS 2003a, entire) will be followed. See Appendix D of the Assessment for explanation of matrix indicators and definition of reference values.

Table 2 describes the status of sediment and physical barrier indicators for all the subbasins in the action area. The sediment and physical barrier indicators are described as Functioning Appropriately (FA), Functioning at Risk (FR), or Functioning at Unacceptable Risk (FUR): they are the two main watershed condition indicators that may be affected by the Program and they subsequently have the potential to affect chemical contaminants (through sediment) and substrate embeddedness (through sediment). Additional indicators will not be assessed in this Opinion because programmatic actions are not expected to affect them.

Table 2. Subbasins within the Action Area and Watershed Condition Indicator Status

Subbasin		Watershed Condition Indicators[1]	
4th HU	Subbasin Name (primary ownership)	Sediment	Barriers
17050111	N Middle Fork Boise (FS)	FUR	FUR
17050112	Boise-Mores (FS)	FR	FUR
17050113	South Fork Boise (FS)	FR	FUR
17050115	M Snake-Payette (BLM)	FR	FUR
17050120	South Fork Payette (FS)	FUR	FUR
17050121	Middle Fork Payette (FS)	FUR	FUR
17050122	Payette (BLM)	FUR	FUR
17050123	North Fork Payette (FS)	FUR	FUR
17050124	Weiser River (FS)	FUR	FUR
17050201	Brownlee (FS)	FR	FR
17060101	Hells Canyon (FS)	FR	FR
17060103	L Snake-Asotin (BLM)	FR	FA
17050102	Bruneau (BLM)	FR	FA
17040217	Little Lost (BLM)	FR	FR
17060201	Upper Salmon (FS)	FR	FUR
17060202	Pahsimeroi (BLM)	FR	FUR
17060203	M Salmon-Panther (FS)	FR	FR
17060204	Lemhi River (BLM)	FR	FR
17060205	U M Fork Salmon (FS)	FR	FA
17060206	L Mid Fork Salmon (FS)	FR	FA
17060207	M Salmon-Chamberlain (FS)	FR	FA
17060208	South Fork Salmon (FS)	FR	FR
17060209	Lower Salmon (FS)	FR	FA
17060210	Little Salmon (FS)	FUR	FUR
17060301	Upper Selway (FS)	FA	FA
17060302	Lower Selway (FS)	FR	FR
17060303	Lochsa (FS)	FUR	FUR
17060304	M Fork Clearwater (FS)	FUR	FR
17060305	S Fork Clearwater (FS)	FUR	FR
17060306	Mainstem Clearwater (BLM)	FUR	FA
17060307	Lower NF Clearwater (FS)	FUR	FR
17060308	Upper NF Clearwater (FS)	FR	FUR
17010101	Middle Kootenai (FS)	FA	FA
17010104	Lower Kootenai (FS)	FR	FA
17010213	Lower Clark Fork (FS)	FA	FA
17010214	Pend Oreille Lake (FS)	FR	FA
17010215	Priest (FS)	FR	FR
17010304	St. Joe River (FS)	FR	FUR

[1]FUR = functioning at unacceptable risk; FR = functioning at risk; FA = functioning appropriately. See Appendix D of the Assessment for details regarding the rating classifications.

Overall watershed conditions (which are characterized by various habitat elements, including substrate conditions and sediment delivery) are functioning at risk or unacceptable risk in most of the subbasins (Table 2), but may vary substantially within each subbasin. Continued effects from past land use activities – such as mining, grazing, road construction and locations, and timber harvest – degrade overall watershed conditions. Road densities and locations contribute to degraded conditions because of their effect on sediment delivery and riparian conditions. There are approximately 2,000-2,500 barriers and an undoubtedly greater number of undersized crossings, which have a higher risk of failure, within the project area. Chronic sediment production and potential sediment delivery due to crossing failures is currently very high. Water quality is continually affected by sediment throughout the region.

Passage barriers and undersized culverts not only act as barriers to fish passage but also contribute to increased sediment in stream channels. The constricted flows at culverts or bridges are largely due to poor installation or undersized structures. In many instances high water velocities amplified by undersized culverts have created large scour pools at the culvert discharge point, altering the stream elevation below the natural gradient. Over time, culverts become elevated above the stream and create a physical barrier to fish passage. In other cases, water also drains under and around culverts, and migrating fish attempting to follow these flows can become stranded or impinged against the culvert or road fill.

Physical Barriers are functioning at risk or unacceptable risk in most subbasins throughout Idaho, but may vary substantially within each subbabin, and is the driving purpose of this Program. Subbasins with wilderness areas tend to have fewer passage barriers because of the lower road densities. In combination with physical barriers on Federal lands, there are a significant number of culverts that are physical barriers on non-Federal lands throughout Idaho, fragmenting habitats and fish populations even further. Road crossings that create barriers to fish passage usually result from installation of culverts that are undersized and placed at the wrong slope. This can lead to high flow velocities within the culvert and outlet drops at culverts that exceed the jump heights of fish, both of which may act as barriers to fish passage.

In addition to habitat fragmentation related to culverts, agricultural practices, such as water diversions and dewatering of stream reaches for irrigation, create migration barriers throughout western states. Even more, the larger hydroelectric, flood-control, and irrigation dams contribute to the isolation of numerous resident fish populations and block historical habitat to both resident and anadromous salmonids.

It is important to note that watershed condition ratings do not necessarily capture the range of conditions within that watershed or subbasin. For the Program considered here it is not readily feasible to accurately characterize watershed conditions at a finer scale than the overall watershed, but we do recognize the range of conditions that occur within and across each watershed. Effects associated with the Program will also vary and the risks to bull trout from a given action will be affected by the baseline watershed conditions where the action takes place.

2.4.2 Bull Trout Critical Habitat

2.4.2.1 Status of Bull Trout Critical Habitat in the Action Area

The Service published a final rule designating critical habitat for bull trout rangewide on October 18, 2010 (effective November 17, 2010). Figure 3, below, shows bull trout critical habitat within the action area. In Idaho, there are 8,771.6 stream miles of critical habitat and 170,217.4 lake or reservoir acres designated. Most of the critical habitat occurs on federal lands managed by the Forest Service or Bureau. For more information regarding critical habitat across the state of Idaho, see section 2.3.2 of this Opinion. Across the action area, streams may provide spawning and rearing critical habitat or foraging, migrating, and overwintering (FMO) critical habitat, depending on site specific stream characteristics and local bull trout population life history expressions. Effects of the Program on critical habitat will often depend on what kind of critical habitat is provided at the specific project site. It is not practical or necessary in the context of this programmatic consultation to present detailed information regarding the status of critical habitat throughout the action area. Site specific information will be made available to the Level 1 teams on a project by project basis.

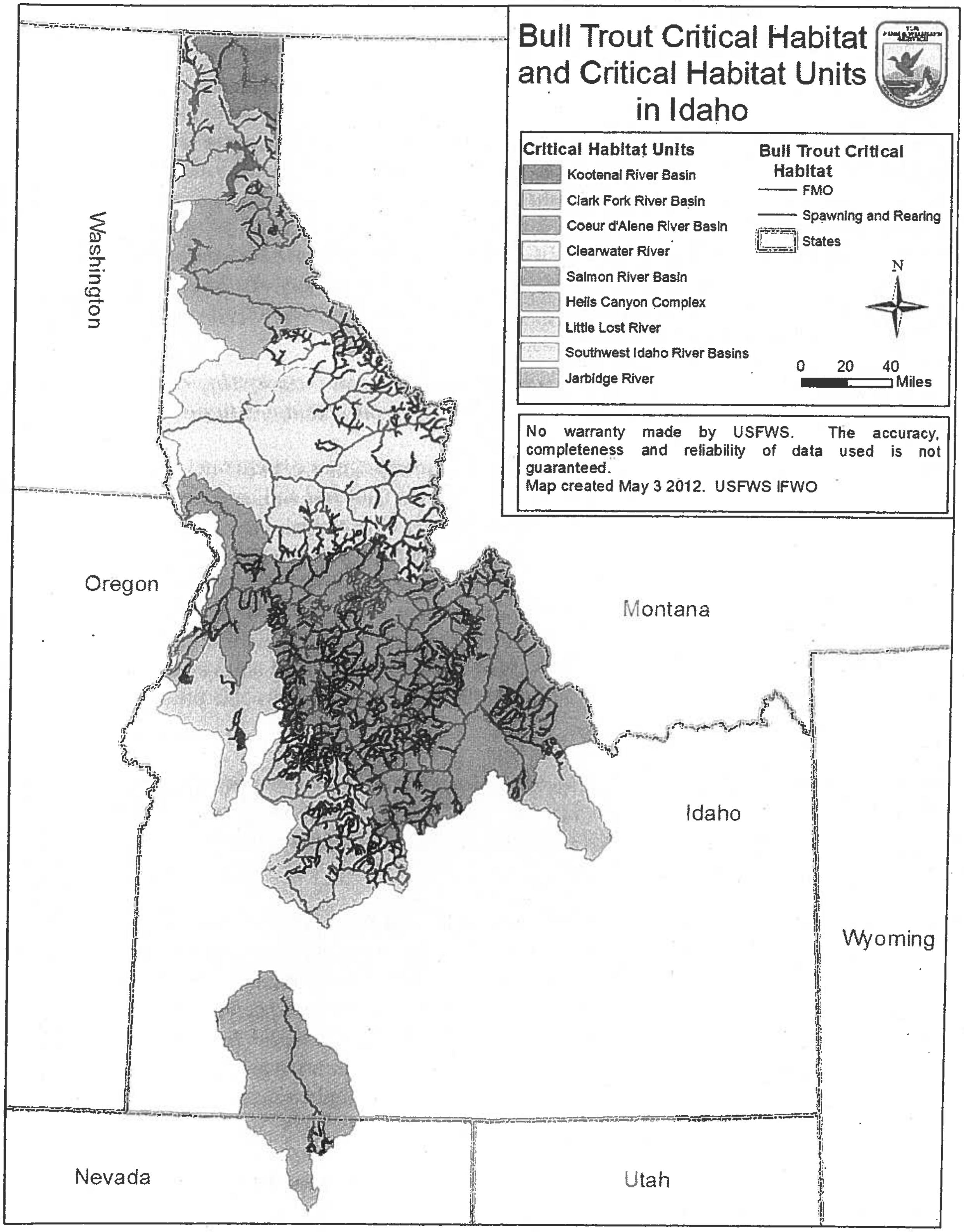

Figure 3. Bull Trout Critical Habitat and Core Areas in the Action Area

2.4.2.2 Factors Affecting Bull Trout Critical Habitat in the Action Area

Primary constituent elements (PCEs) (see Section 2.3.2.2) are used to describe biological and physical habitat features that are essential to the conservation of bull trout. The matrix of watershed condition indicators, as summarized in Table 2, provides a means to assess the baseline condition of the PCEs in the action area and the potential effects of the action on the PCEs. Analysis of the habitat indicators can provide a thorough evaluation of the existing baseline condition and potential project impacts to the PCEs of proposed critical habitat for bull trout. Table 3 shows the relationship between the PCEs for bull trout critical habitat and the habitat indicators. The following, for informational purposes and for analysis of effects to PCEs, describe how the indicators are related to evaluating the function of each PCE for proposed bull trout critical habitat. The information is summarized in Table 3.

1. ***Springs, seeps, groundwater sources, and subsurface water connectivity (hyporehic flows) to contribute to water quality and quantity and provide thermal refugia.***

The analysis of *floodplain connectivity* considers the hydrologic linkage of off-channel areas with the main channel and overbank-flow maintenance of wetland function and riparian vegetation and succession. Floodplain and riparian areas provide hydrologic connectivity for springs, seeps, groundwater upwelling and wetlands and contribute to the maintenance of the water table. The analysis of *changes in peak/base flows* addresses subsurface water connectivity and *substrate embeddedness* addresses inter-gravel flows. *Increase in drainage network* and *road density and location* address potential changes to groundwater sources and subsurface water connectivity. *Streambank condition*, *floodplain connectivity* and *riparian conservation areas* address groundwater influence. *Chemical contamination/nutrients* address concerns regarding groundwater water quality.

2. ***Migratory 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.***

Physical, biological or chemical barriers to migration are addressed directly through water quality habitat indicators, including *temperature*, *sediment*, *chemical contamination/nutrients* and *physical barriers*. The analysis of these indicators assess whether barriers have been created due to impacts such as high temperatures or high concentrations of turbidity or contaminants. Analysis of *change in peak/base flows* and *average wetted width/maximum depth ratio* assess whether changes in flow might create a seasonal barrier to migration. An analysis of *refugia* considers the habitat's ability to support strong, well distributed, and connected populations for all life stages and forms of bull trout.

3. ***An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.***

Floodplain connectivity and *riparian conservation areas* provide habitat to aquatic invertebrates, which in turn provide a forage base for bull trout. *Pool frequency and quality* and *substrate embeddedness* contributes to the variety and density of aquatic invertebrates and other fish species. Changes in *temperature*, *sediment*, and *chemical contaminants and nutrients* affect aquatic invertebrate production, floodplain and riparian areas provide habitat to aquatic invertebrates, which in turn provide a forage base for bull trout. The combined analyses of all the Matrix habitat indicators and the other seven PCEs provide information to assess whether there is an abundant food base in the analysis area. Therefore, any impairment to the food base will be addressed by way of summarizing the biological and habitat indicators.

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 increases channel complexity and creates pools and undercut banks, so the analysis of the current amounts and sources of *large woody debris* available for recruitment is pertinent to this PCE. *Pool frequency and quality* considers the number of pools per mile as well as the amount of cover and temperature of water in the pools. *Average wetted width/maximum depth ratio* is an indicator of channel shape and pool quality. Low ratios suggest deeper, higher quality pools. *Large pools,* consisting of a wide range of water depths, velocities, substrates and cover, are typical of high quality habitat and are a key component of channel complexity. Analysis of *off-channel habitat* describes side-channels and other off-channel areas. *Streambank condition* analyzes the stability of the banks, including features such as undercut banks. The analysis of riparian *conservation areas* and *floodplain connectivity, disturbance history, and disturbance regime* includes the maintenance of habitat and channel complexity, the recruitment of large woody debris, and the connectivity to off-channel habitats or side channels. Complex habitats provide refugia for bull trout and in turn, analysis of *refugia* assesses complex stream channels. All of these habitat indicators consider the numerous characteristics of instream bull trout habitat and quantify critical components that are fundamental to creating and maintaining complex in-stream habitat over time.

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. Specific temperatures within this range will vary depending on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shade, such as that provided by riparian habitat; and local groundwater influence.***

This PCE is addressed directly by the analysis of *temperature*. It is also addressed through consideration of *refugia*, which by definition is high quality habitat of appropriate temperature. Availability of refugia is also considered in analysis of *pool frequency and quality* and *large pools*. *Average wetted width/maximum depth ratio* is an indication of water volume, which indirectly indicates water temperature, i.e., low ratios indicate deeper water, which in turn indicates possible refugia. This indicator in conjunction with *change in peak/base flows* is an indicator of potential temperature and refugia concerns particularly during low flow periods. *Streambank condition, floodplain connectivity, road density and location* and *riparian* *conservation areas* address the components of shade and groundwater influence, both of which are important factors of water temperature. Stable streambanks and intact riparian areas, which include part of the floodplain, typically support adequate vegetation to maintain thermal cover to streams during low flow periods. *Road density and location* addresses the potential contributions of warm water discharges from stormwater ponds.

6. ***Substrates 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 (e.g., less than 12 percent) of fine substrate less than 0.85 mm (0.03 in.) in diameter and minimal embeddedness of these fines in larger substrates are characteristic of these conditions.***

The analyses for *sediment* and *substrate embeddedness* assess substrate composition and stability in relation to the various life stages of the bull trout as well as the sediment transportation and deposition. *Large woody debris* and *pool frequency and quality* affect sediment transport and redistribution within a stream and assessment of these indicators will clarify substrate composition and amounts. Analysis of *streambank condition* will provide insight into the amount of fine sediment contribution.

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.***

The analysis of *change in peak/base flows* considers changes in hydrograph amplitude or timing with respect to watershed size, geology, and geography. Analyses of *floodplain connectivity, increase in drainage network, road density and location, disturbance history*, and *riparian conservation areas* provides further information regarding possible interruptions in the natural stream hydrology. *Floodplain connectivity* considers the hydrologic linkage of off-channel areas with the main channel. Roads and vegetation management both have effects strongly linked to a stream's hydrograph. *Disturbance regime* ties this information together to consider how a watershed reacts to disturbance and the time required to recover back to pre-disturbance conditions.

8. ***Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.***

The quantity of permanent water will be considered in the analyses for PCE 4 natural hydrograph and PCE 5 springs, seeps, and groundwater, which include *floodplain connectivity, changes in peak/base flows, drainage network increase, disturbance history,* and *disturbance regime*. Analysis of *temperature, sediment, and chemical contaminates and nutrients* consider the quality of permanent water. Current listing under 303(d) and 305(d) status should be considered, as well as the causes for that listing. Analysis pertinent to sediment should address turbidity.

9. ***Few or no nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass; inbreeding (e.g., brook trout); or competitive (e.g., brown trout) species present.***

This PCE is addressed in terms of the subpopulation characteristics, as analyzed in *life history and diversity* and *persistence and genetic integrity*. 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. Analysis of these indicators and the associated baseline provides an understanding of biological implications of non-native species. Non-native species can be affected by changed habitat conditions in a subwatershed and the population status can provide information on the existing condition of a local population.

Table 3. The Primary Constituent Elements and Associated Watershed Condition Indicators

PCE	PCE Description	Watershed Indicators
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.
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
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
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.
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.
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.
7	A natural hydrograph, including peak, high, low, and base flows within historic and	Floodplain connectivity, flow/ hydrology (changes in peak /base flows and drainage network increase),

PCE	PCE Description	Watershed Indicators
	seasonal ranges or, if flows are controlled, they minimize departures from a natural hydrograph.	watershed conditions (road density 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.
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.

Factors affecting critical habitat are similar to those described above under the species. It is not feasible to provide a detailed accounting of factors affecting each critical habitat unit within the action area, nor is it necessary under this programmatic effort. Pre-project checklists and discussions within Level 1 teams will cover site specific factors for each project conducting under the Program. Table 2 provides summary information regarding the condition of the sediment and physical barrier indicators for all subbasins within the action area, and shows that for most of the subbasins the two indicators are functioning at risk or not functioning appropriately. These two indicators are the primary watershed condition indicators, along with the subsequent effects to chemical contaminants and substrate embeddedness that may be affected during project implementation. Substrate and physical barriers are therefore the two watershed condition indicators that are the focus of the affects analysis. It is assumed herein that for projects completed under the Program that will occur within bull trout critical habitat, PCE #2 is impaired to some degree. Project sites are likely crossings that impede migration either through complete upstream blockage (blockage may also occur seasonally or may variably affect size classes of bull trout) or by leading to water quality conditions that impede migration. Migration barriers on poorly designed roads/trails, and overall habitat connectivity, are the most important limiting factors being addressed in this Program.

Changes in hydrology and temperature caused by changing climate have the potential to negatively impact aquatic ecosystems in Idaho, with salmonid fishes being especially sensitive. Average annual temperature increases due to increased carbon dioxide are affecting snowpack, peak runoff, and base flows of streams and rivers (Mote et al. 2003, p. 45). Increases in water temperature may cause a shift in the thermal suitability of aquatic habitats (Poff et al. 2002, p. iii). For species that require colder water temperatures to survive and reproduce, warmer temperatures could lead to significant decreases in available suitable habitat. Increased frequency and severity of flood flows during winter can affect incubating eggs and alevins in the streambed and over-wintering juvenile fish. Eggs of fall spawning fish, such as bull trout, may suffer high levels of mortality when exposed to increased flood flows (Independent Scientific Advisory Board 2007, p. iv).

2.5 Effects of the Proposed Action

Effects of the action considers the direct and indirect effects of an action on the listed species and/or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species. Direct effects are defined as those that result from the proposed action and directly or immediately impact the species or its habitat. Indirect effects are those that are caused by, or will result from, the proposed action and are later in time, but still reasonably certain to occur. An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation.

2.5.1 Bull Trout

2.5.1.1 Direct and Indirect Effects of the Proposed Action

Activities that occur as part of this Program have the potential to affect four watershed indicators, or habitat conditions, including: sediment/turbidity, chemical contamination/nutrients and substrate embeddedness (all sediment related); and physical barriers. Although the Program may affect chemical contamination/nutrients indicator, those effects are expected to be related to sediment as the potential pollutant of concern, and chemical leaks from equipment. Substrate embeddedness may be also be affected by sediments released during activities. Accordingly, our analysis is focused on sediment related effects and temporary (occurring during construction phase) passage barrier effects. Changes to these habitat conditions are likely to adversely affect bull trout that may be present at project sites in occupied habitats. In addition to effects to habitat, direct effects to bull trout may occur during fish clearing operations and from increased turbidity downstream of projects. All potential effects to both habitat conditions and bull trout will be short term in nature with beneficial or neutral impacts to habitat following project completion.

The Service does not expect that every project carried out under the Program will have adverse effects to bull trout. Even for projects in occupied habitats there will be a range of effects depending on the size of the stream, the geology of the basin, soil types, condition of the riparian area, the type of crossing project, the nature of bull trout use at the project site, the ability of fish to escape to unaffected areas, the type of habitat provided at the site, and other factors. In some cases the effects to bull trout will be insignificant because of their limited extent or discountable when fish are unlikely to be present or absent. In other circumstance, such as a project going in occupied spawning and rearing habitat, the temporary (occurring during project implementation) effects are likely to be adverse. The programmatic nature of this consultation limits our ability to consider the site specific factors. For the section 7(a)(2) analysis of this Program, it is prudent to anticipate that every project that occurs in occupied habitat has equal potential to affect bull trout, and that effects of similar magnitude and duration will occur at each project in occupied habitat. Accordingly, we have analyzed what we consider to represent the most severe effects expected to occur throughout the action area.

The Assessment (pp. 15-24) identifies seven construction phases that may occur for any given project implemented under this Program. These include: site preparation, fish avoidance, dewatering, construction activities, flow reintroduction, site rehabilitation, and maintenance. For a complete list of construction procedures, sequences and design features intended to minimize effects to listed fish species, refer to the Assessment, pp. 14-25.

Each of these construction phases may have a different likelihood of producing conditions that adversely affect bull trout, which will depend on site specific conditions. In the discussion of potential effects described below we identify the particular construction phase and component that is most likely to be associated with that effect, if it is known. Table 4 summarizes effects to watershed condition indicators. The term "short-term" is used to describe potential effects that may occur within one year of project implementation while "long-term" describes effects occurring beyond one year post-construction to allow for the action to be exposed to a full range of seasonal conditions. An "X" signifies that the watershed condition indicator will be maintained and no significant effects to the indicator are expected.

Table 4. Watershed Condition Indicators and Effects of Program Actions

Watershed Condition Indicators	Effects of the Program Actions		
	Degrade	Maintain	Restore
Water Quality			
Temperature		X	
Sediment	Short-Term		Long-Term
Chemical Contaminants/Nutrients	Short-Term		Long-Term
Habitat Access			
Physical Barriers	Short-Term		Short- and Long-Term
Habitat Elements			
Substrate Embeddedness	Short-Term		Long-Term
Large Woody Debris		X	
Pool Character and Quality		X	
Off Channel Habitat		X	
Refugia			Long-Term
Channel Condition /Dynamics			
Width/Depth Ratios		X	
Streambank Condition		X	
Floodplain Connectivity		X	
Flow/ Hydrology			
Changes in Peak/Base Flows		X	

Watershed Condition Indicators	Effects of the Program Actions		
	Degrade	Maintain	Restore
Drainage Network Increase		X	
Watershed Conditions			
Road/Density/Location		X	
Distrubance history		X	
Disturbance Regime/History			Long-Term
Riparian Reserves		X	
Bull Trout Population Characteristics			
Subpopulation Size	Short-Term		Long-Term
Growth and Survival			Long-Term
Life History			Long-Term
Genetic Integrity			Long-Term

2.5.1.1.1 Beneficial Effects to Bull Trout and Bull Trout Critical Habitat

It is important to note that the explicit purpose of the Program is to restore fish passage and improve aquatic function at degraded sites within the action area. All potential adverse effects are expected to be short term (less than a year) in nature and projects completed under this Program are expected to have beneficial effects for bull trout. Most watershed condition indicators, as shown in Table 4 are not expected to be affected by individual projects. The following list identifies the expected beneficial effects to bull trout when projects are completed under the Program.

1. Passage rehabilitation and improved connectivity between habitats upstream and downstream of the existing road crossing.
2. Improved potential for genetic exchange.
3. Improved stream functioning (physical characteristics and processes), including bedload and woody debris material transport.
4. Increased availability and diversity of habitat for bull trout, including potential refugia.
5. Restoration of natural bedload size and quantity capacity in road crossing structure.
6. Decreased habitat disturbance associated with regular maintenance at undersized crossings and decreased sediment delivery.
7. Decreased potential for roadfill failure and associated sedimentation.

This action will address population and habitat fragmentation factors that contributed to the federal listing of the bull trout. Implementation of this action could restore connectivity and passage for up to 1,560 culverts (and an unspecified number of miles of habitat) over the next 10 years. Connectivity has been identified by the Service as a critical need for enhancing the likelihood of survival and recovery of bull trout. Restoring passage through culverts and other structures will provide access to historically important habitat, which will result in immediate expansions in the distribution of bull trout in some cases while, in other cases, this action will restore connectivity between existing bull trout subpopulations. In either case, the Service expects this action to improve the number, distribution, and reproductive potential of bull trout in Idaho despite anticipated short-term adverse effects to bull trout and bull trout critical habitat.

2.5.1.1.2 Sediment Related Effects

A short-term increase in suspended and deposited sediment, and associated stream turbidity, is expected when crossings are removed or replaced under this Programmatic. Program activities that may cause sediment input to the stream and increased sediment include: site preparation, dewatering the stream, construction activities, reintroduction of flow, and maintenance activities. Sediment controls measures associated with these actions will minimize effects, but will not capture all sediment that is released by the activities. Increased turbidity and sediment deposition will likely occur downstream of each project site, the severity and extent of which depends on site specific factors such as flow, geology, substrate, slope, etc.

General Sediment Effects

Sediment is a very important stressor to salmonids and can affect them in both direct and indirect ways. Bull trout are highly susceptible to sediment inputs and require the lowest turbidity and suspended sediment levels of all salmonids for spawning, incubation, and juvenile rearing. The Service knows of no positive effects to salmonids from increased sediment; while the potential negative impacts of increased suspended sediment on bull trout and other salmonids have been well documented (e.g., Bakke et al. 2002, p.1; Newcombe and MacDonald 1991, pp. 72-73; Newcombe and Jensen 1996, p. 700-715, Bash et al. 2001, p. 24).

Increased sediment and suspended solids have the potential to affect primary production and benthic invertebrate abundance, due to reductions in photosynthesis within murky waters. Thus, food availability for fish may be reduced as sediment levels increase (Cordone and Kelley 1961, pp. 189-190; Lloyd et al. 1987, p. 18; Henley et al. 2000, pp. 129-133). Sediment can also reduce health of in-stream plants, reducing cover for fish making them more vulnerable to predation (Waters 1995, pp. 111-116). Pools, which are an essential habitat type, can be filled by sediment and degraded or lost (Megahan 1982, p. 114).

Increases in suspended sediment have been shown to affect salmonid behavior in several ways. Social (Berg and Northcote 1985, p. 1410) and feeding behavior can be disrupted by increased levels of suspended sediment. Fish may avoid high concentrations of suspended sediments altogether (Hicks et al. 1991, p. 483-485). Even small elevations in suspended sediment may reduce feeding efficiency and growth rates of some salmonids (Sigler et al. 1984, p. 142). Based on their experiments with juvenile rainbow trout (*Oncorhynchus mykiss)*, Suttle et al. (2004, p. 973) concluded that "fine sediment deposition, even at low concentrations, can decrease growth and survival of juvenile salmonids." They found "no threshold below which fine-sediment addition is harmless."

Sediment introduced into streams does not just adversely affect fish at an individual physical level but can adversely affect fish populations. Deposition of silt on spawning beds can fill interstitial spaces in spawning areas with sediment (Phillips et al. 1975, p. 461; Myers and Swanson 1996, p. 245; Wood and Armitage 1997, p. 203) impeding water flow, reducing dissolved oxygen levels, and restricting waste removal which reduces the survival of fish embryos (Chapman 1988, pp. 1-5; Bjornn and Reiser 1991, p. 98).

Newcombe and Jensen (1996, pp. 720-727) and Bash et al. (2001, p. 24) provide syntheses of research that has been conducted on the effects of suspended sediment on the physical condition of salmonids. Newcombe and Jensen (1996) used their syntheses of field and laboratory data on effects from sediment to develop a dose response model and described 14 severity levels of effects, ranging from "no behavioral effects" (0) to greater than 80 to 100 percent mortality (14). This range is divided into four major categories, including "nil effect," "'behavioral effects," "sublethal effects," and "lethal and Para lethal effects." Bash et al. (2001, p. 2) further refine the categories by describing whether the effect is behavioral, physiological, or habitat-based. For example, Newcombe and Jensen (1996, pp. 694-698) report that suspended sediment concentrations of 500 mg/l for 3 hours caused signs of sublethal stress in adult steelhead, which we would also expect for bull trout. If suspended sediment concentrations reach 3,000 mg/l for up to an hour it may cause moderate physiological stress (Newcombe and Jensen 1996, pp. 698-702), and could result in gill trauma and/or temporary adverse changes in blood physiology such as elevated blood sugars, plasma glucose, or plasma cortisol (Servizi and Martens 1987, p. 16; Servizi and Martens 1992, pp. 1389-1390; Bash et al. 2001, p. 17). Lethal effects can occur if suspended sediment concentrations reach 22,026 mg/l at any one time, or remain at concentrations of 3,000 mg/l for 3 hours (Newcombe and Jensen 1996, pp. 698-702).

There are several difficulties in using this information to try and anticipate what amount of sediment in the water column is likely to be produced by a project and what impacts they might cause to fish. First, field turbidity monitoring uses turbidimeters that record data in nephelometric turbidity units (NTUs) while Newcombe and Jensen's data is in milligrams/liter (mg/l). And second, turbidity as a result of project implementation is not consistent and can be present in short intense bursts or at lower level over long periods of time.

While there is a relationship between suspended solids measured in mg/l and NTUs, it is highly variable because of differences in many factors including water temperature and particle size. While developing Total Maximum Daily Load (TMDL) criteria for the Umatilla River Basin, Oregon used regression analysis to express the suspended solids (in mg/l) that represented 30 NTU for 14 watersheds (Oregon Department of Environmental Quality, p. A6-3). Values ranged from 60 to 110 mg/l for the target value of 30 NTUs. If a similar relationship existed with Newcombe and Jensen's data, their 3 hour lethal range of 3,000 mg/l could equate to an NTU reading of between 833 and 1,764 which is a very wide potential range of values.

Because culvert replacement and removal is one of the most common construction activities in fish bearing streams, there is more specific information on the amount of sediment released, degree of turbidity, turbidity plume length and plume duration generated by culvert projects. Culvert removal has a high potential for releasing sediment because the soil is disturbed when removing large culverts, soil is disturbed when the channel is reconfigured and then water is reintroduced into that disturbed site.

Bakke et al. (2002, p.1) reported maximum suspended sediment levels of 514 to 2,060 mg/l associated with culvert removals near Olympia, Washington. These concentrations did not last for more than one hour. Both Jakober (2002, p. 6) and Casselli et al. (2000, pp. 8-9) reported that turbidity dissipated within a few hours of peaking and decreased to pre-project levels within about 24 hours after flow reintroduction. Casselli et al. (2000, pp. 8-9) noted that sediment levels remained at pre-project levels about 1.5 miles downstream of the project site. Idaho's Department of Environmental Quality adopted turbidity criteria of 50 NTU for protection of cold water biota (Bash et al. 2001, p. 67). That NTU level was based on data from Lloyd et al. 1987 (*in* Bash et al. 2001, p. 67) suggesting that salmonids reacted negatively by beginning to move away from areas when the turbidity reaches 50 NTU.

The Emmett Ranger District on the Boise National Forest monitored turbidity on Renwyck Creek during a culvert replacement project in August and September 2006 (Yenko 2007, entire). As expected, turbidity was very low, near baseline conditions, while water was diverted around the work site and spiked when the worksite was re-watered. NTU peaked at 249.5 immediately downstream of the site (50 meters) when the stream was re-watered and was down to 23.6 NTU within one hour as the sediment plume dissipated. Within two hours NTU was down to 11.1 and it continued to fall substantially that day.

Two crossings were monitored for turbidity changes on Carmen Creek, a tributary to the Salmon River, near Salmon, Idaho in October 2011 (Foltz et al. 2012, entire). Turbidity readings measured at the end of the mixing zone during construction activities did not exceed 50 NTU above the background levels, although both sites came very close. Turbidity samples were taken 10 meters downstream of the bypass culvert outlet and 100 meters downstream of the construction zone, the point chosen with the expectation that it was near the end of the mixing zone. Sampling criteria for the Parmenter Lane location was every 15 minutes or when the turbidity visually increased. When the turbidity was visually high, a sample was taken at least every 5 minutes until the stream cleared up. The Archie Lane sampling criteria was modified to sample every 30 minutes or when the turbidity was visually increased. Turbidity at Parmenter Lane was highest when the excavator was working in-stream and when the final remnants of the temporary dam were removed. Turbidity at Archie Lane was highest while the bypass dams were being installed and when the water was released from the bypass dams after the bridge was completed.

All three of these recent studies indicate that sediment plumes or spikes do occur during crossing replacements and occur when equipment is in live water and when water is reintroduced into the new stream channel. They also indicate that plumes dissipate very quickly at 50 and 100 meters below the construction sites. Studies also indicate that sediment mitigation measures, such as working in a dewatered zone, applying retention material, re-watering the stream slowly, etc., were successful in reducing turbidity values.

Project Specific Effects

It is likely that stream crossing structure removal and replacement projects carried out under this Program will result in increased sediment levels similar to those reported in Yenko (2007) and Foltz *et al.* (2012), but could be higher, such as those reported in Jakober (2002), Casselli *et al.* (2000) and Bakke *et al.* (2002), depending on substrate, geology, slope, flows, etc. at a given site. Minimization measures proposed for this consultation such as the use of Sedimat downstream of the project site, stream dewatering or bypassing prior to excavation, and pre-washing the newly simulated channel before re-watering occurs, will significantly reduce the suspended sediment concentrations that may occur during project implementation. The projects described in the two recent studies in Idaho (Yenko 2007 and Foltz *et al.* 2012) had similar minimization measures in place. Bank disturbance during site preparation, prior to stream dewatering, during diversion construction, excavation, construction of approaches, and during rehabilitation of the crossing may also create short-term pulses of turbidity.

Elevated sediment concentrations from Program activities may trigger effects ranging from minor to moderate physiological stress, including increased rates of coughing and respiration, particle build-up on gills, temporary injury associated with avoidance or moving to less turbid areas, and habitat degradation. Effects are not expected to rise to the level of mortality. Another pulse of sediment may occur following precipitation events or in the spring when higher energy spring-flows move through the construction site and these events would likely result in similar effects.

In response to elevated levels of suspended sediment, a reasonable expectation would be that, in order to avoid adverse effects, bull trout juveniles and adults may move away from turbid areas, if possible. Bisson and Bilby (1982, pp. 371-374) found that juvenile coho salmon (*Oncorhynchus kisutch*) avoided increasingly turbid waters in a laboratory setting. But, relocating to avoid sediment may have indirect adverse effects on bull trout. Salmonids exhibit a dominance hierarchy where the dominant fish (usually the largest) maintain the most desirable territories (i.e., defended area) in terms of available cover and food sources (Gilmour et al. 2005, p. 263). Subordinate fish may be excluded from food and cover resources and show reduced fitness and survival (Gilmour et al. 2005, p. 263). Berg and Northcote (1985, pp. 1415-1416) found that dominance hierarchies broke down and territories were not defended when juvenile coho salmon were exposed to short-term sediment pulses. We assume that bull trout behave similarly to other studied salmonids. Based on this assumption, we expect bull trout that abandon territories to avoid turbidity associated with culvert replacement projects may temporarily suffer increased competition, loss of cover, stress, and reduced feeding efficiency.

Increasing suspended sediment in rivers and streams during low-flow periods, when background levels of sediment in the stream system are generally very low or absent, has greater potential to affect fish. Bash et al. (2001, p. 16) reported that background mucus levels of fish are lower during this time period, which may result in amplified effects to fish, associated with the increased sediment inputs. This is in contrast to sediments that may be mobilized during the first high flow events following a construction activity, when background sediment levels are higher. Additional suspended sediment associated with a project is expected to move through the water column, becoming deposited on the substrate in areas of lower velocity, including pools or slack waters. Higher flows within the year following project implementation are expected to remobilize sediments, carrying them further downstream to be deposited. Eventually most sediments mobilized during project implementation will be carried downstream to larger streams, rivers, or water bodies within the watershed. Because high flows that re-mobilize project related sediments are expected to occur when background sediment levels are naturally elevated, they are expected to have less potential for effects to bull trout. High flow events during the spring following project implementation are expected to flush any deposited sediment from the project area.

During the slow re-watering of various worksites, all freshly disturbed substrates within the dewatered worksites will be highly prone to suspension and mobilization in the water column. The Assessment cited personal observations of projects similar to what will be conducted under the Program that observed approximately 90 percent of turbidity and sediment increases occur during flow reintroduction to the dewatered channel. Jakober (2002, p. 6) also found that 95 percent of construction-related sediment was introduced in the first two hours after the diversion was removed and water returned to the new crossing site. Casselli (2000) observed a similar response. In Jakober's study (2002), sediment concentrations instantaneously rose from a background of 1.69 mg/l of suspended sediment pre-diversion removal to a high of 15,588 mg/l for 30 minutes during re-watering of the channel. Suspended sediment levels then continuously dropped over time, decreasing to 105-677 mg/l 1 hour after re-watering, to 17-29 mg/l 2.5 hours after re-watering. In a similar monitoring effort, Bakke (2002) recorded sediment concentrations up to 514 – 2,060 mg/l following removal of culverts. These concentrations reportedly lasted less than 1 hour.

Re-watering of project sites is likely to result in the greatest turbidity/suspended sediment levels achieved during project implementation with values reaching a severity of effects score of up to 8, for approximately 1 hour, based on Newcombe and Jensen (1996) severity of effects analysis. However, intensity levels are expected to be reduced due to conservation measures to minimize sediment effects. Fish exposure may be further minimized as fish are likely to seek less turbid conditions downstream of the generated plume (Servizi and Martens 1992, pp. 1389-1390).The Service expects that turbidity pulses will generate a plume which may extend for approximately 600 feet downstream of the construction site and should dissipate within 3-4 hours, based on the review of literature (Casselli et al. 2000, pp. 8-9; Jakober 2002, p. 6; Fish and Wildlife Service 2004, p. 30): plumes will likely not last more than four hours, at which point turbidity should recover to near background levels. Re-watering the channel could result in suspended sediment levels triggering effects ranging from minor physiological stress and increased coughing and respiration at level 5, to moderate physiological stress at level 6, to moderate habitat degradation and impaired homing at level 7, and to fish demonstrating major physiological stress at level 8. As a result, bull trout are expected to have only acute sub-lethal behavior and physiological effects due to the short period of elevated suspended solids.

The Service is not aware of any study examining substrate embeddedness following a crossing replacement or removal. But it is likely that a thin layer of sediment may temporarily be deposited on substrate up to 600 feet downstream of the project, and until this sediment is washed out could cause embeddedness effecting spawning substrates, juvenile rearing habitat, prey habitat, and stream function. Bull trout are particularly susceptible to sediment effects and tend to use habitats close to the stream bottom, seeking cover in the interstitial spaces, especially as juveniles. The existing conditions and levels of substrate embeddedness will be site specific. We anticipate that project actions may increase substrate embeddedness within 600 feet downstream of project sites in areas where juvenile bull trout exist and may result in displacement. Any change to substrate embeddedness below project sites is considered a significant temporary disruption in the normal feeding and sheltering behavior of juvenile bull trout, which are typically less mobile than adults. Project features designed to capture sediment at the construction site will minimize sediment substrate embeddedness to an extent. Increased levels of substrate embeddedness are expected to be temporary (less than a year) in nature, as we expect either fall or winter storm events or natural high spring flows to mobilize any sediment that was deposited due to project activities within one year of project implementation. Following flushing flows, the stream simulation technique implemented for this project should result in decreased sediment, and potentially reduced substrate embeddedness over the longer-term because the projects are expected to remove or reduce chronic sources of sediment at poorly designed crossings, and to enhance sediment transport through these structures.

The Service stresses that all impacts associated with increased turbidity and suspended sediment will be temporary to short-term in nature, with most effects occurring within a one to four hour time frame, most likely during bypass construction and stream re-watering. Project design features presented as part of the Program are intended to prevent the majority of sediment from being delivered to stream habitat and to minimize release of sediment in the water during in-channel work. Re-watering the stream slowly is expected to reduce, but not eliminate, the risk to bull trout from elevated suspended sediment concentrations. Prolonged exposure to increased suspended sediment levels will not occur and all potential effects to bull trout are expected to be sublethal: we do not anticipate any mortality associated with increased suspended sediment levels. As described in the Assessment (p. 14), projects will not be completed where there are spawning bull trout or their redds, so the risk to spawning bull trout, eggs, and alevins from sediment deposition is discountable.

Road and Trail Relocation and Decommissioning

Action Agencies may choose to relocate a crossing to an area that provides better access or has less potential for failure. As described under the categories of activities, changing the location of a crossing will include decommissioning and reclamation of approaches on the existing crossing and construction of new approaches at the proposed crossing location, with no net increase in route density within riparian areas. The new crossing must be within ¼ mile of the old crossing and may include no more than ½ mile of new road or trail construction.

During the road, route, or trail decommissioning there is potential for an increased risk of erosion and sediment delivery to streams, depending on site specific characteristics, including proximity of the road to the stream, geology, and slope, etc. Design features will minimize sediment delivery to the stream, but if erosion occurs and sediment enters the stream, it could have the same general effects as described above, but we expect suspended sediment levels and turbidity to be much lower than one would see with excavation or re-watering the channel and the plume would likely not extend the full 600 feet. Effects to bull trout from small amounts of sediment entering live water would not be as severe as the other construction components. Increased turbidity from road construction/decommissioning may affect normal fish behavior, disrupt feeding, etc., but will not result in gill injury or mortality. The Service assumes that bull trout will temporarily move out of the area of increased turbidity if they need to. The timing and sequence of construction as it relates to the crossing replacement is unknown, but it is expected to occur within the same work season. Best management practices and design features will minimize potential effects associated with ground disturbance especially where the road to be decommissioned is near a stream channel.

Effects to habitat conditions and bull trout from road and trail relocation are expected to be insignificant. Limiting the area of disturbance to ½ acre of new construction will limit the amount of disturbance that can occur and this level of disturbance is not expected to change stream shading, large woody debris (including future recruitment), or the temperature watershed condition indicators. If the project biologist or project design team determines that affects to these indicators would be adverse, the project would not fit within the analysis provided in the Assessment or in this Opinion and therefore the project would not adhere to this consultation. The project would have to be redesigned so that affects to the watershed indicators were not significant or separate consultation would have to occur.

Temporary Crossings

Introduction of sediment due to equipment fording of streams at designated temporary crossings not within the dewatered work area will also result in increased suspended sediment/turbidity, with elevated turbidity expected to last for one hour after each ford and for a short distance, less than 100 feet, downstream. The Service estimates that the effects of increased turbidity are less significant than other components of the Program because equipment will move through the channel very quickly and infrequently. Sediment is expected to dissipate much quicker than the other construction activities that increase turbidity. Most temporary crossings will be located within the dewatered work area, or on temporary bridges (Assessment p. 18), but if that is not feasible then a temporary crossing area will be designated by the project design team (Assessment p. 21). Considering application of project design features and conservation measures, the Service expects that fording the channel could result in suspended sediment levels triggering effects ranging from minor to moderate physiological stress and increased rates of coughing and respiration, impaired homing, and moderate habitat degradation. All these effects can be considered harmful to fish exposed to these conditions, and may temporarily degrade habitat.

No mortality is expected to occur as a result of sediment exposure, but if fish are not cleared from the temporary crossing area, there is potential for fish to be crushed (killed) or injured when vehicles ford streams.

Maintenance of Structures

Following initial construction activities, maintenance activities will be necessary to protect the integrity of the crossings and ensure stream simulation objectives are met. Maintenance actions include removal of debris that has been determined to obstruct fish passage or poses threats to the integrity of the crossing, minor armoring around structure inlets, and re-vegetation. The need for maintenance is expected to be minimal and machinery will not enter streams. In occupied habitats, all conservation measures identified for the structure construction phase will also be implemented during maintenance activities. We anticipate that maintenance activities will be much shorter in duration, with necessary activities not expected to exceed two days. The Service expects the nature of effects to bull trout associated with maintenance, primarily sediment effects, to be less than those anticipated for initial project implementation, and no more than what are currently occurring under the existing maintenance. Effects to habitat condition indicators (sediment, substrate embeddedness, water quality) from maintenance activities will be minor and will have an insignificant effect on bull trout feeding and sheltering behavior.

2.5.1.1.3 Effects from Fish Handling

Prior to dewatering the stream fish salvage (or clearing) operations may occur to remove and relocate fish from the soon to be dewatered work area. A fisheries biologist will conduct, or direct, a survey of the project location during project planning and also prior to implementation in order to determine if ESA listed fish inhabit the project area. The fisheries biologist or designee will also conduct the fish clearing operations prior to construction activities. Methods used to clear fish include passive movement by slow dewatering in steep reaches, electrofishing, and netting or seining. This section describes the various effects that bull trout experience during this process and also the difficulties and assumptions used for estimating fish densities. Adverse effects may occur due to activities such as block net impingement, seining, netting, electrofishing, removal and relocation, and stranding, or a combination of these factors.

Incorporating NMFS electrofishing guidelines (Assessment pp. 98-102) and Idaho Department of Fish and Game collection permit requirements (or state equivalent), will minimize stress, mortality, and competitive effects to bull trout, and will ensure that trained and capable personnel are performing the clearing operations.

Individual fish captured by nets or electroshocking and then handled are subject to many different types of potential injury. These injuries include stress, tissue damage from electrical current, broken vertebrae, bruising, exposure to chemicals, and infection from wounds. The detrimental impacts to individuals from electroshocking are difficult to predict due to complexity and variables associated with the effort such as: type of current; field intensity; exposure duration; fish size and species; stream size; water conductivity; type of electrical current and pulse, frequency, length, waveform; voltage spikes; and repeated exposures. Degree of impacts also depends on the skill of the sampling crew, stream complexity, and visibility. The possible effects include cardiac or respiratory failure, injury, stress, and fatigue. These effects can be immediate or delayed and long-term.

The Service expects the majority of bull trout injuries and death will be due to block nets and electroshocking techniques, while mortality associated with handling stress, seine, and dip nets is unlikely.

Estimating Bull Trout Density

Estimating bull trout density is important for estimating the number of individual bull trout that may be affected by fish clearing operations. The challenge of developing reliable estimates of bull trout densities is complicated by high variability and the use of different metrics in the published literature. For example, bull trout densities have been reported in terms of area, such as per 100 meters^2, as well as linear measurements, per 100 meters or ever per mile. Some of the biological factors influencing bull trout densities are subpopulation demographics, life histories, and spatial and temporal variables related to seasonal availability of forage and high quality habitat. The Service assumes that lower densities of bull trout occur in foraging, migratory and overwintering habitat (FMO), while higher densities of bull trout occur in spawning and rearing habitat. In addition, adults and some subadult bull trout would be using FMO habitat, while younger age class fish would remain in the spawning and rearing areas and would not be utilizing FMO habitat. In bull trout habitat only occupied by resident life history forms, all age classes may be present.

In this Opinion, the Service is following the bull trout density estimates and assumptions provided in the USFWS biological opinion for fish passage restoration activities in eastern Oregon and Washington (USFWS 2004), a very similar effort with similar methods and effects as this Programmatic consultation, which estimated bull trout density to be 10 bull trout per 100 meters for all habitat types. We understand that bull trout densities will vary across subbasins, core areas, and within subpopulations, but providing specific density data for each stream where a project may occur is not feasible within this consultation; therefore we will follow the estimate provided in the USFWS 2004 and use the same assumptions.

Estimates per project from USFWS 2004 rounded up to the nearest whole number:

- 6 fish could be captured and handled during electrofishing activities.
- 2 fish could be injured or killed due to electrofishing.
- 1 fish could be killed due to impingement on block nets.
- 1 fish could be killed due to stream dewatering and stranding in the substrate.

Assumptions by the USFWS 2004 included:

- Density of 10 bull trout/100 meters.
- Average dewatered stream length of 175 feet.
- 3.5 percent block net impingement mortality rate.
- 95 percent capture rate with electroshocking.
- 25 percent electroshocking injury/mortality rate.
- 5 percent stranded fish rate.

Even though the Service understands that projects may be completed in unoccupied bull trout habitat, due to the absence of priority based criteria to govern the selection of culvert sites, it is possible that every project completed under this programmatic could occur within occupied habitat. Therefore, the Service assumes that each project may occur in an occupied stream reach and may affect a bull trout subpopulation. It is also likely that bull trout densities will not conform to the assumed 10 bull trout/100 meters; in some streams these numbers will be much higher, and others it will be lower.

Number of Projects Expected to be Completed under the Program

The Action Agencies propose that a maximum of 156 projects per year in ESA listed fish occupied habitats could be completed under the Program, for an average of 10 projects per year per administrative unit. It is likely, however, given that only about 66 projects were completed in 5 years under the previous programmatic effort, that this number is an overestimate of the number of projects that will be competed. But for estimates of the number of fish that could be injured during a stream crossing replacement project, the maximum number of projects was used in this Opinion.

Block Nets

Prior to dewatering the stream, fish salvage may occur to remove fish from the soon to be dewatered work area. Block nets will be installed upstream and downstream of each site to prevent fish from moving back into the work area. Typically, the Action Agencies will install the block nets, capture and relocate bull trout, divert the streamflow around the project area, then remove the blocks nets all in the same day (Assessment p. 30). Although bull trout will have a general avoidance response to the work area, they may be startled and, in trying to move away from the disturbance, become entangled in the block nets causing injury or death. The Service assumes that personnel will be available while block nets are in place to remove bull trout promptly, thus minimizing effects of impingement.

- Using block net impingement mortality estimates (3.5 percent of population density) derived from Forest Service Region 6 culvert and replacement/removal projects (USFWS 2004, pp. 48-50), and the average estimated density of 10 bull trout/100 meter, it is estimated that one bull trout per project completed under the Program could be killed from being impinged on a block net. Given that 156 site specific projects could be completed each year under the Program, up to 156 bull trout could be injured or killed from block net impingement each year, or up to 1,560 total over the life of the consultation.

Seines and Dip Nets

Seines and dip nets may be used by an action agency to capture and remove any fish trapped between the block nets in the portion of the stream dewatered. The use of seines and dip nets are expected to capture approximately 70 percent of the fish within the section of stream to be dewatered (USFWS 2004, p. 35), but their use is not mandatory and depending on the size of the stream their use may not be feasible.

- If seines and dip nets are used, the Service predicts that it may result in capture and handling of 4 bull trout per project; 624 bull trout a year; 6,240 bull trout over the life of the consultation.

We arrived at these numbers by the following: (10 fish/100 meters)x(.3048 meters/foot)x (175 feet dewatered area per project)x(0.70 bull trout capture rate)x(number of projects per year)x(10 years).

Electroshocking

To estimate the number of bull trout that may be handled by electroshocking, the Service does not assume seining and dip netting occur and the primary method (or only method) of clearing fish from the construction area will be by electrofishing. The capture and handling of bull trout through electroshocking is a short-duration activity occurring intermittently over one day. The Service assumes, based on review of the literature provided in Elle and Schill 2004, that an estimated 96 percent of the fish will be captured. As reported in Elle and Schill 2004, p. 2, 96 percent represents general (3 pass) capture efficiencies in Idaho. The Service also estimates that up to 25 percent of fish exposed to electrical current could be injured, based on literature review conducted by Nielson (1998). Although the risk of electroshocking injuries increase with the size of the fish, we assumed no age/size-based differences in injury rates.

- All bull trout within the electroshocked stream reach will be exposed to electrical current, which is estimated, given the 10 bull trout/100 meters, to be 6 fish per site exposed to electrical current and potentially captured (due to rounding of 95 percent capture rates), with up to 2 bull trout potentially injured or killed from the experience. Given that 156 site specific projects could be completed each year under the Program, up to 936 bull trout could be exposed to electroshocking, or up to 9,360 over the life of the consultation, and 234 could be injured or killed, or up to 2,340 total over the life of the consultation.

The Service understands, however, that more than 6 bull trout could be collected during clearing operations depending on site characteristics, condition of habitat, and subpopulation characteristics, and that, based on the best available information, up to 25 percent of electroshocked bull trout could be harmed during the process.

Removal and Relocation

Bull trout that are collected during electroshocking efforts will be released away from the project site at suitable locations and where they will not likely be in danger of subsequent impingement on nets. Fish that are forced to new habitat may be released into habitat already occupied by bull trout or other resident fish, and may have to compete for available habitat and niches. As a result of being moved, bull trout may suffer from increased competition, loss of cover, stress, and subsequent reduced feeding efficiencies. These behavioral effects may be resolved very quickly if habitat space is readily available, or fish may be forced to seek out appropriate habitat. Overall, the injurious effects of relocation are expected to be temporary (less than a day), sublethal, and bull trout are expected to adjust to their new habitat quickly. However, adverse behavioral effects to bull trout are likely to occur from being relocated to different habitat.

Stranding During Stream Dewatering

During stream dewatering a small percentage (up to 5 percent) of bull trout may avoid being captured and relocated, and thus may die from being stranded in the dewatered work area. The Service estimates that the proposed capture methods will remove approximately 95 percent of the fish prior to stream dewatering.

- The Service estimates that up to one bull trout may be stranded per project, or up to 156 per year, or up to 1,560 over the life of the consultation.

2.5.1.1.4 Chemical Contamination Related Effects

Bull trout could also be affected through impacts to water quality through chemical contamination. Heavy machinery use in stream channels raises concern for the potential of an accidental spill of fuel, lubricants, hydraulic fluid, and 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 bull trout.

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, p. 420). Fuels and petroleum products are moderately- to highly toxic to salmonids, depending on concentrations and exposure time. Free oil and emulsions can adhere to gills and interfere with respiration, and heavy concentrations of oil can suffocate fish. Evaporation, sedimentation, microbial degradation, and hydrology act to determine the fate of fuels entering fresh water (Saha and Konar 1986, p. 506). 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 (Staples 2001, p.377). Brake fluid is also a mixture of glycols and glycol ethers, and has about the same toxicity as antifreeze.

During project implementation, heavy machinery will be used adjacent to the stream channel and within the dewatered stream channel. Therefore, there is the potential to introduce petroleum products into the Project area's waterways during work activities. The relevant mechanism of effect is the accidental spill of petroleum-based products during fueling and equipment operations. The likelihood of a fuel spill occurring on travel routes is low due to the limited potential for refueling or maintenance of motorized vehicles. Any adverse effect related to a fuel spill is dependent upon the size of the spill, proximity of the spill to action area streams, and success of containment.

Project design features are incorporated as part of the Program to prevent toxic materials from entering live water. The majority of work is anticipated to occur outside of flowing water, which limits the potential for chemical contamination. The Action Agencies have also proposed the development of spill prevention, containment, and control plan (SPCCP) for all projects to be implemented under this consultation. The SPCCP will be submitted to Level 1 teams which will ensure that they adequately reduce the potential for hazards of chemical contamination to discountable levels. Due to the project's design features, the possibility of petroleum-based products reaching occupied waters is very unlikely. If a spill occurs, amounts will likely be small because they will typically be related to individual vehicles and not associated with larger fuel transport and related transfer operations. In addition, it is unlikely that any machinery or equipment fluids will be spilled in volumes or concentrations large enough to harm bull trout in or downstream of the Project area. In light of these features and the fact that bull trout will be removed from the project area prior to construction activities, effects to bull trout associated with chemical contamination are expected to be discountable.

2.5.1.1.5 Passage Obstruction, Disturbance, Use of Explosives

Passage Obstruction

Where fish passage currently exists, project implementation will temporarily block fish movement at and through the construction site. Resident adult and juvenile bull trout that may be rearing or feeding locally will be temporarily restricted prior to the stream flow being diverted. During fish clearing operations, block nets will be installed at upstream and downstream locations to prevent fish from moving back into the work area. The block nets will typically be in place while the diversion channel is constructed and then will be removed – this normally takes less than one day.

Although there will be a diversion channel that contains flow, it probably will not be designed to provide upstream passage around the project site, but may provide downstream movement. It should be noted that the purpose of most of these projects will be to restore aquatic organism passage, so upstream passage migration blockage may have already been occurring and project activities (stream diversion) will not result in a change of the baseline condition. Although not specified in the Assessment, the Service assumes that most projects may need to divert the channel for a week, but, depending on site specific project complexities, may take longer. If the stream needs to be diverted for longer than two weeks, Level 1 teams should be consulted to ensure there is no additional project effects not already considered in this consultation.

The temporary passage obstruction and diversion around the construction site are not expected to interfere with major life history processes such as spawning, because work will be completed prior to bull trout spawning periods and will not occur where there are redds. Overall, the injurious effects of blocked passage are expected to be temporary, sublethal, and bull trout are expected to recover quickly once the construction is complete and the flow is returned to the stream. The effects associated with passage obstruction are considered insignificant and will not adversely affect bull trout.

Noise and Disturbance Effects

The presence of large machinery in dewatered areas and adjacent to streams where bull trout are present will result in increased noise levels, vibration, and other disturbances associated with increased human presence. The general increase in human activity associated with Program activities is likely to disturb and displace bull trout in the action area. However, these actions are expected to result in only minor disturbances to fish overall, with temporary and insignificant potential avoidance behaviors. Bull trout are typically most active at night, so daytime activities could result in bull trout moving from cover to avoid perceived threats associated with human and equipment presence. The response will be minimal, with fish moving to other available cover in the immediate area. These effects are not considered a significant disruption to normal feeding, holding or sheltering behavior. In most circumstances, the immediate work area during instream construction will be cleared of fish and dewatered so fish will already be moved away from the majority of the disturbance.

Use of Explosives

Site excavation activities may require the removal of large rock or excavation of bedrock to achieve the desired depth for a new crossing structure. If possible, the Action Agencies will use Betonamit, which is a noiseless, shock-free, non-toxic substance that breaks rock through expansive pressure. If it is not possible to use Betonamit for excavation activities, explosive blasting within dewatered areas may be used. The Action Agencies have proposed several measures and design criteria which reduce potential effects of explosive blasting (e.g., fish exposure to chemicals, noise, vibrations, and debris) to insignificant levels. The proposed action also includes buffer distances for explosive use adapted from Wright and Hopky (1998), which we expect will adequately reduce effects to bull trout associated with pressure, toxicity, or vibration. The Service does not anticipate any adverse effects to bull trout associated with potential explosive blasting activities under the proposed action.

2.5.1.2 Effects of Interrelated or Interdependent Actions

Interrelated actions are those that are a part of a larger action and depend on the larger action for their justification. Interdependent actions are those actions that have no independent utility apart from the action under consideration. Because future maintenance activities are included in the proposed Program they are not considered interrelated or interdependent. The Service did not identify any other potentially interrelated or interdependent actions associated with the proposed action.

2.5.2 Bull Trout Critical Habitat

2.5.2.1 Direct and Indirect Effects of the Proposed Action

The Action Agencies use the watershed condition indicator (WCI) matrix for bull trout to evaluate and document baseline conditions and to aid in determining whether a project is likely to adversely affect bull trout. Using the WCI matrix and the effects analysis included in the

Assessment provides a thorough evaluation of the potential effects of the Program on the primary constituent elements (PCEs) of bull trout critical habitat. How the WCIs relate to the PCEs and the expected effects of the Program on PCEs are summarized in Table 3. Analysis of the affected WCI can provide a thorough evaluation of the existing baseline condition and potential project impacts to the Primary Constituent Elements (PCEs) of bull trout critical habitat (Table 5).

Table 5. Summary Effects to 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. Dewatering and diverting the streams will adversely affect water quantity in short section of dewatered stream. **Significant temporary effect.**
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 crossing projects with overall beneficial effects to refugia and migration habitats.	Upstream migration habitat will be blocked during dewatering, although it was likely already blocked, and may be temporarily impacted by increased localized turbidity pulses below the project site. **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 in the 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 crossings. 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 temporarily impaired.	This PCE will be adversely affected by dewatering, which effectively eliminates habitat temporarily (expected to take less than 2 weeks). **Significant temporary effect.**
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. PDF 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	Floodplain connectivity, flow/ hydrology (changes in peak /base flows and	No effects to these habitat features	This PCE will be maintained.

#	PCE Desc iption	te shed Indicators	Indicators Degrade by Program	Anticipated Effect to PCE
	ranges or, if flows are controlled, they minimize departures from a natural hydrograph.	drainage network increase), watershed conditions (road density 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 and quality within the stream crossing areas will be temporarily affected, but the reduction in water quality and quantity is not likely to adversely affect reproduction, growth or survival of bull trout. Effects to this PCE are expected to be insignificant.
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.	No effects to persistence and genetic integrity because projects that would facilitate the expansion of brook trout into occupied bull trout habitat are excluded from the Program.	This PCE will be maintained.

As discussed above in Section 2.5, Program activities will have temporary adverse effects to bull trout habitat mainly due to ground disturbing activities associated with increased sediment in streams and dewatering of habitat. PCEs likely to be adversely effected by Program activities are PCE 1, 2, 3, 4, and 6. Project design features, such as diverting the stream, placing sedimats, and re-watering the channel slowly, will be employed to minimize effects.

In-stream work requires block nets, fish salvage, and channel diversion to minimize direct impacts to individuals, and migratory habitats (PCE 2) will be affected during this time. Downstream migration will be blocked for a brief (1 – 2 days) period during fish salvage. Upstream migration will be blocked continually while the stream is dewatered, however, it should be noted that a majority of the crossings removed or replaced under this Program are likely current upstream migration barriers, and dewatering and diverting the stream will not be a change in the baseline at those sites. Bull trout downstream of the culvert may also have migration delayed by turbidity pulses released during project implementation. The adverse effects to PCE 2 will be temporary (during construction) with the ultimate objective to restore passage for bull trout, reduce sediment, and provide access to additional habitat.

Sediment/turbidity is the primary indicator that, as altered, will adversely affect PCEs 3 and 6, by reducing water quality downstream of projects. Road decommissioning and construction activities (for road and trail relocation and decommissioning) may also increase sediment in streams depending on site characteristics, but the end result should be a decrease in sediment from poorly placed or designed crossings and roads. The aquatic food base (PCE 3) may be negatively impacted by deposited sediment for 600 feet downstream of crossings, which may cover aquatic invertebrates and compromise their habitat. Increased sediment and suspended solids downstream of activities have the potential to affect primary production and benthic invertebrate abundance, due to reductions in photosynthesis within murky waters, resulting in decreased food availability for fish (Cordone and Kelley 1961, pp. 189-190; Lloyd et al. 1987, p. 18). Dewatering will also result in the loss of macroinvertebrates in that stream reach. Both dewatering and increased sediment will have temporary adverse effects to PCE 3 for a few months following construction.

Spawning areas (PCE 6) within 600 feet of each stream crossing may be temporarily adversely affected by fine sediment released during the project as there is potential for fine sediment to settle on spawning gravels during construction and re-watering of the stream channel. PDFs to capture sediment will be employed, but the potential increase of fine sediments will not be removed completely.

Dewatering the stream during stream crossing replacements will adversely affect PCEs 1, 3, and 4 for approximately 175 feet at each site for one to two weeks (or longer if agreed upon by the Level 1 team). Small projects would likely be completed in a much shorter time frame. Springs, groundwater sources, and groundwater flows will not be impacted in the action area, but water quantity as it relates to PCE 1 will be eliminated during de-watering. Stream complexity, PCE 4, will be adversely affected in the immediate area of the stream crossings, because the habitat will be unavailable while the stream is dewatered during construction. In the long term, this PCE 4 will be improved as stream function through the crossing, including large woody debris movement, would be restored.

The slight increase in deposited sediment in streams from all activities associated with the Program will not significantly affect PCE 1 or 8. The reduction in the aquatic food base and the temporary alteration of water quality are not expected to have measurable effects to normal reproduction, growth, and survival of bull trout (PCE 8). The lack of water flowing in the construction sites will not have significant effects to PCE 8 as bull trout would be removed from the action area: the Service assumes bull trout will be able to resume normal growth and survival upstream of the project after relocation.

PCEs 5 and 7 relating to stream temperatures and the natural stream hydrograph will not be affected by the Program. PCE 9, relating to invasive species, will also be maintained because projects that would facilitate the expansion of brook trout into occupied bull trout habitat are excluded from the Program.

2.5.2.2 Effects of Interrelated or Interdependent Actions

Interrelated actions are those that are a part of a larger action and depend on the larger action for their justification. Interdependent actions are those actions that have no independent utility apart from the action under consideration. Because future maintenance activities are included in the proposed Program they are not considered interrelated or interdependent. The Service did not identify any other potentially interrelated or interdependent actions associated with the proposed action.

2.6 Cumulative Effects to Bull Trout and Bull Trout Critical Habitat

The implementing regulations for section 7 define cumulative effects to include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

To a large extent bull trout in the action area are distributed on federally managed lands. However, private and state activities and management programs may affect bull trout or their habitat in some parts of the action area. These may be continuation of effects associated with ongoing activities that include timber harvest, grazing and management of domestic livestock, road construction, agriculture, water diversions, and residential development. Population growth and associated demands for agricultural, commercial, or residential development are expected to affect available habitat quality and quantity for bull trout in the future. Similarly, landowners may take steps to curtail or avoid land management practices that would harm or harass bull trout. However, there is no certainty that this will occur. Therefore, the Service assumes future non-federal actions in Idaho are likely to continue over the next 10 years at similar intensities as in recent years and these actions will cumulatively affect bull trout. The Service anticipates that majority of cumulative effects related to State and private activities will occur within bull trout forage, migratory, and overwintering habitats where the greatest concentration of non-federal lands occur.

Illegal and inadvertent harvest of bull trout is considered a cumulative effect. Harvest can occur through both misidentification and deliberate catch. Schmetterling and Long (1999, p. 1) found that only 44 percent of the anglers they interviewed in Montana could successfully identify bull trout. Being aggressive piscivores, bull trout readily take lures or bait (Ratliff and Howell 1992, pp. 15-16). Spawning bull trout are particularly vulnerable to harvest because the fish are easily observed during autumn low flow conditions. Spawning bull trout are particularly vulnerable to harvest because the fish are easily observed during autumn low flow conditions. Hooking mortality rates range from 4 percent for non-anadromous salmonids with the use of artificial lures and flies (Schill and Scarpella 1997, p. 1) to a 60 percent worst-case scenario for bull trout taken with bait (Cochnauer et. al. 2001, p. 21). Thus, even in cases where bull trout are released after being caught, some mortality can be expected.

An additional cumulative effect to bull trout is global climate change. Warming of the global climate seems quite certain. Changes have already been observed in many species' ranges consistent with changes in climate (Independent Scientific Advisory Board 2007, p. iii; Hansen et al. 2001, p. 767). Global climate change threatens bull trout throughout its range in the coterminous United States. Downscaled regional climate models for the Columbia River basin predict a general air temperature warming of 1.0 to 2.5 °C (1.8 to 4.5 °F) or more by 2050 (Rieman et al. 2007, p. 1552). This predicted temperature trend may have important effects on the regional distribution and local extent of habitats available to salmonids (Rieman et al. 2007, p. 1552), although the relationship between changes in air temperature and water temperature are not well understood. Bull trout spawning and early rearing areas are currently largely constrained by low fall and winter water temperatures that define the spatial structuring of local populations or habitat patches across larger river basins; habitat patches represent networks of thermally suitable habitat that may lie in adjacent watersheds and are disconnected (or fragmented) by intervening stream segments of seasonally unsuitable habitat or by actual physical barriers (Rieman et al. 2007, p. 1553).

With a warming climate, thermally suitable bull trout spawning and rearing areas are predicted to shrink during warm seasons, in some cases very dramatically, becoming even more isolated from one another under moderate climate change scenarios (Rieman et al. 2007, pp. 1558–1562; Porter and Nelitz 2009, pp. 5–7). Climate change will likely interact with other stressors, such as habitat loss and fragmentation (Rieman et al. 2007, pp. 1558–1560; Porter and Nelitz 2009, p. 3); invasions of nonnative fish (Rahel et al. 2008, pp. 552–553); diseases and parasites (McCullough et al. 2009, p. 104); predators and competitors (McMahon et al. 2007, pp. 1313–1323; Rahel et al. 2008, pp. 552–553); and flow alteration (McCullough et al. 2009, pp. 106–108), rendering some current spawning, rearing, and migratory habitats marginal or wholly unsuitable. Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features described in PCEs 1, 2, 3, 5, 7, 8 and 9.

2.7 Conclusion

2.7.1 Bull Trout

The Service has reviewed the current status of the bull trout, the environmental baseline in the action area, effects of the proposed Program, and cumulative effects, and it is our conclusion that the Program is not likely to jeopardize the continued existence of the species. The Service concludes that direct effects to adult, subadult, and juvenile bull trout will occur at project sites across Idaho and Nevada (and those portions of surrounding states including in this Program). Effects will be limited to short-term disturbance, feeding rate reduction, increased predation risk, and physiological distress resulting in adverse effects from increased levels of suspended sediment/turbidity and deposited sediment. Anticipated effects should be minimized (but not precluded) by the design features incorporated into the Program. In addition, adult, subadult, and juvenile bull trout may be harmed by impingement on block-nets and all bull trout within the area cleared for fish would be exposed to capture and handling effects from electroshocking. In-stream activities will be completed prior to the on-set of spawning; therefore, spawning bull trout, eggs, or alevins are not expected to be affected by the Project.

Up to 156 individual projects may be implemented across the Idaho bull trout core areas and 38 subbasins per year, with an average maximum of 10 projects per year per administrative unit in occupied habitat. The Service considers this number to be flexible, however, and if an administrative unit has the opportunity to complete more than 10 projects in a single year it is up to the Level 1 team to determine if potential effects are within those described in this Opinion, and consistent with the overall totals anticipated across the action area over the term of the action. The limit to the number of projects is meant to reduce the potential for aggregate effects to a single bull trout subpopulation.

The Service expects that the numbers and distribution of bull trout in the Columbia Basin and Jarbidge population segments will not be significantly changed as a result of this Program; Program impacts will not reduce appreciably the likelihood of both the survival and recovery of bull trout, and may increase the likelihood of both survival and recovery by restoring local connectivity and potential refugia. Therefore, although the proposed action may have some adverse effects to small numbers of bull trout, these effects are not likely to cause a measurable response to bull trout at the local population, core area, management unit, or coterminous U.S. scales. It is the Service's biological opinion that the proposed Program will not jeopardize the coterminous population of bull trout.

2.7.2 Bull Trout Critical Habitat

The Service has reviewed the current status of bull trout critical habitat, the environmental baseline in the action area, effects of the proposed Program, and cumulative effects, and it is our conclusion that the proposed Program is not likely to destroy or adversely modify designated critical habitat for bull trout. Projects completed under the Program will result in temporary adverse effects to 5 of the 9 PCEs (1, 2, 3, 4, and 6), but should improve the condition of critical habitat once the project is complete. Particularly, migratory habitats (PCE 2) will be restored in some streams, and additional spawning and rearing habitat (PCE 6) will be made available. We expect that project design features should reduce the magnitude of adverse effects, but not eliminate them.

There are over 8,770 miles of critical habitat in Idaho, made up of spawning and rearing habitat, and foraging, migratory and overwintering habitat. Individual projects completed under the Program will have temporary significant effects to critical habitat primarily during stream de-watering and construction, which will likely take from one or two days to approximately two weeks. Each project would affect approximately 600 feet of critical habitat; with 156 projects allowed to be completed under the Program this equates to approximately 18 miles, or 0.20%, of critical habitat that could be affected each year. The Service expects, however, that this number is an overestimate; 66 projects were completed over 5 years under the previous programmatic.

Impacts to critical habitat will not affect the functioning or the conservation value of the Kootenai River, Clark Fork River, Coeur d'Alene River, Clearwater River, Salmon River, Hells Canyon Complex, Little Lost River, Southwest Idaho River Basins, or Jarbidge River Critical Habitat Units or any of the subunits within those units. Therefore, we conclude that the project will not destroy or adversely modify designated critical habitat.

2.8 Incidental Take Statement

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without specific exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm in the definition of take in the Act means an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The Forest Service, Bureau of Land Management and the Corps of Engineers have a continuing duty to regulate the activity covered by this incidental take statement. If the action agency fails to assume and implement the terms and conditions the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the action agency must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

2.8.1 Form and Amount or Extent of Take Anticipated

Take Related to Increased Turbidity and Suspended Sediment from Dewatering, Construction Activities, and Reintroduction of Flow

Because it is difficult to anticipate the number of individual bull trout that will be taken as a result of implementing the Program, we will use both the amount of habitat affected and an estimate of the number of bull trout that may be handled. To address take associated with sediment and turbidity, we will use the amount of habitat affected as a surrogate. We anticipate that all adult, subadult, and juvenile bull trout present within 600 feet downstream of a stream crossing improvement project (replacement or removal), will be subject to take in the form of harassment and harm from direct exposure to the increased levels of suspended sediment, turbidity, and deposited sediment. Elevated suspended sediment may result in direct injury (gill irritation, physiological stress, reduced feeding efficiency), and may also result in harassment and an increased likelihood of injury by causing bull trout to move out of areas of elevated suspended sediment. Effects are not expected to rise to the level of mortality. Moving out of the areas (harassment) may cause loss of territories, increase competition and stress, and reduce feeding efficiency. Incidental take of bull trout associated with sediment effects from stream crossing projects is only anticipated to occur during the in-stream work window (generally May 1 – August 15th) when spawning bull trout, redds or alevins are not present at each stream crossing project. Project design features incorporated into the project are expected to reduce the level of anticipated take. Harassment of juvenile bull trout below project sites may occur as well due to a significant temporary disruption in the normal feeding and sheltering behavior of juvenile bull trout due to increased substrate embeddedness. This take is expected to last until a precipitation event (resulting in a flushing flow) or spring high stream flow flush sediment out of the area (up to one year).

Take associated with increased turbidity and suspended sediment is expected to occur during the construction phases, de-watering and re-watering the stream, but is not expected to occur during the entire project implementation. Take is expected to be periodic during that time, following any turbidity pulses that may occur usually following significant events such as construction of the bypass, and re-watering of the stream channel. Pulses are only expected to last 3 to 4 hours and turbidity levels should drop down significantly by that point.

Sediment and turbidity will not affect spawning bull trout, redds, eggs, alevins because project will not occur where there are spawning bull trout or their redds. No take is provided for spawning adults, eggs or alevins.

Take Related to Temporary Crossings

Considering application of project design features and conservation measures, the Service expects that fording the channel when temporary crossings are needed could result in suspended sediment levels triggering effects ranging from minor to moderate physiological stress and increased rates of coughing and respiration, impaired homing, and moderate habitat degradation, resulting in harassment and harm of adult, subadult and juvenile bull trout in the fording area and immediately downstream for 100 feet for approximately one hour. If fish are not cleared from the temporary crossing area, there is potential for bull trout to be crushed (killed) or injured when vehicles ford streams. This take is expected only when vehicles ford a stream at temporary crossings that are considered necessary and have been designated by the project design teams.

Because each crossing site and bull trout densities within those will be different, and because the need for temporary crossings will be rare, it is difficult for the Service to predict the number of bull trout that could be taken as part of this component. Therefore, we will use habitat as a surrogate. For each temporary crossing that is needed, all bull trout within the crossing area and downstream 100 feet will be subject to take in the form of harm and harassment. The Service assumes that crossings will be approximately 14 feet wide, the average road width of Forest Service roads.

Take Associated with Fish Handling

Prior to dewatering the stream, fish salvage may occur to remove fish from the soon to be dewatered work area. Block nets will be installed upstream and downstream of each site and fish will be removed from the construction site by dip netting and seining, by electroshocking, or by both. Slow dewatering in steep topography may serve to move some of the fish out of the area prior to fish clearing operations.

Take in the form of harm and harassment is expected due to impingement on block nets. Although we do not have bull trout density estimates for every potential site, using block net impingement mortality estimates (3.5 percent of population density) derived from Forest Service Region 6 culvert and replacement/removal projects (USFWS 2004, pp. 48-50), we estimate that one bull trout at each site could be harmed or killed from impingement on the block net. Given that 156 site specific projects could be completed each year under the Program, up to 156 bull trout could be injured or killed from block net impingement each year, or up to 1,560 total over the life of the consultation. Incidental take of bull trout associated with the use of block-nets is only anticipated to occur while the block nets are in place during construction.

If seines and dip nets are used, the Service predicts that it may result in capture and handling of 4 bull trout per project; 624 bull trout a year; 6,240 bull trout over the life of the consultation. No mortality is expected from using seines and dip nets.

If fish are present within a project site, it is most likely that electroshocking will occur to remove fish. All bull trout within the electroshocked stream reach will be exposed to electrical current, which is estimated, given the 10 bull trout/100 meters density we assume in this Opinion, to be 6 fish per site exposed to electrical current and potentially captured (due to rounding of 95 percent capture rates), with up to 2 bull trout potentially injured or killed from the experience. If 156 projects are completed each year then up to 936 bull trout a year, or 9,360 bull trout over the life of the consultation, could be exposed to electroshocking and 234 bull trout a year, or 2,340 over bull trout over the life of the consultation, could be injured or killed. This take is expected to occur only during and immediately following fish clearing operations.

The Service understands, however, that more than 6 bull trout could be collected during clearing operations depending on site characteristics, condition of habitat, and subpopulation characteristics, and that, based on the best available information, up to 25 percent of electroshocked bull trout could be harmed during the process. Therefore, take in the form of harassment is provided for all bull trout that could potentially be electroshocked and harm is provided for up to 25 percent of collected fish.

Bull trout that are collected during electroshocking efforts will be released away from the project site at suitable locations and where they will not likely be in danger of subsequent impingement on nets. Additional take for these fish is not provided for relocation because these are the same fish captured by dip nets, seines and electrofishing efforts and take is provided for them under those categories.

Stranding from Stream Dewatering

During stream dewatering a small percentage (up to 5 percent) of bull trout may avoid being captured and relocated, and thus may die from being stranded in the dewatered work area. The Service estimates that the proposed capture methods will remove approximately 95 percent of the fish prior to stream dewatering. The Service estimates that up to one bull trout may be harmed by being stranded per project, or up to 156 per year, or 1,560 over the life of the consultation.

Summary

If incidental take anticipated by this document is exceeded, all project activities will cease and the action agency will immediately contact the Service to determine if consultation should be reinitiated. Authorized take will be exceeded under the following conditions.

1. Suspended sediment levels within the project site and for 600 feet downstream exceed those described in this Opinion and as reported by Yenko (2007), Foltz et al. (2012), Casselli et al. (2000), Jakober (2002); or

2. Suspended sediment levels that cause adverse effects to fish (on the severity scale described in Section 2.5.1.1.2) are observed further than 600 feet downstream from project activities; or

3. Temporary crossings are wider than 14 feet and increased turbidity extends beyond 100 feet downstream; or

4. More than one bull trout per project is harmed or killed by impingement on blocknets; or

5. More than 25 percent of all bull trout collected by electroshocking are injured or killed. The Service expects that all bull trout within a project site will be subject to take in the form of harassment from electroshocking (average of 6 bull trout per 100 meters of habitat); or

6. More than 4 bull trout are captured by seines or dip nets per project; or

7. More than one bull trout are harmed or killed by stranding during stream dewatering; or

8. More than 156 projects are implemented in any single year, or more than 10 projects implemented on an administrative unit without prior approval from the Level 1 Team.

2.8.2 Effect of the Take

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to jeopardize the continued existence of the bull trout across its range. This Program will occur in two population segments, the Jarbidge River and the Columbia River, and is not expected to reduce the reproduction, status, and distribution of bull trout in the action area, and will not appreciably reduce the likelihood of survival and recovery of either population segments.

The Jarbidge population segment currently contains a single core area with six local populations: East Fork Jarbidge River, West Fork Jarbidge River, Dave Creek, Jack Creek, Pine Creek and Slide Creek. Recent information provided in Allen *et al.* (2010) indicates population is much healthier (up to four times the numbers) than the recovery plan estimate of 500, and bull trout exhibit more migratory behavior than previously thought. No stream crossing projects were implemented in this population segment through the previous programmatic (Hoefer 2012. *in litt.*) and the Bureau expects that there is only approximately 15 to 20 stream crossings total in occupied bull trout habitat that may be replaced under the Program (Hoefer 2012, *in litt.*). Given the conditions in the Jarbidge and the low number of potential projects, the Program will not appreciably reduce the population.

The Columbia River population segment comprises 22 management units. This population segment currently contains 97 core areas and 527 local populations. The action area for this Programmatic includes Forest Service and Bureau managed lands in Idaho, which spans nine management units: Clark Fork River; Kootenai River; Imnaha-Snake River; Hells Canyon Complex; Coeur d'Alene Lake Basin; Clearwater River; Salmon River; Southwest Idaho (Boise, Payette and Weiser river basins); Little Lost River. The number of local populations puts this population segment at a low risk for extirpation.

We do not anticipate appreciable changes in the numbers, distribution, or reproduction of bull trout in any of the core areas or local populations that occur in the action area. Over the long term, the projects implemented under this programmatic consultation are expected to contribute to the conservation and recovery of bull trout throughout the action area, and the Columbia River and Jarbidge River distinct population segments.

2.8.3 Reasonable and Prudent Measures

The Service concludes that the following reasonable and prudent measures (RPM) are necessary and appropriate to minimize the take of bull trout caused by the proposed action.

1. Minimize incidental take and site disturbance by appropriate consideration of alternative project designs and implementation methods during the streamlining process.
2. Minimize incidental take that occurs as a result of programmatic project implementation.
3. Establish a monitoring program on each Forest or Bureau District to confirm that projects implemented under this Program are meeting objectives of the programmatic consultation and are also not exceeding the amount and/or extent of take from permitted activities.

2.8.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forest Service and Bureau of Land Management must comply with the following terms and conditions, which implement the reasonable and prudent measures described above:

1. To implement RPM #1 the Forest Service, Bureau, and Corps shall ensure the Project Design Team (PDT) seeks input and agreement from Level 1 Teams during design process and during pre-project reviews. The PDT shall remain flexible in the design process in order to adapt to various and unique site conditions and ensure the likelihood that completed projects meet programmatic objectives.

2. To implement RPM #2 the Forest Service, Bureau, and Corps shall ensure the following.
   a. Implement the following best management practices in addition to implementing all programmatic activities consistent with the project design criteria, activity types, and mitigation measures presented in the proposed action.
      1. Determine, based on site characteristics, whether or not reducing stream flow in order to passively move fish out of the construction site prior to electroshocking would reduce the potential for take of bull trout associated with electroshocking. Prioritize this passive movement of fish as appropriate.
      2. Electroshocking (where utilized) will be conducted with a three pass method to ensure the greatest level of fish salvage unless previously approved by the appropriate Level 1 Team to perform more or fewer passes.

3. Ensure that holding conditions for any transported fish provide the lowest level of stress to captured individuals by ensuring the availability of cold, well oxygenated water in holding vessels, minimizing holding time, and avoiding any predation in holding vessels. To avoid predation consider separate holding vessels for different age classes.
4. While block nets are set, inspect them regularly for fish and remove any living to an area far enough away from the crossing to avoid additional impingement risk.
5. Stream dewatering is not expected to last more than two weeks. If site specific conditions require dewatering and diverting the stream channel for longer than two weeks, Level 1 Teams shall be consulted to determine if additional measures are necessary to ensure that project effects are within those described in this Opinion.
6. For projects in bull trout spawning and rearing habitat, if in-stream work is required, in-stream work shall be completed by August 15th and in-stream work may not commence in the spring until May 1, to avoid potential effects to spawning bull trout, eggs, alevins, and fry. If site specific information and rationale (attached to the pre-project checklist) shows that these time frames can be adjusted without additional harm to bull trout, the Level 1 Team has the discretion to do so. Rationale for work in spawning areas in the spring prior to May 1 should also include site specific survey data that indicates bull trout did not spawn there the previous year.

b. The guidelines found at http://swr.nmfs.noaa.gov/pdf/Treated%20Wood%20Guidelines-FINALClean_2010.pdf (NOAA 2010) shall be used for any installation of treated wood if copper or creosote-based treatments are used. For other treated wood products, adhere to guidelines and BMPs in "Preservative-Treated Wood and Alternative Products in the Forest Service" (USFS 2006) and the Western Wood Preservers Institute "Best Management Practices for the Use of Treated Wood in Aquatic Environments" (1996).

c. Survey all proposed ford sites prior to design and implementation to evaluate the stream for potential bull trout spawning habitat and to ensure project design does not promote spawning at or immediately downstream of the proposed ford site.

d. Provide Level 1 Teams with a written rationale statement (attached to pre-project checklist) supporting any determination that overall impacts to stream channels will be reduced at crossing sites proposed for conversion to a ford.

e. If a temporary crossing is needed, the PDT will ensure that the designated temporary crossing area minimizes effects to fish and critical habitat.

1. Provide Level 1 Teams with a written rationale statement (attached to the pre-project checklist) as to why the temporary crossing is necessary and what steps are being taken to ensure effects are minimized.

2. The area shall be cleared of fish prior to equipment crossing, and the block nets will removed immediately after equipment crosses.
3. Minimize the frequency of crossings by equipment: Only allow equipment and vehicles to cross that are absolutely necessary.
4. Width of temporary crossings will be approximately 14 feet wide, the average road width of Forest Service roads.

3. To implement RPM #3 the Forest Service, Bureau, and Corps shall ensure the following.
   a. All captured, handled and killed ESA-listed fish shall be identified, counted, and reported on the 'post-project checklist' (Appendix A).
   b. The Action Agencies will implement a suspended sediment/turbidity monitoring program. Under the monitoring plan a reasonable sample of projects implemented under this consultation will be assessed to assure that the incidental take associated with suspended sediment and exempted in this Opinion has not been exceeded. At a minimum, 25 percent of projects completed under this Program will have monitoring completed that assesses the duration and intensity of turbidity. Monitoring can be adjusted as needed, but should consider the following recommendations.
      1. Monitoring should occur above the site once for reference conditions before the project begins and prior to stream re-watering.
      2. Monitoring should occur below the construction site where the bypass or stream diversion enters the stream and 600 feet below the site. Alternative sites may be chosen if 600 feet is excessive for a particular site.
      3. Measurements shall be recorded at the following times: (a) Prior to re-watering the stream, and (b) every 30 minutes after re-watering for 4 hours or until turbidity decreases to background.

2.8.5 Reporting and Monitoring Requirement

In order to monitor the impacts of incidental take, the Federal agency or any applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [(50 CFR 402.14 (i)(3)].

1. The action agency shall provide a Post Project Checklist for each project to the Level 1 Team within one year of completion detailing project implementation, including monitoring information and fish capture results. Bull trout surveys conducted for a project must adhere to the State Collection Permit and agencies must comply with the reporting requirements within the Permit.
2. Upon locating dead, injured, or sick bull trout not anticipated by this Opinion, as a result of Project activities, such activities shall cease. Please notify the Service within 24 hours. Circumstances leading to this unanticipated take will be discussed between the action agencies and the Service to determine whether and how the individual project and the Program as a whole, can move forward.

3. During project implementation promptly notify the Service of any emergency or unanticipated situations arising that may be detrimental for bull trout relative to the proposed activity.

2.9 Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery programs, or to develop new information on listed species.

- Prioritize culvert replacement projects to better allocate scarce funds and replace crossings that provide the most benefits to listed fish.
- Minimize the use of riprap on new structures to the smallest extent reasonable to limit the amount of streambank alteration and to ensure fish habitat is maintained while providing structural stability.
- Removal and disturbance of riparian vegetation will be minimized as much as possible when designing projects, siting relocated trails, roads and crossings, and designating temporary crossings. Disturbance to riparian vegetation will not degrade stream shading, large woody debris recruitment, or temperature to a significant level.
- If fords are proposed, relocated, or culvert crossing are proposed to be converted to a ford, and surveys indicate that it is within spawning habitat, seek alternative locations outside of spawning habitat.
- As feasible, incorporate bioengineering techniques as a substitute for or with hard armoring techniques (riprap).

2.10 Reinitiation Notice

This concludes formal consultation on programmatic Restoration Activities at Stream Crossings on National Forests and Bureau of Land Management lands in Idaho. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if:

1. The amount or extent of incidental take is exceeded. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.
2. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion.
3. The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this Opinion.
4. A new species is listed or critical habitat designated that may be affected by the action.

3. LITERATURE CITED

3.1 Literature Cited

Allen, M.B, P.J. Connolly, M.G. Mesa, J. Charrier, and C. Dixon. 2010. Distribution and movement of bull trout in the upper Jarbidge River watershed, Nevada. U.S. Geological Survey Open-File Report 2010-1033, 80 pp.

Bakke, P.D., B. Peck, and S. Hager. (2002). Geomorphic controls on sedimentation impacts. Eos. Trans. AGU, 83(47), Fall Meet. Suppl., Abstract H11C-0847, 2002. Poster presented at AGU 2002 Fall Meeting, San Francisco, California. Fish and Wildlife Service, Western Washington Fish and Wildlife Office, Lacey, Washington.

Bash, J., C. Berman, and S. Bolton. 2001. Effects of turbidity and suspended solids on salmonids. Center for Berg, R.K. and E.K. Priest. 1995. Appendix Table 1: A list of stream and lake fishery surveys conducted by U.S. Forest Service and Montana Fish, Wildlife and Parks fishery biologists in the Clark Fork River Drainage upstream of the confluence of the Flathead River from the 1950s to the present. Montana Fish, Wildlife, and Parks, Job Progress Report, Project F-78-R-1, Helena, Montana.

Berg, L. and T.G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhyncus kisutch*) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences. 42(8):1410-1417.

Berg, R.K. and E.K. Priest. 1995. Appendix Table 1: A list of stream and lake fishery surveys conducted by U.S. Forest Service and Montana Fish, Wildlife and Parks fishery biologists in the Clark Fork River Drainage upstream of the confluence of the Flathead River from the 1950s to the present. Montana Fish, Wildlife, and Parks, Job Progress Report, Project F-78-R-1, Helena, Montana.

Bisson, P.A. and R.E. Bilby. 1982. Avoidance of suspended sediment by juvenile coho salmon. North American Journal of Fisheries Management 2(4):371-374.

Bjomn, T.C., and D.W. Reiser. 1991. Habitat requirements of Salmonids in streams. Pages 83-138 *In* W.R. Meehan, editor. Influences of forest and rangeland management on salmonid fishes and their habitats. Special Publication 19. American Fisheries Society, Bethesda, Maryland.

Boag, T.D. 1987. Food habits of bull char, *Salvelinus confluentus*, and rainbow trout, *Salmo gairdneri*, coexisting in a foothills stream in northern Alberta. Canadian Field-Naturalist 101(1): 56-62.

Bond, C.E. 1992. Notes on the nomenclature and distribution of the bull trout and the effects of human activity on the species. Pages 1-4 in Howell, P.J. and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

Brewin, P.A. and M.K. Brewin. 1997. Distribution maps for bull trout in Alberta. Pages 206-216 in Mackay, W.C., M.K. Brewin and M. Monita, editors. Friends of the Bull Trout Conference Proceedings.

Buchanan, D. M. and S. V. Gregory. 1997. Development of water temperature standards to protect and restore habitat for bull trout and other cold water species in Oregon. Pages 1-8 in Mackay, W.C., M.K. Brewin and M. Monita, editors. Friends of the Bull Trout Conference Proceedings.

Burkey, T.V. 1989. Extinction in nature reserves: the effect of fragmentation and the importance of migration between reserve fragments. Oikos 55:75-81.

Casselli, J., B. Riggers, and A. Rosquist. 2000. Seigel Creek Culvert Removal, Water Monitoring Report. Lolo National Forest, Missoula, Montana. 9 pp.

Cavender, T.M. 1978. Taxonomy and distribution of the bull trout, *Salvelinus confluentus* (Suckley), from the American Northwest. California Fish and Game 64(3): 139-174.

Chapman, D. W. 1988. Critical review of variables used to define effects of fines in redds of large salmonids. Transactions of the American Fisheries Society 117(l):1-21.

Cochnauer, T., E. Schriever, and D. Schiff. 2001. Idaho Department of Fish and Game Regional Fisheries Management Investigations: North Fork Clearwater River Bull Trout, Project 9. F-73-R-22.

Cordone, A. J., and D. W. Kelley. 1961. The influences of inorganic sediment on the aquatic life of streams. California Fish and Game 47: 189-228.

Donald, D.B. and D.J. Alger. 1993. Geographic distribution, species displacement, and niche overlap for lake trout and bull trout in mountain lakes. Canadian Journal of Zoology 71: 238-247.

Dunham, J.B. and B.E. Rieman. 1999. Metapopulation structure of bull trout: influences of physical, biotic, and geometrical landscape characteristics. Ecological Applications 9(2):642-655.

Elle, F.S. and D.J. Schill. 2004. Impacts of electrofishing injury on Idaho stream salmonids at the population scale. Paper presented at the 2004 Wild Trout VIII Symposium. Idaho. 4 pp.

Foltz, R.B, B. Westfall, and B. Kopyscianski. 2012. Turbidity changes during culvert to bridge upgrades at Carmen Creek, Idaho. Rocky Mountain Research Station, Forest Service, Agreement No. DL1070035. Moscow, Idaho. 9 pp.

Fraley, J.J. and B.B. Shepard. 1989. Life history, ecology and population status of migratory bull trout (*Salvelinus confluentus*) in the Flathead Lake and River system, Montana. Northwest Science 63(4): 133-143.

Gilmour, K.M., J.D. DiBattista, and J.B. Thomas. 2005. Physiological causes and consequences of social status in salmonid fish. Integrative and Comparative Biology 45:263-273.

Goetz, F. 1989. Biology of the bull trout, *Salvelinus confluentus*, a literature review. Willamette National Forest. Eugene, Oregon.

Goetz, F. 1994. Distribution and juvenile ecology of bull trout (*Salvelinus confluentus*) in the Cascade Mountains. M.S. Thesis, Oregon State University, Corvallis, Oregon.

Hansen, A.J., R.P. Neilson, V.H. Dale, C.H. Flather, L.R. Iverson, D.J. Currie, S. Shafer, R. Cook, and P.J. Bartlein. 2001. Global Change in Forests: Responses of Species, Communities, and Biomes. BioScience 51(9):765-779.

Henley, W.F., M.A. Patterson, R.J. Neves, and A. Dennis Lemly. 2000. Effects of sedimentation and turbidity on lotic food webs: a concise review for natural resource managers. Reviews in Fisheries Science 8(2): 125-139.

Hicks, B. J., et al. 1991. Response of salmonids to habitat change. *In* Meehan, W.R., editor. Influences Of Forest And Rangeland Management On Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19. 483-518. Hogen, D. 2001. Spatial and temporal distribution of bull trout, *Salvelinus confluentus*, in the upper East Fork South Fork Salmon River watershed, Idaho. Challenge cost share agreement No. 12-CCS-99-003. Moscow, Idaho. 84 pp.

Idaho Department of Fish and Game. 1995. List of stream extirpations for bull trout in Idaho.

Independent Scientific Advisory Board (ISAB). 2007. Climate Change Impacts on Columbia River Basin Fish and Wildlife. Portland, Oregon. 136 pp.

Jakober, M. 1995. Autumn and winter movement and habitat use of resident bull trout and westslope cutthroat trout in Montana. M.S. Thesis, Montana State University, Bozeman, Montana.

Kinsella, S.R. 2005. Weathering the Change – Helping Trout in the West Survive the Impacts of Global Warming. Available at: www.montanatu.org/issuesandprojects/climatechange.pdf (last accessed January 11, 2011)

Leary, R.F., F.W. Allendorf, and S.H. Forbes. 1993. Conservation genetics of bull trout in the Columbia and Klamath River drainages. Conservation Biology 7(4):856-865.

Leary, R.F. and F.W. Allendorf. 1997. Genetic confirmation of sympatric bull trout and Dolly Varden in western Washington. Transactions of the American Fisheries Society 126:715-720.

Leathe, S.A. and P. Graham. 1982. Flathead Lake fish food habits study. E.P.A. through Steering Committee for the Flathead River Basin Environmental Impact Study.

Light, J., L. Herger and M. Robinson. 1996. Upper Klamath Basin bull trout conservation strategy, a conceptual framework for recovery. Part One. The Klamath Basin Bull Trout Working Group.

Lloyd, D.S., J.P. Koenings, and J.D. LaPerriere. 1987. Effects of turbidity in fresh waters of Alaska. North American Journal of Fisheries 7:18-33.

McCullough, D.A., J.M. Bartholow, H.I. Jager, R.L. Beschta, E.F. Cheslak, M.L. Deas, J.L. Ebersole, J.S. Foott, S.L. Johnson, K.R. Marine, M.G. Mesa, J.H. Petersen, Y. Souchon, K.F. Tiffan, and W.A. Wurtsbaugh. 2009. Research in thermal biology: burning questions for coldwater stream fishes. Reviews in Fisheries Science 17(1):90-115.

McMahon, T.E., A.V. Zale, F.T. Barrows, J.H. Selong, and R.J. Danehy. 2007. Temperature and competition between bull trout and brook trout: a test of the elevation refuge hypothesis. Transactions of the American Fisheries Society 136:1313-1326.

Meefe, G.K. and C.R. Carroll. 1994. Principles of conservation biology. Sinauer Associates, Inc. Sunderland, Massachusetts.

Megahan, W.F. 1982. "Channel sediment storage behind obstruction in forested drainage basins draining the granitic bedrock of the Idaho Batholith", in Sediment Budges and Routing in Forested Drainage Basins, USDA Forest Service General Technical Report, PNW-GTR-141, 114-121.

Montana Bull Trout Scientific Group (MBTSG). 1998. The Relationship Between Land Management Activities and Habitat Requirements of Bull Trout. Helena, Montana. 78 pp. + vi.

Mote, P.W., E.A. Parson, A.F. Hamlet, K.N. Ideker, W.S. Keeton, D.P. Lettenmaier, N.J. Mantua, E.L. Miles, D.W. Peterson, D.L. Peterson, R. Slaughter, and A.K. Snover. 2003. Preparing for climatic change: The water, salmon, and forests of the Pacific Northwest. *Climatic Change* 61:45-88.

Myers, T.J. and S. Swanson. 1996 Long term aquatic habitat restoration: Mahogany Creek, Nevada, as a case study. Journal of the American Water Research Association 32: 241-252.

Neff, J.M. 1985. Polycyclic aromatic hydrocarbons. In: Fundamentals of aquatic toxicology, G.M. Rand, and S.R. Petrocelli (eds.), pp. 416-454. Hemisphere Publishing, Washington, D.C.

Newcombe, C.P. and J.O.T. Jensen. 1996. Channel suspended sediments and fisheries: a synthesis for quantitative assessment of risk and impact. North American Journal of Fisheries Management 16: 693-727.

Newcombe, C.P. and D.D. MacDonald. 1991. Effects of Suspended Sediments on Aquatic Ecosystems. North American Journal of Fisheries Management 11:72-82.

Newton, J.A. and S. Pribyl. 1994. Bull trout population summary: Lower Deschutes River Subbasin. Oregon Department of Fish and Wildlife, The Dalles, Oregon.

Nielson, J.L. 1998. Electrofishing California's endangered fish populations. Fisheries 23:6-12.

Oregon Department of Environmental Quality. 2001. Umatilla River Basin Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP). Portland, OR.

Phillips, R., R. Laritz, E. Claire, and J. Moring. 1975. Some effects of gravel mixtures on emergence of coho salmon and steelhead trout fry. Transactions of the American Fisheries Society 104 (3): 461-466.

Poff, N. L., M. M. Brinson, and J. W. Day, Jr. 2002. Aquatic ecosystems & global climate change: Potential impacts on inland freshwater and coastal wetland ecosystems in the United States. Pew Center on Global Climate Change.

Porter, M. and M. Nelitz. 2009. A future outlook on the effects of climate change on bull trout (Salvelinus confluentus) habitats in the Cariboo-Chilcotin. Prepared by ESSA Technologies Ltd. for Fraser Salmon and Watersheds Program, British Columbia. Ministry of Environment, and Pacific Fisheries Resource Conservation Council. Available at: http://www.thinksalmon.com/reports/BullTroutHabitatOutlook_090314.pdf. (Last accessed April 29, 2011).

Pratt, K.L. 1992. A review of bull trout life history. Pages 5-9 in Howell, P. J. and D. V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

Quigley, T.M. and J.J. Arbelbide. 1997. An assessment of ecosystem components in the Interior Columbia Basin and portions of the Klamath and Great basins. Vol. III. 1174-1185pp.

Rahel, F.J., B. Bierewagen, and Y. Taniguchi. 2008. Managing aquatic species of conservation concern in the face of climate change and invasive species. Conservation Biology 22(3):551-561.

Ratliff, D. E. and P. J. Howell. 1992. The Status of Bull Trout Populations in Oregon. Pages 10-17 in Howell, P.J. and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

Rich, C.F., Jr. 1996. Influence of abiotic and biotic factors on occurrence of resident bull trout in fragmented habitats, western Montana. M.S. thesis. Montana State University, Bozeman, Montana.

Rieman, B.E. and F.W. Allendorf. 2001. Effective population size and genetic conservation criteria for bull trout. North American Journal of Fisheries Management 21:756-764.

Rieman, B.E. and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. General Technical Report INT-302, Intermountain Research Station, U.S. Department of Agriculture, Forest Service, Boise, Idaho.

Rieman, B.E. and J.D. McIntyre. 1995. Occurrence of bull trout in naturally fragmented habitat patches of varied size. Transactions of the American Fisheries Society 124 (3): 285-296.

Rieman, B.E. and J.D. McIntyre. 1996. Spatial and temporal variability in bull trout redd counts. North American Journal of Fisheries Management 16: 132-141.

Rieman, B.E., D.C. Lee and R.F. Thurow. 1997. Distribution, status and likely future trends of bull trout within the Columbia River and Klamath basins.

Rieman, B.E., J.T. Peterson, and D.L. Meyers. 2006. Have brook trout (*Salvelinus fontinalis*) displaced bull trout (*Salvelinus confluentus*) along longitudinal gradients in central Idaho streams? Canadian Journal of Fisheries and Aquatic Sciences 63:63-78.

Rieman, B.E., D. Isaak, S. Adams, D. Horan, D. Nagel, C. Luce, and D. Meyers. 2007. Anticipated climate warming effects on bull trout habitats and populations across the Interior Columbia River Basin. Transactions of the American Fisheries Society 136:1552-1565.

Robins, C.R., R.M. Bailey, C.E. Bond, J.R. Brooker, E.H. Lachner, R.N. Lea and W.B. Scott. 1980. A list of common and scientific names of fishes from the United States and Canada. American Fisheries Society Special Publication 12, Bethesda, Maryland.

Rode, M. 1990. Bull trout, *Salvelinus confluentus* Suckley, in the McCloud River: status and recovery recommendations. Administrative Report Number 90-15. California Department of Fish and Game, Sacramento, California.

Saunders, D.A., R.J. Hobbs, and C.R. Margules. 1991. Biological consequences of ecosystem fragmentation: A review. Conservation Biology 5:18-32.

Saha, M. K., and S. K. Konar. 1986. Chronic Effects of Crude Petroleum on Aquatic Ecosystem. Environmental Ecology. 4:506-510.

Schill, D.J. 1992. River and stream investigations. Idaho Department of Fish and Game.

Schill, D.J. and R.L. Scarpella. 1997. Barbed hook restrictions in catch-and-release trout fisheries: a social issue. North American Journal of Fisheries Management 17(4): 873-881.

Schmetterling, D.A. and M.H. Long. 1999. Montana anglers' inability to identify bull trout and other salmonids. Fisheries 24: 24-27.

Servizi, J.A. and D.W. Martens. 1987. Some effects of suspended Fraser River sediments on sockeye salmon (*Oncorhynchus nerka*), p. 254 – 264. In H.D. Smith, L. Margolis, and C.C. Wood [ed.]. Sockeye salmon (*Oncorhynchus nerka*) population biology and future management. Can. Spec. Publ. Fish. Aquat. Sci. 96.

Servizi, J.A. and D.W. Martens. 1992. Sublethal responses of coho salmon (Oncorhynchus kisutch) to suspended sediments. Can. J. Fish. Aquat. Sci., 49: 1389-1395.

Sexauer, H.M. and P.W. James. 1997. Microhabitat use by juvenile trout in four streams located in the Eastern Cascades, Washington. Pages 361-370 in Mackay, W.C., M.K. Brown and M. Monita, editors. Friends of the Bull Trout Conference Proceedings.

Sigler, J.W., T.C. Bjornn, and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of steelheads and coho salmon. Transactions of American Fisheries Society 113:142-150.

Staples, C.A, Williams J.B., Craig G.R., Roberts K.M. 2001. Fate, effects and potential environmental risks of ethylene glycol: a review. Chemosphere. Volume 43, Number 3, April 2001, pp. 377-383.

Suttle, K.B., M.E. Power, J.M. Levine, and C. McNeely. 2004. How fine sediment in riverbeds impairs growth and survival of juvenile salmonids. Ecological Applications 14(4):969-974.

Thomas, G. 1992. Status of bull trout in Montana. Report prepared for Montana Department of Fish, Wildlife and Parks, Helena, Montana.

U.S. Fish and Wildlife Service (USFWS). 2002a. Chapter 1, Introduction. 137pp. In: Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service (USFWS). 2002b. Chapter 2, Klamath River Recovery Unit, Oregon. 82pp. In: Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service (USFWS). 2002c. Chapter 25, St. Mary-Belly River Recovery Unit, Montana. 134 pp. In: Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service (USFWS). 2002d. Chapter 16, Clearwater River Recovery Unit, Idaho. 196 pp. In: Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service. 2004. Biological Opinion for USDA Forest Service Fish Passage Restoration Activities in Eastern Oregon and Washington 2004-2008. U.S. Fish and Wildlife Service, Region 1. Portland, Oregon, and Western Washington Fish and Wildlife Office, Lacey, Washington.

U.S. Fish and Wildlife Service (USFWS). 2004a. Draft Recovery Plan for the Jarbidge River Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon. 132 + xiii pp.

U.S. Fish and Wildlife Service (USFWS). 2004b. Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). Volume I (of II): Puget Sound Management Unit. Portland, Oregon. 389 + xvii pp.

U.S. Fish and Wildlife Service (USFWS). 2004c. Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). Volume II (of II): Olympic Peninsula Management Unit. Portland, Oregon. 277 + xvi pp.

U.S. Fish and Wildlife Service (USFWS). 2005. Bull Trout Core Area Conservation Status Assessment. U.S. Fish and Wildlife Service, Portland, Oregon. 95pp. plus appendices.

U.S. Fish and Wildlife Service (USFWS). 2006. Recovery Units and Jeopardy Determinations under Section 7 of the Endangered Species Act. Director Memorandum: FWS/AES/DCHRS/024358. March 6, 2006.

U.S. Fish and Wildlife Service (USFWS). 2008. Bull Trout (*Salvelinus confluentus*) 5-Year Review: Summary and Evaluation. 53pp.

U.S. Fish and Wildlife Service and U.S. National Marine Fisheries Service (USFWS and NMFS). 1998. Endangered Species Consultation Handbook. 351pp.

U.S. Forest Service (USFS). 2003a. Payette National Forest – Land and Resource Management Plan and Environmental Impact Statement and Appendices. McCall, Idaho. Unnumbered pages.

U.S. Forest Service (USFS). 2003b. Biological Assessment for USDA Forest Service Restoration Activities Affecting ESA-Listed Animal and Plant Species Found in Eastern Oregon and the Whole of Washington. Prepared by Region 6 United States Forest Service. 165 pp.

U.S. Forest Service (USFS). 2006. Preservative-treated wood and alternative products in the Forest Service. Technology and Development Program 0677-2809-MTDC. Missoula, MT. 50 pp.

U.S. Forest Service and U.S. Bureau of Land Management. 2011. Biological Assessment for Restoration Activities at Stream Crossings Affecting the Habitat on ESA-listed Fish Species on National Forests and Bureau of Land Management Public Lands in Idaho. Idaho Panhandle National Forest, Coeur d'Alene, Idaho and Boise, Idaho. 111 pp.

U.S. National Marine Fisheries Service. 2009. The Use of Treated Wood Products in Aquatic Environments: Guidelines to west coast NOAA Fisheries staff for Endangered Species Act and Essential Fish Habitat consultations in the Alaska, Northwest and Southwest Regions. NOAA Southwest Region. 58 pp.

Waters, T. F. 1995. Sediment in streams: sources, biological effects, and control. American Fisheries Society Monograph 7: 61-117.

Watson, G. and T. Hillman. 1997. Factors affecting the distribution and abundance of bull trout: an investigation into hierarchical scales. North American Journal of Fisheries Management 17:237-252.

Western Wood Preservers Institute. 1996. Best management practices for the use of treated wood in aquatic environments. USA Version, Revised July, 1996. Canadian Institute of Treated Wood. 27 pp.

Whitesel, T.A., J. Brostrom, T. Cummings, J. Delavergne, W. Fredenberg, H. Schaller, P. Wilson, and G. Zydlewski. 2004. Bull Trout Recovery Planning: A review of the science associated with population structure and size. Science Team Report #2004-01. U.S. Fish and Wildlife Service, Regional Office, Portland, Oregon.

Wood, P.J. and P.D. Armitage. 1997. Biological effects of fine sediment in the lotic environment. Environmental Management, 21:203 -217.

Wright, D.G. and G.E. Hopky. 1998. Guidelines for the use of explosives in or near Canadian fisheries waters. Canadian Technical Report of Fisheries and Aquatic Sciences, 2107.

Yenko, M. 2007. Renwyck Creek culvert replacement turbidity monitoring methods and results. Emmett Ranger District, Boise National Forest, Boise, Idaho. 15 pp.

Ziller, J.S. 1992. Distribution and relative abundance of bull trout in the Sprague River Subbasin, Oregon. Pages 18-29 in Howell, P.J. and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

3.2 *In Litteris* References

Hoefer, S. 2012, *in litt.* Email from Scott Hoefer, Fish Biologist (U.S. Bureau of Land Management, Idaho State Office, Boise, Idaho) to Pam Druliner, Biologist (U.S. Fish and Wildlife Service, Boise, Idaho). Subject: Re: How many potential projects would occur in Jarbidge. May 10, 2012.

4. APPENDICES

4.1 Appendix A: Project Checklists

PRE-Project Checklist

Complete checklist prior to implementation and submit to NMFS and FWS at Level 1 meetings and if requesting Section 404 permit coverage, to USACOE. Use one checklist/crossing. Provide the following attachments: NEPA documentation, map, and photos of existing crossing, and document if any are not applicable.

Administrative unit	
Subbasin Name and Number (Table 4)	
Project Name:	
Stream Name:	
Activity category (Section II.A)	
Width and slope of existing structure	
Bankfull width and slope of channel	
width and slope of proposed structure	
Anticipated date of implementation	
Pre-project fish passage (red/green/gray)	
Bull trout spawning and rearing (Yes/No)	
Bull Trout Recovery Unit and Core Area (Apdx. A)	
Chinook, steelhead population (Appendix A)	
Anticipated adverse effects to listed species (Y/N)	
If 'Yes,' provide brief explanation:	
Design Team members	**Additional Team members, if necessary**
Fisheries Biologist:	
Wildlife Biologist:	
Hydrologist:	
Engineer:	

ESA-listed Species within Project Area (check those that apply):

Species	√	Species/Critical Habitat	√
Grizzly Bear		Bull trout	
Canada lynx		Critical habitat	
Northern Idaho ground squirrel		Steelhead	
Yellow-billed cuckoo		Critical habitat	
Columbia spotted frog		Sockeye salmon	
McFarlane's four-o'clock		Critical habitat	
Spalding's catchfly		Spring/summer Chinook salmon	
Water howellia		Critical habitat	
Slickspot peppergrass		Fall Chinook salmon	
		Critical habitat	

NMFS Tracking # ____________________ **USFWS Tracking #** ____________________

POST-Project Checklist

Complete checklist within one year of project implementation and submit to NMFS and FWS at Level 1 Meeting. Use one checklist/crossing. Provide the following attachments: photos of new crossing and pre-project checklist.

Administrative unit	
Subbasin Name and Number (Table 4)	
Project Name	
Stream Name	
Width and slope of new structure	
Length of upstream habitat opened for passage	
Date of implementation	
Post-project fish passage (red/green/gray)	
Turbidity monitored during implementation (Yes/No)	
Excessive erosion observed as a result of project (Yes/No)	
If 'Yes,' provide brief explanation	
Headcutting observed above new crossing (Yes/No)	
If 'Yes,' provide brief explanation	
Is there effective substrate retention or recruitment (Y/N)	
If 'No,' provide brief explanation	
Method of fish collection during dewatering operations	
Area dewatered during implementation	
Number, species, and life stage of ESA-listed fish *handled*	
Number, species, and life stage of ESA-listed fish *injured*	
Number, species, and life stage of ESA-listed fish *killed*	

NMFS Tracking # ____________________ **USFWS Tracking #** ____________________