U.S. FISH AND WILDLIFE SERVICE PROGRAMMATIC BIOLOGICAL OPINION
for

Bonneville Power Administration's Columbia River Basin Habitat Improvement Program (HIP III)

Action Agency: Bonneville Power Administration

Consultation Conducted by: U.S. Fish and Wildlife Service
Oregon Fish and Wildlife Office

Date Issued: November 8, 2013

Issued by: Rollie White
Acting for
Paul Henson, Ph.D.
State Supervisor

Refer to: 2013-F-0199
Tails no.: 01EOFW00-2013-F-0199

Suggested Citation:

U.S. Fish and Wildlife Service. 2013. Formal section 7 programmatic consultation on BPA's Columbia River Basin Habitat Improvement Program. Oregon Fish and Wildlife Office, Portland, Oregon. TAILS no. 01EOFW00-2013-F-0199.

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1.0 Introduction

The Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to insure, in consultation with the U.S. Fish and Wildlife Service (FWS or Service) and the National Marine Fisheries Service (NMFS), as appropriate, that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitats. Section 7(a)(4) of the ESA requires Federal agencies to confer with USFWS and NMFS (the Services), as appropriate, in cases where the agency or the Services have determined that a proposed or ongoing Federal action is likely to jeopardize the continued existence of species proposed to be listed under section 4 of the ESA or result in the destruction or adverse modification of critical habitat proposed to be designated for such species.

We encourage Federal agencies to conference on actions that may affect a proposed species or proposed critical habitat. In such cases, conference concurrence determinations or conference opinions can be adopted as formal concurrences or biological opinions, respectively, after a proposed species is listed or the critical habitat is designated. Such an approach can avoid disruption of project implementation due to the need to initiate and complete formal consultation at the time of listing or designation. It also facilitates or promotes action agency consideration of the conservation needs of proposed species and the recovery function of proposed critical habitat.

This document transmits the USFWS's biological opinion (BO) based on an interagency consultation on Bonneville Power Administration's Columbia Basin Habitat Improvement Program (HIP) pursuant to sections 7(a)(2) and 7(a)(4) of the ESA and its implementing regulations found in the Code of Federal Regulations (CFR) at 50 Part 402. BPA's HIP program consists of aquatic and wildlife habitat restoration projects designed and implemented to restore or enhance stream and riparian function as well as upland wildlife habitat. These projects will improve channel dimensions and stability, sediment transport and deposition, riparian, wetland, and floodplain function, hydrologic function, as well as water quality. Furthermore, such improvements will help address limiting factors related to spawning, rearing, migration, and more for ESA listed and other native fish and wildlife species. BPA's biological assessment (BA) was received at the Service's Pacific Region Office on July 27, 2012. An amended BA was provided to the Service's Oregon Fish and Wildlife Office on August 26, 2013. The initial BA addressed effects of the proposed action on the federally threatened bull trout (*Salvelinus confluentus*), and threatened Oregon chub (*Oregonichthys crameri*), as well as federally listed anadromous salmon and steelhead under the jurisdiction of the NMFS.

Upon review of the initial BA by the Service's Oregon Fish and Wildlife Office, a recommendation was made to BPA to include federally listed and proposed wildlife and plant species in the consultation. BPA agreed to the request and the Service offered to help develop project design criteria and conservation measures for wildlife and plants to minimize the proposed action's effects. It was agreed that once complete, BPA would send a revised proposed action, by way of a BA amendment, to the Service. BPA and the Service met numerous times in the fall of 2012 and winter and spring 2013 to discuss the amendment and other aspects of the consultation such as widening the action area to include western Montana. A final BA amendment from BPA was received by the Service on August 26, 2013. The amendment requested concurrence from the Service with BPA's determination that the proposed action "may affect, but is not likely to adversely affect", a suite of listed and proposed wildlife and plant species and aquatic invertebrates. In addition to bull trout and Oregon chub, the amendment requested formal consultation on marbled murrelet (*Brachyramphus marmoratus*) and its designated critical habitat. A draft BO was subsequently provided to BPA on September 20, 2013. BPA provided comments on the draft BO back to the Service on October 21, 2013.

This document includes our concurrence on BPA's determination that the proposed action may affect, but is "not likely to adversely affect", a suite of other federally listed and proposed species and their respective critical habitats (discussed in the Concurrences section below). This BO is based on information provided in BPA's July 2012 BA and August 2013 BA Amendment, published literature and other sources of information. A complete decision record for this consultation is on file at the Service's Oregon Fish and Wildlife Office in Portland, Oregon.

Time Frame of Proposed Action

Although BPA's proposed actions under their HIP I and HIP II consultations with NMFS were for a set period of 5 years each, with the HIP III proposed action, BPA is proposing their action indefinitely. The Service and NMFS agreed to this proposal with the caveat that any new listings of species or critical habitat within the action area will be cause for reinitiation.

1.1 Background

In 1980, Congress passed the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Public Law 96-501), which authorized the creation of the Northwest Power Planning Council (now called the Northwest Power and Conservation Council, NPCC) with representatives appointed by the states of Idaho, Montana, Oregon, and Washington. The Act directed the NPCC to prepare a program to "protect, mitigate and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries … affected by the development, operation, and management of hydroelectric projects while assuring the Pacific Northwest an adequate, efficient, economical and reliable power supply." BPA's authority and responsibility to fund fish and wildlife habitat improvement actions derive in large part from this law. The NWPCC's Columbia River Basin Fish and Wildlife Program (the Fish and Wildlife Program) (NWPPC 2000) is the largest regional effort in the nation to recover, rebuild, and mitigate fish, wildlife and associated habitats.

In addition to the projects identified through the NWPCC's Fish and Wildlife Program, BPA funds other fish and wildlife habitat projects that may be covered under the HIP III consultation. With the listing of a number of anadromous fish species under the ESA in the late 1990s, BPA, the U.S. Army Corps of Engineers (USACE), and U.S. Bureau of Reclamation (BOR) (together the "Action Agencies") began a series of consultations with the Services on the operation and maintenance of the Federal Columbia River Hydropower System (FCRPS). The latest of these is the 2008 FCRPS consultation, a multi-species biological opinion that addresses the aggregate effects of continued operation and maintenance of the Columbia and Snake River hydropower system by the Action Agencies on the tributaries, mainstem, and estuary and plume, on ESA-listed species (NMFS 2008). Since 1978, BPA has committed nearly $12.5 billion to support Northwest fish and wildlife recovery.

BPA's operations are governed by several statutes, including the Northwest Power Act. Among other things, this Act directs BPA to protect, mitigate, and enhance fish and wildlife affected by the development and operation of the FCRPS. To assist in accomplishing this, the Act requires BPA to fund fish and wildlife protection, mitigation, and enhancement actions consistent with the Northwest Power and Conservation Council's (NPCC's) Fish and Wildlife Program. Under this program, the NPCC makes recommendations to BPA concerning which fish and wildlife projects to fund. It is important to note that we are consulting on a set of actions that BPA routinely funds through that programunder the authorities of the Northwest Power Act.

BPA funds the implementation of about 500 habitat restoration projects a year through the HIP. The projects include repairing and improving fish spawning and rearing habitat, studying fish diseases, resident fish mitigation, providing fish passage, and protecting and improving wildlife habitat. Certain fish and wildlife habitat improvement projects funded by BPA are the focus of this consultation. BPA funds these projects in fulfillment of its obligations under two auspices: The NPCC's Columbia River Basin Fish and Wildlife Program, and the various Biological Opinions issued to BPA.

Since BPA is one of the Action Agencies involved in the 2008 FCRPS BO, the estuary and tributary habitat improvement actions proposed under the HIP III consultation include many of the habitat actions developed to implement the 2010/2008 FCRPS BO. The goals, objectives, scientific foundation and actions of the Fish and Wildlife Program are structured in a "framework," an organizational concept for fish and wildlife mitigation and recovery efforts, that brings together ESA requirements for recovering listed species, the broader requirements of the Northwest Power Act, and the policies of the states and Indian Tribes of the Columbia River Basin into a comprehensive program that has a solid scientific foundation. Fish and wildlife projects are recommended to BPA by the NPCC through a process that includes review by an independent scientific review panel, regional fish and wildlife agencies, Indian Tribes, and BPA. The majority of actions are to be covered under the FCRPS BO, as well as the habitat actions being implemented for the NPCC's Fish and Wildlife Program. While the 2008 FCRPS Opinion is currently under remand to the District Court, the Action Agencies are continuing to implement the updated proposed actions. To the extent additional habitat improvement actions are committed to in the remand process for the 2008 FCRPS Opinion, most are expected to be covered by the HIP III consultations and resulting opinions from the USFWS and NMFS.

1.2 Consultation History

After issuance of the FCRPS 2000 BO, a number of Reasonable and Prudent Alternatives (RPAs) were implemented to improve habitat conditions towards salmon survival and recovery. While the proposed habitat improvement projects are, in the long term, beneficial to many listed species, some actions produce short-term adverse effects and required further ESA consultation. Many of the proposed activities are minor in nature and their effects are similar. Because of new ESA listings and the large number of habitat improvement projects being implemented under the Fish and Wildlife Program, BPA engaged the Services for programmatic coverage on habitat improvement activities beginning in 1999.

On August 1, 2003, NMFS issued a programmatic opinion and essential fish habitat (EFH) consultation (NMFS No. 2003/00750) for the BPA's HIP I. This program is carried out according to the BPA's authority under the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Public Law 96-501) throughout the Columbia River basin to mitigate for the effects of the FCRPS on fish, wildlife, and their habitat.

On June 21, 2007, the BPA submitted a new BA to NMFS and re-initiated formal consultation for the Habitat Improvement Program. A second BO (HIP II BO) was signed on January 10, 2008, to cover calendar years 2008-2012. As shown in more detail in the next section, BPA has continued to increase the numbers of projects using the HIP II BO during the time the programmatic has been in place.

Beginning in 2010, BPA created a quality control process to review all HIP documents prior to submission to NMFS to improve consistency, and thus more detailed implementation information is available from 2010 forward. Under HIP II, 753 project activities were funded and implemented (again, one project may involve more than one activity category). Of these, 263 were vegetation management projects, with a total of 23,887 acres treated with herbicides (primarily eastern Oregon, eastern Washington, and Idaho); of these, 3,186 acres were within riparian areas. Other common activities, in descending order of frequency, were installing habitat-forming natural materials and instream structures; fish passage (maintain facilities and improve passage); and replacement of bridges, culverts, and fords. Table 1 provides information on the total number of projects that were covered under HIP II by activity category and subcategory.

Table 1. Total number of projects that were covered under NMFS' HIP II BO by activity category and subcategory, from 2008 through April 30, 2012.

Category	Subcategory
Surveying, Construction, Operation, and Maintenance Activities (136)	
Planning and Habitat Protection Actions (78)	
	Survey Stream Channels, Floodplains, and Uplands; Install Stream Monitoring
	Devices such as Steamflow and Temperature Monitors (57)
	Acquire Fee-Title Easement, Enter Cooperative Agreements, Lease Land, and/or Water (6)
	Protect Streambanks Using Bioengineering Methods (15)
Small-Scale Instream Habitat Actions (110)	
	Install Habitat-Forming Natural Materials Instream Structures (43)
	Improve Secondary Channel Habitats (17)
	Create Rehabilitate, and Enhance Riparian and Wetland Habitat (16)
	Improve Fish Passage (34)
	Supplement In-Channel Nutrients (0)
Livestock Impact Reduction (55)	
	Construct Fencing for Grazing Control (29)
	Install Off-Channel Watering Facilities (22)
	Harden Fords for Livestock Crossing of Streams (4)
Control of Soil Erosion from Upland Farming (28)	
	Create Upland Conservation Buffers (2)
	Implement Conservation Cropping Systems (0)
	Stabilize Soils via Planting and Seeding (16)
	Implement Erosion Control Practices (10)
Irrigation and Water Delivery/Management Actions (35)	
	Convert Delivery System to Drip or Sprinkler Irrigation (1)
	Convert Water Conveyance from Open Ditch to Pipeline, Line Leaking Ditches and Canals (8)
	Convert from Instream Diversions to Groundwater Wells for Primary Water Sources (5)
	Install or Upgrade/Maintain Existing Fish Screens (8)
	Consolidate Diversions, Replace Irrigation Diversion with Pump Station, Remove Diversion(9)
	Install or Replace Return Flow Cooling Systems (1)
	Install Irrigation Water Siphon Beneath Waterway (2)
Native Plant Community Establishment and Protection (321)	
	Plant Vegetation (58)
	Manage Vegetation Using Physical Controls (43)
	Manage Vegetation Using Herbicides (220)
Road Actions (45)	
	Maintain Roads (13)
	Maintain, Remove, and Replace Bridges, Culverts, and Fords (27)
	Decommission Roads (5)
Special Actions (2)	
	Install/Develop Wildlife Structures (2)

In September of 2011, BPA contacted both NMFS and USFWS to discuss programmatic consultation on their HIP program. After numerous telephone conversations, e-mail exchanges, and meetings to clarify the scope and implementation of the HIP III consultation, BPA decided to move forward with a joint BA that would address aquatic species under both USFWS and NMFS jurisdiction. During this initiation of consultation, BPA, NMFS, and USFWS staff met numerous times to discuss issues and refine the activity descriptions and conservation measures. While BPA is consulting with NMFS for the third time on the HIP program, the consultation between BPA and the USFWS represents the first programmatic consultation between the two agencies on the HIP program.

On July 27, 2012, the Service received a final BA and request for consultation from BPA. In the months following receipt of the BA, the Service determined that the proposed action could potentially impact a number of federally listed and proposed terrestrial species. Consequently, we requested BPA consider amending the HIP III BA to include terrestrial species to which they agreed, with the caveat that the Service would provide assistance. In addition, BPA requested via email to the Service on 10/15/2012, that the action area be widened to include western Montana (the action area previously included just Oregon, Washington and Idaho). We received a BA amendment from BPA on August 26, 2013, that clarified the action area and addressed potential effects to terrestrial species. We consider the August 26, 2013 date as the date that a complete package was received for initiating formal consultation with the Service on the HIP III proposed action.

On September 20, 2013, the Service submitted a draft final BO to BPA. BPA's comments on the draft BO were received by the Service on October 21, 2013, and a final BO was signed by the Service on November 8, 2013.

1.3 Concurrences on other Listed and Proposed Species

As noted above, BPA's original BA did not consider effects to federally listed and proposed terrestrial species and several aquatic invertebrates that could potentially be impacted by the aquatic restoration actions contained in the HIP III proposed action. Based on examination of projects previously implemented under BPA's HIP I and HIP II program, the Service determined the vast majority of actions proposed under the HIP III program would likely have insignificant or discountable affects to these species and associated critical habitat, particularly if general and species-specific conservation measures (CMs) were followed to avoid or reduce the likelihood of adverse effects to these species. BPA subsequently agreed to amend their BA to include these species (Table 2 below) and the Service agreed to draft general and species-specific CMs that BPA would adopt as part of their proposed action through an amended BA.

Both agencies agreed that the measures would be developed such that if adhered to by BPA and their project proponents, would allow BPA to reach a Not Likely to Adversely Affect (NLAA) determination for each of the potentially affected terrestrial and aquatic invertebrate species and any associated critical habitat. It was further agreed that if a restoration project implemented under the HIP program could not adhere to the general and species-specific CMs, thus avoiding adverse effects, then the project would need to be modified to comply with the CMs, or a variance would need to be requested from the Service, or the project would need to undergo individual section 7 consultation. Furthermore, if species currently proposed are listed during the time period this consultation is in effect, and the listing is finalized without any substantive changes, then this document will also represent the Service's concurrence on the "may affect, not likely to adversely affect" determinations for the proposed action because the effects of the action are insignificant and discountable or wholly beneficial. No further section 7 consultation for these species would be necessary.

We considered BPA's request for our concurrence that the HIP III proposed action may affect, but is not likely to adversely affect the listed species shown in Table 2. We agree that with implementation of the general and species-specific CMs described in Appendix D to this document, effects to these species are extremely unlikely to occur, and are therefore insignificant or discountable. Thus we concur with your determination of effects on listed and proposed species (Table 2) from specific activities described as part of the HIP III proposed action.

Our concurrences are based on the following summarized information available to the Service and presented in BPA's final BA and August 2013 BA Amendment:

- The goals of BPA's HIP III program addressed in the programmatic BA is to restore native habitats to benefit native fish, wildlife, and plant species, including federally listed species.
- By following the General and Activity-Specific CMs identified in the proposed action and the terrestrial and aquatic invertebrate CMs identified in Appendix D of this document, short-term impacts to habitats, including designated and proposed critical habitats, respectively, supporting the federally listed species in Table 1 are limited to those that are insignificant, discountable or wholly beneficial. Adverse effects to these habitats are not anticipated.
- By following the general and species-specific CMs the proposed action is not likely to result in harm or harassment to the federally listed and proposed species identified in Table 2 below.
- No primary constituent elements (PCEs) or constituent/essential biological elements, as appropriate, in designated critical habitat for the species listed in Table 1 will be adversely affected by the proposed action. The General and Activity-Specific CMs and terrestrial and aquatic invertebrate CMs have been designed to substantially minimize or eliminate the amount and severity of potential effects to the physical and biological habitat components represented by PCEs or constituent/essential biological elements for the species.

Table 2. Listed or Proposed Species and Critical Habitat Concurrences

SPECIES/CRITICAL HABITAT & STATUS			STATE				Categories of Action							
SPECIES	**ESA Status**	**Critical Habitat**	**ID**	**MT**	**OR**	**WA**	**Fish Passage Restoration**	**River, Stream, Floodplain, and Wetland Restoration**	**Invasive and Non-native Plant Control**	**Piling Removal**	**Road and Trail Erosion Control, Maintenance, and Decommissioning**	**In-channel Nutrient Enhancement**	**Irrigation and Water Delivery/Manageme nt Actions**	**Fisheries, Hydrologic, and Geomorphologic Surveys**
MAMMALS														
Canada lynx - Contiguous US DPS	T	Y	X	X	X	X	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Columbian White-tailed Deer	E	N			X	X	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Gray wolf	E	N				X	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Grizzly Bear	T	N	X	X		X	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
North American wolverine	PT	N	X	X	X	X	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Northern Idaho ground squirrel	T	N	X				NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Pygmy rabbit	E	N				X	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Woodland caribou - Selkirk Mtn	E	Y	X			X	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
BIRDS														
Northern spotted owl	T	Y			X	X	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Short-tailed albatross	E	N			X	X	NE	NE	NE	NE	NE	NE	NE	NE
Streaked horned lark	T	Y			X	X	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Western snowy plover	T	Y			X	X	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
INVERTEBRATES														
Banbury Springs limpet	E	N	X				NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Bliss Rapids snail	T	N	X				NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Bruneau Hot springsnail	E	N	X				NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Snake River Physa snail	E	N	X				NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Fender's blue butterfly	E	N			X		NE	NLAA	NLAA	NE	NLAA	NE	NE	NE

SPECIES/CRITICAL HABITAT & STATUS			STATE				Categories of Action							
SPECIES	ESA Status	Critical Habitat	ID	MT	OR	WA	Fish Passage Restoration	River, Stream, Floodplain, and Wetland Restoration	Invasive and Non-native Plant Control	Piling Removal	Road and Trail Erosion Control, Maintenance, and Decommissioning	In-channel Nutrient Enhancement	Irrigation and Water Delivery/Management Actions	Fisheries, Hydrologic, and Geomorphologic Surveys
Oregon silverspot butterfly	T	N			X	X	NE	NLAA	NLAA	NE	NLAA	NE	NE	NE
Taylor's checkerspot butterfly	E	Y			X		NE	NLAA	NLAA	NE	NLAA	NE	NE	NE
PLANTS														
Bradshaw's lomatium	E	N			X	X	NE	NLAA	NLAA	NE	NLAA	NE	NE	NE
Cook's lomatium	E	Y			X		NE	NE	NLAA	NE	NLAA	NE	NE	NE
Gentner's fritillary	E	N			X		NE	NE	NLAA	NE	NLAA	NE	NE	NE
Golden paintbrush	T	N			X	X	NE	NE	NLAA	NE	NLAA	NE	NE	NE
Howell's spectacular thelypody	T	N			X		NE	NE	NLAA	NE	NLAA	NE	NE	NE
Kincaid's lupine	T	Y			X	X	NE	NE	NLAA	NE	NLAA	NE	NE	NE
Large-flowered wooly meadowfoam	E	Y			X		NE	NE	NLAA	NE	NLAA	NE	NE	NE
Malheur wire-lettuce	E	Y			X		NE	NE	NLAA	NE	NLAA	NE	NE	NE
McFarlane's four o'clock	T	N	X		X		NE	NE	NLAA	NE	NLAA	NE	NE	NE
Nelson's checkermallow	T	N			X	X	NE	NLAA	NLAA	NE	NLAA	NE	NE	NE
Rough popcorn flower	E	N			X		NE	NE	NLAA	NE	NLAA	NE	NE	NE
Showy stickseed	E	N				X	NE	NE	NLAA	NE	NLAA	NE	NE	NE
Slickspot peppergrass	PT	P	X				NE	NE	NLAA	NE	NLAA	NE	NE	NE
Spalding's catchfly	T	N	X	X	X	X	NE	NE	NLAA	NE	NLAA	NE	NE	NE
Umtanum Desert buckwheat	PT	Y				X	NE	NE	NLAA	NE	NLAA	NE	NE	NE
Ute ladies' tresses	T	N	X	X		X	NE	NLAA	NLAA	NE	NLAA	NE	NE	NE
Water howellia	T	N	X	X	X	X	NE	NLAA	NLAA	NE	NLAA	NE	NE	NE

SPECIES/CRITICAL HABITAT & STATUS			STATE				Categories of Action							
SPECIES	ESA Status	Critical Habitat	ID	MT	OR	WA	Fish Passage Restoration	River, Stream, Floodplain, and Wetland Restoration	Invasive and Non-native Plant Control	Piling Removal	Road and Trail Erosion Control, Maintenance, and Decommissioning	In-channel Nutrient Enhancement	Irrigation and Water Delivery/Management Actions	Fisheries, Hydrologic, and Geomorphologic Surveys
Wenatchee Mtn checkermallow	E	Y				X	NE	NE	NLAA	NE	NLAA	NE	NE	NE
Western lily	E	N			X		NE	NLAA	NLAA	NE	NLAA	NE	NE	NE
Willamette daisy	E	Y			X		NE	NLAA	NLAA	NE	NLAA	NE	NE	NE
White Bluffs bladderpod	PT	Y				X	NE	NE	NLAA	NE	NLAA	NE	NE	NE

Although Oregon spotted frog (*Rana pretiosa*) and associated critical habitat were proposed for listing in the Federal Register on August 29, 2013, we are choosing to not conference on this species in this consultation due to the fact that limited conservation measures and project design criteria have been developed for this species that would be relevant to the restoration actions included in BPA's proposed action. We anticipate developing conservation measures over the next year that could be applied to restoration projects when and if the species is listed. If a federal listing is announced, the Service will coordinate with BPA on review of spotted frog distribution relative to the HIP III action area and on an assessment of likely effects from HIP III implementation. If implementation of conservation measures and project design criteria (to be developed) can ensure insignificant or discountable effects to Oregon spotted frog, then we will amend our BO accordingly to include this species in the concurrence section. If we determine implementation of HIP III will likely have adverse affects on Oregon spotted frog, we will reinitiate consultation and amend our BO to include Oregon spotted frog. In the interim period between now and a listing determination, please consider reviewing the proposed critical habitat unit maps on our website: http://www.fws.gov/wafwo/osf.html

The proposed critical habitat maps respresent the best available information on the distribution of this species in Oregon and Washington. There are 14 critical habitat unit maps, 8 of which document occurrence within the HIP III action area. These include Units 5 and 6 in Washington (Kickatat and White Salmon river basins), and in Oregon, Unit 7 (L. Deschutes), Units 8A and 8B (Upper Deschutes), Unit 9 (Little Deschutes), Unit 10 (McKenzie), and Unit 11 (Middle Fork Willamette). If a HIP III action is planned within an area of spotted frog occupancy based on the maps referenced above, we recommend contacting Jennifer O'Reilly (Oregon) at (541) 541-312-7146 or Deanna Lynch (Washington) at (360) 753-9545 to discuss possible conservation measures.

2.0 Biological Opinion

This Biological Opinion (BO) presents the results of our consultation with BPA on the HIP III proposed action. For the jeopardy analyses, the Service reviewed the status of bull trout, Oregon chub, and marbled murrelet, the environmental baseline in the action area, the effects of the action, and cumulative effects (50 CFR 402.14(g)).

For the critical habitat destruction or adverse modification analysis, the Service considered the status of critical habitat, the functional condition of critical habitat in the action area (environmental baseline), the likely effects of the action on that level of function, and the cumulative effects. From this assessment, the Service discerned whether any predicted change in the function of the constituent elements of critical habitat in the action area would be enough, in view of existing risks, to appreciably reduce the conservation value of the critical habitat at the designation scale. This analysis does not employ the regulatory definition of "destruction or adverse modification" at 50 CFR 402.02. Instead, this analysis relies on statutory provisions of the ESA, including those in section 3 that define "critical habitat" and "conservation," in section 4 that describe the designation process, and in section 7 that set forth the substantive protections and procedural aspects of consultation, and on agency guidance for application of the "destruction or adverse modification" standard (Hogarth 2005).

2.1 Summary of Changes from the Previous HIP II Consultation with NMFS

The HIP III proposed action is a reorganization and expansion of the original HIP II activity categories. By using existing BOs on similar restoration-based programmatic actions, BPA has taken advantage of existing successful approaches to promote regional consistency in design criteria for similar project types. The documents used include: USFWS Partners for Fish and Wildlife, U.S. Forest Service (USFS) and Bureau of Land Management (BLM) Aquatic Restoration BO (ARBO I and ARBO II BA), NOAA Restoration Center's BO, USACE Standard Local Operating Procedures for Endangered Species (SLOPES IV) (Restoration and Transportation) (in Oregon), USACE Washington State Fish Passage and Habitat Enhancement Restoration Programmatic consultation, and NMFS' HIP I and HIP II BOs. Using project design criteria, conservation measures, and language from these existing programs, BPA has added activities that are new to the HIP such as piling removal, low flow consolidation, headcut and grade stabilization, boulder structures, engineered logjams, and channel reconstruction. BPA also widened the action area for HIP III beyond the Columbia River Basin in Oregon, Washington and Idaho to include western Montana and Oregon coastal river basins from the Columbia River south to Cape Blanco in southwestern Oregon, to reflect anticipated HIP expenditures in these geographic areas.

With HIP III, BPA has proposed to form an internal restoration review team (RRT) of technical experts who shall provide a design review of each moderate to high-risk project in accordance with design complexity and significance. This is a new internal quality assurance/quality control (QA/QC) process at BPA, the role of which is to define high, medium, and low risk project types, and then provide additional review on medium and higher risk projects. This process is described in detail in Appendix C of this BO. The RRT structure will include a Team leader, Core Team members, technical Team members, and representatives from NMFS and USFWS. The RRT will evaluate projects to (a) ensure consistency among projects, (b) maximize ecological benefits of restoration and recovery projects, and (c) ensure consistent use and implementation throughout the geographic area covered by the USFWS and NMFS BOs.

3.0 Description of the Proposed Action

Aquatic and wildlife habitat restoration projects are generally designed and implemented to restore or enhance stream and riparian area function and fish habitat. The projects included under this programmatic consultation will improve channel dimensions and stability, sediment transport and deposition, riparian, wetland, and floodplain functions, hydrologic function, as well as water quality. Furthermore, such improvements will help address limiting factors related to spawning, rearing, migration, and more for ESA-listed and other native fish species.

3.1 Categories of Actions

The following nine categories of actions that are anticipated to receive funding by BPA are described in more detail later in this BO. As previously noted, the aquatic and wildlife restoration activity categories listed below represent the integration, consolidation and expansion of prior restoration programmatic consultations in the Pacific Northwest to take advantage of successful approaches and to promote regional consistency in design criteria for similar project types.

1. **Fish Passage Restoration.**
   Profile Discontinuities.
   a. Dams, Water Control or Legacy Structure Removal.
   b. Consolidate, or Replace Existing Irrigation Diversions.
   c. Headcut and Grade Stabilization.
   d. Low Flow Consolidation.
   e. Providing Fish Passage at an Existing Facility.
   Transportation Infrastructure.
   f. Bridge and Culvert Removal or Replacement.
   g. Bridge and Culvert Maintenance.
   h. Installation of Fords.
2. **River, Stream, Floodplain, and Wetland Restoration.**
   a. Improve Secondary Channel and Wetland Habitats.
   b. Set-back or Removal of Existing, Berms, Dikes, and Levees.
   c. Protect Streambanks Using Bioengineering Methods.
   d. Install Habitat-Forming Natural Material Instream Structures (Large Wood, Boulders, and Spawning Gravel).
   e. Riparian Vegetation Planting.
   f. Channel Reconstruction.
3. **Invasive and Non-Native Plant Control.**
   a. Manage Vegetation using Physical Controls.

   b. Manage Vegetation using Herbicides.

4. **Piling Removal.**
5. **Road and Trail Erosion Control, Maintenance, and Decommissioning.**
   a. Maintain Roads.
   b. Decommission Roads.
6. **In-channel Nutrient Enhancement.**
7. **Irrigation and Water Delivery/Management Actions.**
   a. Convert Delivery System to Drip or Sprinkler Irrigation.
   b. Convert Water Conveyance from Open Ditch to Pipeline or Line Leaking Ditches or Canals.
   c. Convert from Instream Diversions to Groundwater Wells for Primary Water Sources.
   d. Install or Replace Return Flow Cooling Systems.
   e. Install Irrigation Water Siphon Beneath Waterway.
   f. Livestock Watering Facilities.
   g. Install New or Upgrade/Maintain Existing Fish Screens.
8. **Fisheries, Hydrologic, and Geomorphologic Surveys.**
9. **Special Actions (for Terrestrial Species).**
   a. Install/develop Wildlife Structures.
   b. Fencing construction for Livestock Controll
   c. Implement Erosion Control Practices.
   d. Plant Vegetation.
   e. Tree Removal for LW Projects.

3.2 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for this consultation is the Columbia River Basin within the contiguous United States excluding the portion of Nevada that is in the Columbia Basin (Figure 1). At the request of the NMFS, the action area also includes Oregon coastal river basins from Cape Blanco in the south to the Columbia River in the north.

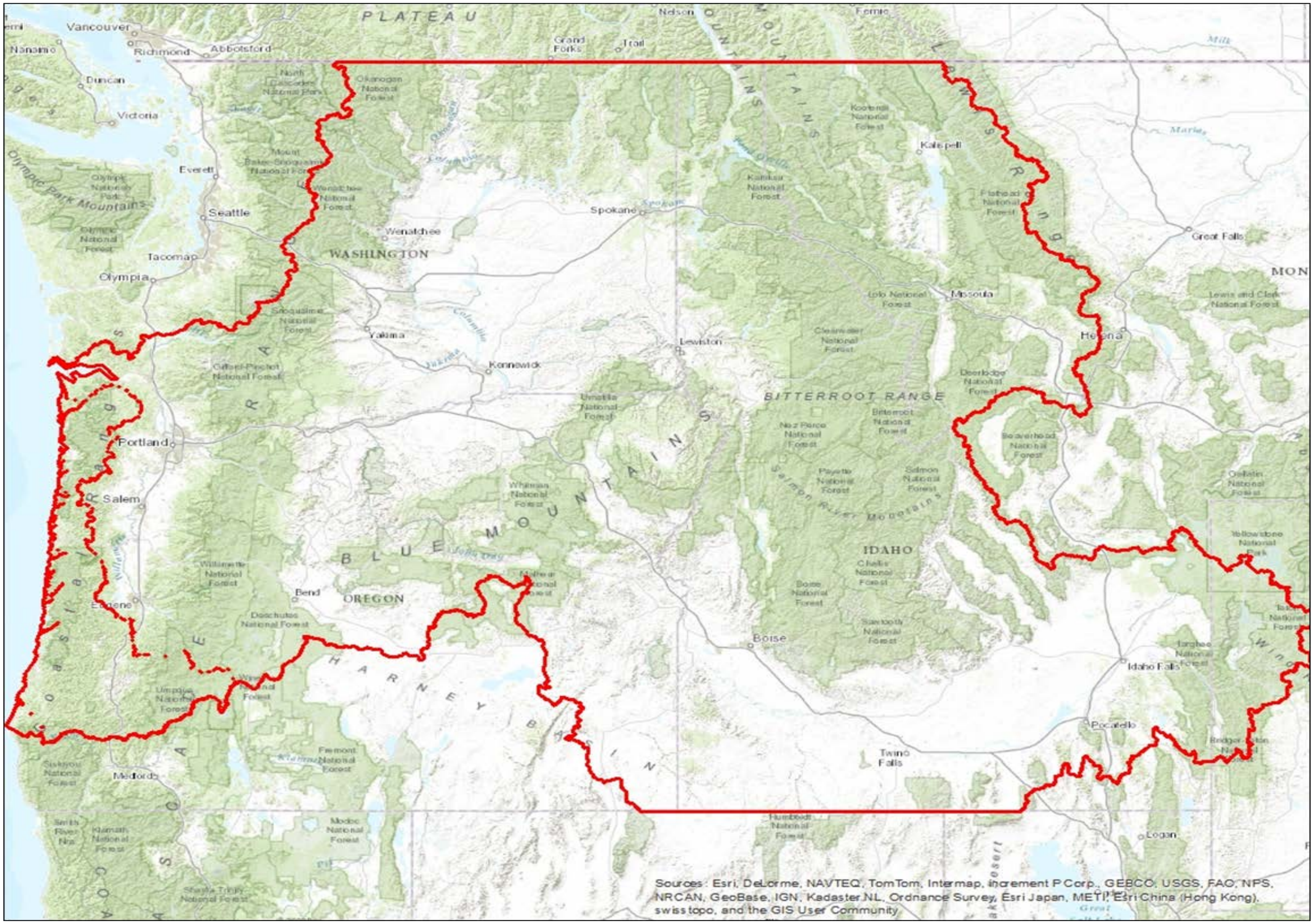

Figure 1. BPA's HIP III Action Area

3.3 Program Administration

3.3.1 Project Review and Notification

To ensure ESA Section 7 compliance under the HIP III consultation for each site-specific action, BPA environmental compliance (EC) staff will individually review each action through information submitted by the project sponsor. For HIP funded projects occurring on U.S. Forest Service (USFS) and Bureau of Land Management (BLM) lands in Oregon and Washington, the Aquatic Restoration Biological Opinions (ARBO II) from FWS and NMFS should be adhered to rather than the HIP III BOs from the Services.

The Corps is a cooperating agency in this consultation between the Service and BPA. The Corps will issue permits under Section 404 of the Clean Water Act (CWA) (33 U.S.C. 1251 et seq) and/or Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C 403) for activity categories described in BPA's proposed action and authorized under this BO (and NMFS' HIP III BO). The Corps has reviewed the BPA's HIP III BA and concurs with the effects analyisis regarding those actions requiring Corps permits and requests that these permit actions be included in the consultation. For HIP funded actions requiring Corps permits, the Corps will review applications to ensure the effects are within the range of those described in this BO. Any Corps permits issued for these activities will include a condition requiring the applicant to comply with all of BPA's conservation measures contained in the proposed action, and any reasonable and prudent measures and implementing terms and conditions resulting from this consultation.

The following describes the process that will be implemented for HIP III. BPA determines which projects it will fund and contracts with the project sponsors (i.e., state fish and wildlife agencies, Indian Tribes, soil and water conservation districts, irrigation districts, and other Federal agencies and non-profit entities) to implement the projects. As part of the contract and statement of work development process, the BPA EC staff will review the individual work elements in the statement of work to determine what, if any, ESA compliance will be needed prior to implementation of the work. If ESA compliance is needed, BPA EC staff will make a preliminary determination of whether the proposed work can be covered under the HIP III programmatic consultations by USFWS and NMFS. If so, the BPA EC staff will notify the project sponsor that they will need to complete a Project Notification/Completion form (Appendix A of this BO). The Project Notification/Completion form (PNC) that will be used for HIP III represents the combining of individual Notification and Completion forms that were utilized in the HIP I and HIP II consultations between NMFS and BPA.

To determine if the project needs Restoration Review Team (RRT) review, BPA EC staff will make a preliminary determination of the level of risk. The risk levels are ***low, medium,*** and ***high*** and shall take into consideration both project impact and stream response potential. If BPA EC staff determines the project is within the ***medium*** to ***high*** risk category, the project shall be submitted to the RRT for review. With the exception of the **Fish Passage Restoration** activity category, most projects that will fulfill all proposed conservation measures will not require RRT review. If RRT review is triggered, then procedures outlined in Appendix C of this BO shall be followed.

BPA will submit a PNC form to USFWS and/or NMFS (together the Services) in addition to the USACE, no later than 30-days before beginning in-water work on any action that will be funded or carried out under this programmatic BO. If the BPA EC staff is satisfied that the project can and will be implemented according to the HIP III proposed action and subsequent requirements in BOs from USFWS and NMFS, and BPA decides to move forward with project funding for implementation, the BPA EC staff will approve the project using internal procedural guidelines outlined in the HIP III BA (and Appendix A of this BO). After that is completed the project may proceed without further consultation with the Services. If, however, BPA or the project sponsor determines the project cannot be implemented according to the Services HIP III BOs, then one of the following must occur: 1) changes must be made to the project design so that it *can* be implemented according to the HIP III BOs; or, 2) a variance must be requested and approved by the FWS and/or NMFS; or, 3) BPA and the project sponsor must initiate individual (non-programmatic) Section 7 consultation with the Services on the identified action.

3.3.2 Variance Requests

Because of the wide range of activities that could be proposed within the categories included in BPAs HIP III proposed action, and the natural variability within and between watersheds, some projects may require minor variations from the measures specified herein (either from the general conservation measures applicable to all actions, or conservation measures specific to any of the eight action categories). Minor variances will be sought, as needed, from the appropriate NMFS Branch Chief or USFWS Field Office Supervisor (see Appendix B of this document). Minor variance requests will: (a) cite the relevant opinion by identifying number; (b) cite the relevant criterion by page number; (c) define the requested variance; (d) explain why the variance is necessary; and (e) provide a rationale why the variance will either provide a conservation benefit or, at a minimum, not cause additional adverse effects.

The Services will consider granting variances, especially when there is a clear conservation benefit or there are no additional adverse effects (especially incidental take) beyond that considered in the Services BOs. Variance requests can be made on the PNC form, which can then be submitted and approved by the Services via email correspondence.

If at any time there are uncertainties in implementing the proposed action's conservation measures or interpreting the reasonable and prudent measures and terms and conditions of the HIP III BOs, or doubts about the consistency with the HIP III BOs, the project sponsor, in conjunction with BPA staff, and if necessary the RRT, will coordinate with the Services to address these concerns and resolve any outstanding issues. If the project sponsor or BPA EC staff determines that a proposed action is not consistent with the HIP III BOs, or if the Services do not approve a request for variance, the project sponsor and BPA will initiate individual Section 7 consultation with USFWS and/or NMFS on the identified action.

In addition, if, during completion of a habitat improvement project, BPA or the project sponsor becomes aware of new information or unforeseen circumstances such that the project cannot be completed according to the scope of effects or terms and conditions of the HIP III BOs, BPA will require that the project sponsor stop all project operations, except for efforts to avoid or minimize resource damage, pending completion of individual consultation on the project.

3.3.4 Documentation

1) Name(s), phone number(s), and address(es) of the person(s) responsible for oversight will be posted at the work site;
2) A description of hazardous materials that will be used, including inventory, storage, and handling procedures will be available on-site;
3) Procedures to contain and control a spill of any hazardous material generated, used or stored on-site, including notification of proper authorities, will be readily available on-site;
4) A standing order to cease work in the event of high flows (above those addressed in the design and implementation plans), or exceedance of incidental take or water quality limits, will be posted on-site.

3.3.5 Post-Project Reporting and Monitoring

Each project sponsor will submit a PNC form to BPA within 120 days of project completion. After the BPA environmental compliance lead and quality control staff reviews the form for completeness, the BPA will then submit reports to the Services by email.

In addition, all activities that require a site rehabilitation plan will be monitored annually for a minimum of three years after completion of the activity to ensure that the performance standards of the plan are being met. Documentation of the monitoring and any corrective actions will be maintained by the project sponsor. Information from the reports will be reviewed in an annual meeting between BPA and the Services' staff to determine whether changes need to be made to the HIP III BOs or its procedures.

3.3.6 Annual Program Report

BPA requires project notifications via email for each set of contract actions implemented. Appendix A of the BA describes BPA's internal standard operating procedures for submission and content of those email notifications. Environmental leads on the contract will submit completed forms to a BPA HIP reporting mailbox for QA/QC. The BPA mailbox manager will check the forms before forwarding to USFWS (hip3@fws.gov) and/or NMFS (hip.nwr@noaa.gov) for approval. There is a single standard reporting form: the Project Notification/Completion (PNC) form (which includes fish capture/mortality information). All activities that require a site rehabilitation plan will be monitored annually for a minimum of three years to ensure that the performance standards of the plan are being met. In addition, BPA will host an annual meeting and provide an annual monitoring report to the Services by April 15 each year that describes BPA's efforts to carry out the HIP and compliance with requirements under the Services BOs.

3.3.7 Compliance Requirements

For activities implemented under the HIP III BOs, BPA will include language in its contracts with project sponsors requiring that project sponsors implement all terms and conditions of the HIP III BOs, as well as any other pertinent environmental requirements. The BPA will include each applicable design criterion as a condition of funding for every action funded or carried out under the HIP that may impact a federally listed species or designated critical habitat.

To monitor compliance with the programmatic consultation terms and conditions, BPA will conduct random evaluations of activities authorized under the HIP III BOs. If BPA receives information indicating there may be a problem, BPA may specifically target an individual activity to determine if it is in compliance with the terms and conditions as authorized under the programmatic consultations. If BPA determines that a contractor is in violation of the programmatic consultation terms and conditions or has deviated from the authorization, BPA will notify the contractor and the Services. BPA may enforce this by withdrawing funding from a project if the violations are serious or ongoing.

If a contractor is in violation of the programmatic consultations conditions or has engaged in unauthorized take of a listed species, the Services may implement enforcement actions against the contractor under ESA regulations and procedures.

3.4 General Conservation Measures Applicable to all Actions

The activities covered under this programmatic consultation are intended to protect and restore fish and wildlife habitat with long-term benefits to ESA-listed species. However, project construction may have short-term adverse effects on ESA-listed species and associated critical habitat. To minimize these short-term adverse effects and make them predictable for the purposes of programmatic analysis, the BPA included in their proposed action the following general conservation measures (developed in coordination with USFWS and NMFS) that are applicable to all projects implemented under HIP III:

3.4.1 Project Design and Site Preparation

1) Climate change. Best available science regarding the future effects within the project area of climate change, such as changes in stream flows and water temperatures, will be considered during project design.

2) State and Federal Permits. All applicable regulatory permits and official project authorizations will be obtained before project implementation. These permits and authorizations include, but are not limited to, National Environmental Policy Act, National

Historic Preservation Act, and the appropriate state agency removal and fill permit, USACE Clean Water Act (CWA) 404 permits, and CWA section 401 water quality certifications.

3) Timing of in-water work. Appropriate state (Oregon Department of Fish and Wildlife (ODFW), Washington Department of Fish and Wildlife (WDFW), Idaho Department of Fish and Game (IDFG), and Montana Fish Wildlife and Parks (MFWP)) guidelines for timing of in-water work windows (IWW) will be followed.
    a) Oregon chub – if work occurs in occupied habitat, in-water work will not occur between June 1 and August 15.
    b) Bull trout - While utilizing the appropriate State designated in-water work period will lessen the risk to bull trout, this alone may not be sufficient to adequately protect local bull trout populations. This is especially true if work is occurring in spawning and rearing areas because eggs, alevin, and fry are in the substrate or closely associated habitats nearly year round. Some areas may not have designated in-water work windows for bull trout or if they do, they may conflict with work windows for salmon and steelhead. If this is the case, or if proposed work is to occur within bull trout spawning and rearing habitats, project proponents will contact the appropriate USFWS Field Office (see Appendix B in this BO) to insure that all reasonable implementation measures are considered and an appropriate in-water work window is being used to minimize project effects.
    c) Lamprey – the project sponsor and/or their contractors will avoid working in stream or river channels that contain Pacific Lamprey from March 1 to July 1 in low to mid elevation reaches (<5,000 feet). In high elevation reaches (>5,000 feet), the project sponsor will avoid working in stream or river channels from March 1 to August 1. If either timeframe is incompatible with other objectives, the area will be surveyed for nests and lamprey presence, and avoided if possible. If lampreys are known to exist, the project sponsor will utilize dewatering and salvage procedures outlined in US Fish and Wildlife Service (2010)[1].
    d) Exceptions to ODFW, WDFW, MFWP, or IDFG in-water work windows will be requested from NMFS and the FWS. An IWW variance request (pre-coordinated with staff biologists) will be e-mailed from an appropriate representative of the action agency to the NMFS Habitat Branch Chief and the FWS Field Office Supervisor for the project area. Work will not proceed outside of the IWW until the exception is approved by e-mails from NMFS and/or the FWS.

4) Oregon Chub Restrictions. Restoration projects, covered under this Section 7 programmatic consultation, which involve in-water work, will not occur within habitats known to be occupied by Oregon chub or within Oregon chub critical habitat. This information is available in GIS form and is updated annually by the ODFW Native Fish

[1] U.S. Fish and Wildlife Service. 2010. Best management practices to minimize adverse effects to Pacific lamprey. Available online at: http://www.fws.gov/pacific/Fisheries/sphabcon/lamprey/pdf/Best%20Management%20Practices%20for%20Pacific%20Lamprey%20April%202010%20Version.pdf

Program (current point-of-contact is Brian Bangs 541-757-4263, extension 224). Only one in-water work project per year may occur within 2 stream miles upstream of connected off-channel habitat occupied by Oregon chub or its critical habitat. These projects will be evaluated by the Oregon Fish and Wildlife Office in order to design the project to avoid or minimize effects to Oregon chub habitats downstream. If the project is likely to cause more than a 30 percent reduction (e.g. reduced water volume causing desiccation of vegetation used for spawning habitat, sedimentation reducing habitat area, increased flows resulting in habitat becoming unsuitable for chub) in a downstream habitat occupied by Oregon chub or its critical habitat, that project will not be covered by this programmatic section 7 consultation and will require an individual consultation.

At restoration project sites with suitable habitat for Oregon chub (low gradient valley bottom floodplain habitats), pre-project sampling will be conducted by qualified fisheries biologists as early as possible in the planning process to determine whether Oregon chub may be present. If Oregon chub are found at the proposed project site during this sampling, a separate individual Section 7 consultation will be initiated for that project.

It is possible that a previously unknown population of Oregon chub may be captured at a project site during pre-construction in-water work-site isolation. In the event this occurs, the USFWS and ODFW will be contacted immediately in order to recommend additional site-specific conservation measures. Additionally, the following conservation measures will be implemented if Oregon chub are captured during in-water work-site isolation:

a) All live Oregon chub captured shall be released as soon as possible, and as close as possible to the point of capture.
b) If it necessary for Oregon chub to be held, a healthy environment for the stressed fish must be provided, and the holding time must be minimized.

5) <u>Contaminants.</u> The project sponsor will complete a site assessment with the following elements to identify the type, quantity, and extent of any potential contamination for any action that involves excavation of more than 20 cubic yards of material:
   a) A review of available records, such as former site use, building plans, and records of any prior contamination events;
   b) A site visit to inspect the areas used for various industrial processes and the condition of the property;
   c) Interviews with knowledgeable people, such as site owners, operators, and occupants, neighbors, or local government officials; and
   d) A summary, stored with the project file that includes an assessment of the likelihood that contaminants are present at the site, based on items 3(a) through 3(c).

6) <u>Site layout and flagging.</u> Prior to construction, the action area will be clearly flagged to identify the following:
   a) Sensitive resource areas, such as areas below ordinary high water, spawning areas, springs, and wetlands;
   b) Equipment entry and exit points;

c) Road and stream crossing alignments;
d) Staging, storage, and stockpile areas; and
e) No-spray areas and buffers.

7) Temporary access roads and paths.
   a) Existing access roads and paths will be preferentially used whenever reasonable, and the number and length of temporary access roads and paths through riparian areas and floodplains will be minimized to lessen soil disturbance and compaction, and impacts to vegetation.
   b) Temporary access roads and paths will not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure. If slopes are steeper than 30%, then the road will be designed by a civil engineer with experience in steep road design.
   c) The removal of riparian vegetation during construction of temporary access roads will be minimized. When temporary vegetation removal is required, vegetation will be cut at ground level (not grubbed).
   d) At project completion, all temporary access roads and paths will be obliterated, and the soil will be stabilized and revegetated. Road and path obliteration refers to the most comprehensive degree of decommissioning and involves decompacting the surface and ditch, pulling the fill material onto the running surface, and reshaping to match the original contour.
   e) Temporary roads and paths in wet areas or areas prone to flooding will be obliterated by the end of the in-water work window.

8) Temporary stream crossings.
   a) Existing stream crossings will be preferentially used whenever reasonable, and the number of temporary stream crossings will be minimized.
   b) Temporary bridges and culverts will be installed to allow for equipment and vehicle crossing over perennial streams during construction.
   c) Equipment and vehicles will cross the stream in the wet only where:
      i. The streambed is bedrock; or
      ii. Mats or off-site logs are placed in the stream and used as a crossing.
   d) Vehicles and machinery will cross streams at right angles to the main channel wherever possible.
   e) The location of the temporary crossing will avoid areas that may increase the risk of channel re-routing or avulsion.
   f) Potential spawning habitat (i.e., pool tailouts) and pools will be avoided to the maximum extent possible.
   g) No stream crossings will occur at active spawning sites, when holding adult listed fish are present, or when eggs or alevins are in the gravel. The appropriate state fish and wildlife agency will be contacted for specific timing information.
   h) After project completion, temporary stream crossings will be obliterated and the stream channel and banks restored.
9) Staging, storage, and stockpile areas.

a) Staging areas (used for construction equipment storage, vehicle storage, fueling, servicing, and hazardous material storage) will be 150 feet or more from any natural water body or wetland, or on an adjacent, established road area in a location and manner that will preclude erosion into or contamination of the stream or floodplain.
b) Natural materials used for implementation of aquatic restoration, such as large wood, gravel, and boulders, may be staged within the 100-year floodplain.
c) Any large wood, topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration at a specifically identified and flagged area.
d) Any material not used in restoration, and not native to the floodplain, will be removed to a location outside of the 100-year floodplain for disposal.

10) Equipment. Mechanized equipment and vehicles will be selected, operated, and maintained in a manner that minimizes adverse effects on the environment (e.g., minimally-sized, low pressure tires; minimal hard-turn paths for tracked vehicles; temporary mats or plates within wet areas or on sensitive soils). All vehicles and other mechanized equipment will be:
a) Stored, fueled, and maintained in a vehicle staging area placed 150 feet or more from any natural water body or wetland or on an adjacent, established road area;
b) Refueled in a vehicle staging area placed 150 feet or more from a natural waterbody or wetland, or in an isolated hard zone, such as a paved parking lot or adjacent, established road (this measure applies only to gas-powered equipment with tanks larger than 5 gallons);
c) Biodegradable lubricants and fluids should be used, if possible, on equipment operating in and adjacent to the stream channel and live water.
d) Inspected daily for fluid leaks before leaving the vehicle staging area for operation within 150 feet of any natural water body or wetland; and
e) Thoroughly cleaned before operation below ordinary high water, and as often as necessary during operation, to remain grease free.

11) Erosion control. Erosion control measures will be prepared and carried out, commensurate in scope with the action, that may include the following:
a) Temporary erosion controls.
   i) Temporary erosion controls will be in place before any significant alteration of the action site and appropriately installed downslope of project activity within the riparian buffer area until site rehabilitation is complete.
   ii) If there is a potential for eroded sediment to enter the stream, sediment barriers will be installed and maintained for the duration of project implementation.
   iii) Temporary erosion control measures may include fiber wattles, silt fences, jute matting, wood fiber mulch and soil binder, or geotextiles and geosynthetic fabric.
   iv) Soil stabilization utilizing wood fiber mulch and tackifier (hydro-applied) may be used to reduce erosion of bare soil if the materials are noxious weed free and nontoxic to aquatic and terrestrial animals, soil microorganisms, and vegetation.
   v) Sediment will be removed from erosion controls once it has reached 1/3 of the exposed height of the control.

vi) Once the site is stabilized after construction, temporary erosion control measures will be removed.

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

12) Dust abatement. The project sponsor will determine the appropriate dust control measures (if necessary) by considering soil type, equipment usage, prevailing wind direction, and the effects caused by other erosion and sediment control measures. In addition, the following criteria will be followed:
   a) Work will be sequenced and scheduled to reduce exposed bare soil subject to wind erosion.
   b) Dust-abatement additives and stabilization chemicals (typically magnesium chloride, calcium chloride salts, or ligninsulfonate) will not be applied within 25 feet of water or a stream channel and will be applied so as to minimize the likelihood that they will enter streams. Applications of ligninsulfonate will be limited to a maximum rate of 0.5 gallons per square yard of road surface, assuming a 50:50 (ligninsulfonate to water) solution.
   c) Application of dust abatement chemicals will be avoided during or just before wet weather, and at stream crossings or other areas that could result in unfiltered delivery of the dust abatement materials to a waterbody (typically these would be areas within 25 feet of a waterbody or stream channel; distances may be greater where vegetation is sparse or slopes are steep).
   d) Spill containment equipment will be available during application of dust abatement chemicals.
   e) Petroleum-based products will not be used for dust abatement.

13) Spill prevention, control, and counter measures. The use of mechanized machinery increases the risk for accidental spills of fuel, lubricants, hydraulic fluid, or other contaminants into the riparian zone or directly into the water. Additionally, uncured concrete and form materials adjacent to the active stream channel may result in accidental discharge into the water. These contaminants can degrade habitat, and injure or kill aquatic food organisms and ESA-listed species. The project sponsor will adhere to the following measures:
   a) A description of hazardous materials that will be used, including inventory, storage, and handling procedures will be available on-site.
   b) Written procedures for notifying environmental response agencies will be posted at the work site.
   c) Spill containment kits (including instructions for cleanup and disposal) adequate for the types and quantity of hazardous materials used at the site will be available at the work site.
   d) Workers will be trained in spill containment procedures and will be informed of the location of spill containment kits.

e) Any waste liquids generated at the staging areas will be temporarily stored under an impervious cover, such as a tarpaulin, until they can be properly transported to and disposed of at a facility that is approved for receipt of hazardous materials.

14) Invasive species control. The following measures will be followed to avoid introduction of invasive plants and noxious weeds into project areas:
a) Prior to entering the site, all vehicles and equipment will be power washed, allowed to fully dry, and inspected to make sure no plants, soil, or other organic material adheres to the surface.
b) Watercraft, waders, boots, and any other gear to be used in or near water will be inspected for aquatic invasive species.
c) Wading boots with felt soles are not to be used due to their propensity for aiding in the transfer of invasive species.

3.4.2 Construction Conservation Measures

Work Area Isolation & Fish Salvage.

Any work area within the wetted channel will be isolated from the active stream whenever ESA-listed fish are reasonably certain to be present, or if the work area is less than 300-feet upstream from known spawning habitats. When work area isolation is required, design plans will include all isolation elements, fish release areas, and, when a pump is used to dewater the isolation area and fish are present, a fish screen that meets NMFS's fish screen criteria (NMFS 2011[2], or most current). Work area isolation and fish capture activities will occur during periods of the coolest air and water temperatures possible, normally early in the morning versus late in the day, and during conditions appropriate to minimize stress and death of species present.

For salvage operations in known bull trout spawning and rearing habitat, electrofishing shall only occur from May 1 to July 31. No electrofishing will occur in any bull trout occupied habitat after August 15. Bull trout are very temperature sensitive and generally should not be electroshocked or otherwise handled when temperatures exceed 15 degrees celsius. Salvage activities should take place during periods of the coolest air and water temperatures possible, normally early in the morning versus late in the day, and during conditions appropriate to minimize stress to fish species present.

Salvage operations will follow the ordering, methodologies, and conservation measures specified below in Steps 1 through 6. Steps 1 and 2 will be implemented for all projects where work area isolation is necessary according to conditions above. Electrofishing (Step 3) can be implemented to ensure all fish have been removed following Steps 1 and 2, or when other means of fish capture may not be feasible or effective. Dewatering and rewatering (Steps 4 and 5) will be

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

implemented unless wetted in-stream work is deemed to be minimally harmful to fish, and is beneficial to other aquatic species. Dewatering will not be conducted in areas known to be occupied by lamprey, unless lampreys are salvaged using guidance set forth in US Fish and Wildlife Service (2010)[3].

1) Isolate

a. Block nets will be installed at upstream and downstream locations and maintained in a secured position to exclude fish from entering the project area.
b. Block nets will be secured to the stream channel bed and banks until fish capture and transport activities are complete. Block nets may be left in place for the duration of the project to exclude fish.
c. If block nets remain in place more than one day, the nets will be monitored at least daily to ensure they are secured to the banks and free of organic accumulation. If the project is within bull trout spawning and rearing habitat, the block nets must be checked every four hours for fish impingement on the net. Less frequent intervals must be approved through a variance request.
d. Nets will be monitored hourly anytime there is instream disturbance.

2) Salvage – As described below, fish trapped within the isolated work area will be captured to minimize the risk of injury, then released at a safe site:

a. Remove as many fish as possible prior to dewatering.
b. During dewatering, any remaining fish will be collected by hand or dip nets.
c. Seines with a mesh size to ensure capture of the residing ESA-listed fish will be used.
d. Minnow traps will be left in place overnight and used in conjunction with seining.
e. If buckets are used to transport fish:
    i. The time fish are in a transport bucket will be limited, and will be released as quickly as possible;
    ii. The number of fish within a bucket will be limited based on size, and fish will be of relatively comparable size to minimize predation;
    iii. Aerators for buckets will be used or the bucket water will be frequently changed with cold clear water at 15 minute or more frequent intervals.
    iv. Buckets will be kept in shaded areas or will be covered by a canopy in exposed areas.

[3] U.S. Fish and Wildlife Service. 2010. Best management practices to minimize adverse effects to Pacific lamprey. Available online at: http://www.fws.gov/pacific/Fisheries/sphabcon/lamprey/pdf/Best%20Management%20Practices%20for%20Pacific%20Lamprey%20April%202010%20Version.pdf

   v. Dead fish will not be stored in transport buckets, but will be left on the stream bank to avoid mortality counting errors.

f. As rapidly as possible (especially for temperature-sensitive bull trout), fish will be released in an area that provides adequate cover and flow refuge. Upstream release is generally preferred, but fish released downstream will be sufficiently outside of the influence of construction.
g. Salvage will be supervised by a qualified fisheries biologist experienced with work area isolation and competent to ensure the safe handling of all fish.

3) Electrofishing – Electrofishing**.** Electrofishing will be used only after other salvage methods have been employed or when other means of fish capture are determined to not be feasible or effective.
   a. If electrofishing will be used to capture fish for salvage, the salvage operation will be led by an experienced fisheries biologist and the following guidelines will be followed:
      i. The NMFS's electrofishing guidelines (NMFS 2000)[4].
      ii. Only direct current (DC) or pulsed direct current (PDC) will be used and conductivity must be tested.
         1. If conductivity is less than 100 µs, voltage ranges from 900 to 1100 will be used.
         2. For conductivity ranges between 100 to 300 µs, voltage ranges will be 500 to 800.
         3. For conductivity greater than 300 µs, voltage will be less than 400.
      iii. Electrofishing will begin with a minimum pulse width and recommended voltage and then gradually increase to the point where fish are immobilized.
      iv. The anode will not intentionally contact fish.
      v. Electrofishing shall not be conducted when the water conditions are turbid and visibility is poor. This condition may be experienced when the sampler cannot see the stream bottom in one foot of water.
      vi. If mortality or obvious injury (defined as dark bands on the body, spinal deformations, de-scaling of 25% or more of body, and torpidity or inability to maintain upright attitude after sufficient recovery time) occurs during electrofishing, operations will be immediately discontinued, machine settings, water temperature and conductivity checked, and procedures adjusted or electrofishing postponed to reduce mortality.

[4] National Marine Fisheries Service. 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act. Portland, Oregon and Santa Rosa, California. Available online at http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf

4) Dewater. Dewatering, when necessary, will be conducted over a sufficient period of time to allow species to naturally migrate out of the work area and will be limited to the shortest linear extent practicable.
   a. Diversion around the construction site may be accomplished with a coffer dam and a by-pass culvert or pipe, or a lined, non-erodible diversion ditch. Where gravity feed is not possible, a pump may be used, but must be operated in such a way as to avoid repetitive dewatering and rewatering of the site. Impoundment behind the cofferdam must occur slowly through the transition, while constant flow is delivered to the downstream reaches.
   b. All pumps will have fish screens to avoid juvenile fish impingement or entrainment, and will be operated in accordance with NMFS's current fish screen criteria (NMFS 2011[5], or most recent version). If the pumping rate exceeds 3 cubic feet second (cfs), a NMFS Hydro fish passage review will be necessary.
   c. Dissipation of flow energy at the bypass outflow will be provided to prevent damage to riparian vegetation or stream channel.
   d. Safe reentry of fish into the stream channel will be provided, preferably into pool habitat with cover, if the diversion allows for downstream fish passage.
   e. Seepage water will be pumped to a temporary storage and treatment site or into upland areas to allow water to percolate through soil or to filter through vegetation prior to reentering the stream channel.

5) Re-watering. Upon project completion, the construction site will be slowly re-watered to prevent loss of surface flow downstream and to prevent a sudden increase in stream turbidity. During re-watering, the site will be monitored to prevent stranding of aquatic organisms below the construction site.

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

3.4.3 Construction and Post-Construction Conservation Measures for Aquatic Species

1) Fish passage. Fish passage will be provided for any adult or juvenile fish likely to be present in the action area during construction, unless passage did not exist before construction or the stream is naturally impassable at the time of construction. If the provision of temporary fish passage during construction will increase negative effects on aquatic species of interest or their habitat, a variance can be requested from the NMFS Branch Chief and the FWS Field Office

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

Supervisor (Appendix B of this BO). Pertinent information, such as the species affected, length of stream reach affected, proposed time for the passage barrier, and alternatives considered, will be included in the variance request.

2) Construction and discharge water.

a) Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate.
b) Diversions will not exceed 10% of the available flow.
c) All construction discharge water will be collected and treated using the best available technology applicable to site conditions.
d) Treatments to remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present will be provided.

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

4) Cessation of work. Project operations will cease under the following conditions:
a) High flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage;
b) When allowable water quality impacts, as defined by the state CWA section 401 water quality certification, have been exceeded; or
c) When “incidental take” limitations have been reached or exceeded.

5) Site restoration. When construction is complete:
a) All streambanks, soils, and vegetation will be cleaned up and restored as necessary using stockpiled large wood, topsoil, and native channel material.
b) All project related waste will be removed.
c) All temporary access roads, crossings, and staging areas will be obliterated. When necessary for revegetation and infiltration of water, compacted areas of soil will be loosened.
d) All disturbed areas will be rehabilitated in a manner that results in similar or improved conditions relative to pre-project conditions. This will be achieved through

redistribution of stockpiled materials, seeding, and/or planting with local native seed mixes or plants.

6) Revegetation. Long-term soil stabilization of disturbed sites will be accomplished with reestablishment of native vegetation using the following criteria:
    a) Planting and seeding will occur prior to or at the beginning of the first growing season after construction.
    b) An appropriate mix of species that will achieve establishment, shade, and erosion control objectives, preferably forb, grass, shrub, or tree species native to the project area or region and appropriate to the site will be used.
    c) Vegetation, such as willow, sedge and rush mats, will be salvaged from disturbed or abandoned floodplains, stream channels, or wetlands.
    d) Invasive species will not be used.
    e) Short-term stabilization measures may include the use of non-native sterile seed mix (when native seeds are not available), weed-free certified straw, jute matting, and other similar techniques.
    f) Surface fertilizer will not be applied within 50 feet of any stream channel, waterbody, or wetland.
    g) Fencing will be installed as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
    h) Re-establishment of vegetation in disturbed areas will achieve at least 70% of pre-project conditions within 3 years.
    i) Invasive plants will be removed or controlled until native plant species are well-established (typically 3 years post-construction).

7) Site access. The project sponsor will retain the right of reasonable access to the site in order to monitor the success of the project over its life.

8) Implementation monitoring. Project sponsor staff or their designated representative will provide implementation monitoring to ensure compliance with the applicable biological opinion, including:

    a) General conservation measures are adequately followed; and
    b) Effects to listed species are not greater than predicted and incidental take limitations are not exceeded.

9) CWA section 401 water quality certification. The project sponsor or designated representative will complete and record water quality observations to ensure that in-water work is not degrading water quality. During construction, CWA section 401 water quality

certification provisions provided by the Oregon Department of Environmental Quality, Washington Department of Ecology, or Idaho Department of Environmental Quality will be followed.

3.5 Action-Specific Descriptions and Conservation Measures

3.5.1 Action Category 1. Fish Passage Restoration (Profile Discontinuities)

The BPA proposes to review and fund fish passage projects for ESA-listed salmon, steehead and bull trout (hereafter salmonids). The objective of fish passage restoration is to allow all life stages of salmonids access to historical habitat from which they have been excluded and focuses on restoring safe upstream and downstream fish passage to stream reaches that have become isolated by obstructions. Although passage actions are generally viewed as positive actions for native fish restoration, there may be occasions where restoring passage exposes native fish (isolated above or below a barrier) to negative influences (predation, competition, hybridization) from non-native species such as brook trout, brown trout and lake trout. Proposed passage projects that may increase bull trout or Oregon chub exposure to non-native species must be approved by the appropriate FWS Field Office Supervisor (see appendix B).

BPA grouped passage projects according the effects and review requirements in the following subcategories: **Profile Discontinuities** and **Transportation Infrastructure**. These subcategories represent a logical break between transportation related effects and effects due to physical fish barriers, classified by water velocity, water depth, and barrier height (profile discontinuities).

Profile Discontinuities Subcategory.

The BPA proposes to fund removal, modification, construction and maintenance of instream structures to improve fish passage. The objective of this activity category is to allow all life stages of ESA-listed salmonids access to historical habitats from which they have been excluded by non-functioning structures or instream profile discontinuities resulting from insufficient depth, or excessive jump heights and velocities.

The BPA proposes the following activities to improve fish passage; (a) Dams, Water Control or Legacy Structure Removal; (b) Consolidate, or Replace Existing Irrigation Diversions; (c) Headcut and Grade Stabilization; (d) Low Flow Consolidation; and (e) Providing Fish passage at an existing facility.

a. Dams, Water Control Structures, or Legacy Structures Removal.

Description. BPA proposes to fund and review fish passage projects, and restore more natural channel and flow conditions by removing small dams, channel-spanning weirs, earthen embankments, subsurface drainage features, spillway systems, tide gates, outfalls, pipes, instream flow redirection structures (*e.g.*, drop structure, gabion, groin), or similar devices used to control, discharge, or maintain water levels.

Small dams include instream structures that are 10 feet in height or less for streams with an active channel width of less than 50-feet and a slope less than 4%, or up to 16.4 feet in height and a slope greater than 4%.

If the structure being removed contains material (i.e. large wood, boulders, etc) that is typically found within the stream or floodplain at that site, the material can be reused to implement habitat improvements. Any such project must follow the design criteria outlined in the **Install Habitat-Forming Natural Material Instream Structures (Large Wood, Boulders, and Spawning Gravel)** activity category.

Guidelines for Review.

The following proposed activities are considered ***low risk*** and will not require RRT review: Removal of subsurface drainage features, tide gates, outfalls, pipes, small dams with a maximum total head measurement equal to or less than 3 feet, and instream flow redirection-structures.

The following proposed removal activities for the following structures are considered ***medium*** to ***high risk*** and will require RRT and NMFS Hydro review: small dams with a maximum total head measurement greater than 3 feet, channel spanning weirs, earthen embankments and spillway systems.

Prior to going to the RRT, Medium to High Risk projects shall address the **General Project and Data Summary Requirement** (**Appendix C)** in addition to the following:

1) A longitudinal profile of the stream channel thalweg for 20 channel widths upstream and downstream of the structure shall be used to determine the potential for channel degradation.
2) A minimum of three cross-sections – one downstream of the structure, one through the reservoir area upstream of the structure, and one upstream of the reservoir area outside of the influence of the structure) to characterize the channel morphology and quantify the stored sediment.
3) Sediment characterization to determine the proportion of coarse sediment (>2mm) in the reservoir area.
4) A survey of any downstream spawning areas that may be affected by sediment released by removal of the water control structure or dam. Reservoirs with a d35 greater than 2 mm (i.e., 65% of the sediment by weight exceeds 2 mm in diameter) may be removed without excavation of stored material, if the sediment contains no contaminants; reservoirs with a d35 less than 2 mm (i.e., 65% of the sediment by weight is less than 2 mm in diameter) will require partial removal of the fine sediment to create a pilot channel, in conjunction with stabilization of the newly exposed streambanks with native vegetation.

Conservation Measures.

1) Restore all structure banklines and fill in holes with native materials to restore contours of stream bank and floodplain. Compact the fill material adequately to prevent washing out of the soil during over bank flooding. Do not mine material from the stream channel to fill in "key" holes. When removal of buried (keyed) structures may result in significant disruption to riparian vegetation and/or the floodplain, consider leaving the buried structure sections within the streambank.
2) If the legacy structures (log, rock, or gabion weirs) were placed to provide grade control, evaluate the site for potential headcutting and incision due to structure removal by using the appropriate guidance.[6] If headcutting and channel incision are likely to occur due to structure removal, additional measures must be taken to reduce these impacts (see grade control options described under **Headcut and Grade Stabilization** activity category).
3) If the structure is being removed because it has caused an over-widening of the channel, consider implementing other HIP III restoration categories to decrease the width to depth ratio of the stream at that location to a level commensurate with representative upstream and downstream sections (within the same channel type).
4) Tide gates can only be removed not modified or replaced. Modification or replacement of tidegates will require a separate individual consultation with the Services.

b. Consolidate, or Replace Existing Irrigation Diversions

Description. The BPA proposes to fund and review the consolidation or replacement of existing diversions with pump stations or engineered riffles (including cross vanes, "W" weirs, or "A" frame weirs) to reduce the number of diversions on streams and thereby conserve water and improve habitat for fish, improve the design of diversions to allow for fish passage and adequate screening, or reduce the annual instream construction of push-up dams and instream structures. Small instream rock structures that facilitate proper pump station operations are allowed when designed in association with the pump station. Infiltration galleries and lay-flat stanchions are not part of the proposed action. Periodic maintenance of irrigation diversions will be conducted to ensure their proper functioning, *i.e.*, cleaning debris buildup, and replacement of parts.

The BPA HIP III will only cover irrigation efficiency actions within this activity category that use state approved regulatory mechanisms (e.g. Oregon ORS 537.455-.500, Washington RCW 90.42) for ensuring that water savings will be protected as instream water rights, or in cases where project implementers identify how the water conserved will remain instream to benefit fish without any significant loss of the instream flows to downstream diversions.

[6] Castro, J. 2003. Geomorphologic Impacts of Culvert Replacement and Removal: Avoiding Channel Incision. Oregon Fish and Wildlife Office, Portland, OR. Available at: http://library.fws.gov/pubs1/culvert-guidelines03.pdf

Unneeded or abandoned irrigation diversion structures will be removed where they are barriers to fish passage, have created wide shallow channels or simplified habitat, or are causing sediment concerns through deposition behind the structure or downstream scour according to **Dams, Water Control Structures, or Legacy Structures Removal** section.

Guidelines for Review.

The following proposed activities are considered ***low risk*** and will not require RRT review: Irrigation diversion structures less than 3 feet in height that are to be removed only.

This proposed activity is considered ***medium*** to ***high risk*** and will require RRT and NMFS Hydro review. Irrigation diversion structures greater than 3 feet in height that are to be removed or replaced. Prior to going to the RRT, medium to high risk projects shall address the **General Project and Data Summary Requirements (Appendix C)** in addition to the following:

1) A longitudinal profile of the stream channel thalweg for 20 channel widths upstream and downstream of the structure shall be used to determine the potential for channel degradation.
2) A minimum of three cross-sections – one downstream of the structure, one through the reservoir area upstream of the structure, and one upstream of the reservoir area outside of the influence of the structure) to characterize the channel morphology and quantify the stored sediment.

Conservation Measures.

1) Diversion structures will be designed to meet NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011 or more recent version)[7].
2) Placement of rock structures or engineered riffles shall follow criteria outlined in the **Headcut and Grade Stabilization** activity category).
3) Diversions will be designed so that diverted water withdrawal is equal to or less than the irrigator's state water right, or equal to the current rate of diversion, whichever is less.
4) Project design will include the installation of a totalizing flow meter device on all diversions for which installation of this device is possible. A staff gauge or other device capable of measuring instantaneous flow will be utilized on all other diversions.
5) Multiple existing diversions may be consolidated into one diversion if the consolidated diversion is located at the most downstream existing diversion point unless sufficient low flow conditions are available to support unimpeded passage. The design will clearly

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

identify the low flow conditions within the stream reach relative to the cumulative diverted water right. If instream flow conditions are proven favorable for fish passage and habitat use then diversion consolidation may occur at the upstream structure.

6) If low flow conditions coupled with diversion withdrawals result in impassable conditions for fish, then irrigation system efficiencies will be implemented with water savings committed to improve reach passage conditions.

c. <u>Headcut and Grade Stabilization.</u>

Description. BPA proposes to fund and review the restoration of fish passage and grade control (i.e. headcut stabilization) with geomorphically appropriate structures constructed from rock or large wood (LW). Boulder weirs and roughened channels may be installed for grade control at culverts, mitigate headcuts, and to provide passage at small dams or other channel obstructions that cannot otherwise be removed. For wood dominated systems, grade control engineered log jams (ELJ)'s should be considered as an alternative.

Grade control ELJs are designed to arrest channel downcutting or incision and retain sediment, lower stream energy, and increase water elevations to reconnect floodplain habitat and diffuse downstream flood peaks. Grade control ELJs also serve to protect infrastructure that is exposed by channel incision and to stabilize over-steepened banks. Unlike hard weirs or rock grade control structures, a grade control ELJ is a complex broadcrested structure that dissipates energy more gradually.

Guidelines for Review.

The following proposed activities are considered ***low risk*** and will not require RRT review: Installation of boulder weirs, roughened channels and grade control structures that are less than 18 inches in height and include all of the conservation measures listed below.

This proposed activity is considered ***medium*** to ***high risk*** and will require RRT and NMFS hydro review. Installation of boulder weirs, roughened channels and grade control structures that are above 18 inches in height.

Prior to going to the RRT, medium to high risk projects shall address the **General Project and Data Summary Requirements (Appendix C)** in addition to the following:

1) A longitudinal profile of the stream channel thalweg for 20 channel widths upstream and downstream of the structure shall be used to determine the potential for channel degradation.
2) A minimum of three cross-sections – one downstream of the structure, one through the reservoir area upstream of the structure, and one upstream of the reservoir area outside of the influence of the structure) to characterize the channel morphology and quantify the stored sediment.

Conservation Measures.

1) All structures will be designed to the design benchmarks set in (NMFS 2011 or more recent version)[8].
2) Construction of passage structures over dams is limited to dams of less than seven feet in height.
3) Construction of passage structures is limited to facilitate passage at existing diversion dams, not in combination with new dams.
4) Install boulder weirs low in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 1.5-year flow event).
5) Boulder weirs are to be placed diagonally across the channel or in more traditional upstream pointing “V” or “U” configurations with the apex oriented upstream. The apex should be lower than the structure wings to support low flow consolidation.
6) Boulder weirs are to be constructed to allow upstream and downstream passage of all native fish species and life stages that occur in the stream. This can be accomplished by providing plunges no greater than 6” in height, allowing for juvenile fish passage at all flows.
7) Key weirs into the stream bed to minimize structure undermining due to scour, preferably at least 2.5x their exposure height. The weir should also be keyed into both banks, if feasible greater than 8 feet.
8) Include fine material in the weir material mix to help seal the weir/channel bed, thereby preventing subsurface flow. Geotextile material can be used as an alternative approach to prevent subsurface flow
9) Rock for boulder weirs shall be durable and of suitable quality to assure permanence in the climate in which it is to be used. Rock sizing depends on the size of the stream, maximum depth of flow, planform, entrenchment, and ice and debris loading.
10) Full spanning boulder weir placement shall be coupled with measures to improve habitat complexity (LW placement etc.) and protection of riparian areas.
11) The use of gabions, cable or other means to prevent the movement of individual boulders in a boulder weir is not allowed.
12) If geomorphic conditions are appropriate, consideration should be given towards use of a roughened channel or constructed riffle to minimize the potential for future development of passage (jump height) barrier.
13) Headcut stabilization shall incorporate the following measures:

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

a. Armor head-cut with sufficiently sized and amounts of material to prevent continued up-stream movement. Materials can include both rock and organic materials which are native to the area.
b. Focus stabilization efforts in the plunge pool, the head cut, as well as a short distance of stream above the headcut.
c. Minimize lateral migration of channel around head cut ("flanking") by placing rocks and organic material at a lower elevation in the center of the channel cross section to direct flows to the middle of channel.
d. Provide fish passage over a stabilized head-cut through a series of log or rock weir structures or a roughened channel.
e. Headcut stabilization structure will be constructed utilizing streambed simulation bed material, which will be washed into place until there is apparent surface flow and minimal subsurface material to ensure fish passage immediately following construction if natural flows are sufficient.
f. Structures will be constructed with stream simulation materials and fines added and pressure washed into the placed matrix. Successful washing will be determined by minimization of voids within placed matrix such that ponding occurs with little to no percolation losses to minimize low flow fish passage effects immediately following construction.

d. Low Flow Consolidation

Description: BPA proposes to fund and review projects that; (a) modify diffused or braided flow conditions that impede fish passage; (b) modify dam aprons with shallow depth (less than 10 inches), or (c) utilize temporary placement of sandbags, hay bales, and ecology blocks to provide depths and velocities passable to upstream migrants.

Land use practices such as large scale agriculture, including irrigation, and urban and residential development have drastically changed the hydrology of affected watersheds. Reduced forest cover and increased impervious surface have resulted in increased runoff and peak flows and in less aquifer recharge, resulting in increased frequency, duration and magnitude of summer droughts. During recent droughts, temporary placement of sandbags, hay bales, and ecology blocks have been successful in providing short term fish passage through low flow consolidation techniques.

Guidelines for Review.

All of the proposed activities under the **Low Flow Consolidation** activity category are considered ***medium*** to ***high risk*** and will both require RRT and NMFS hydro review.

Prior to going to the RRT, medium to high risk projects shall address the **General Project and Data Summary Requirements (Appendix C)** in addition to the following:

Conservation Measures.

1) Fish Passage will be designed to the design benchmarks set in (NMFS 2011 or more recent version)[9].
2) Conceptual Design Review process with NMFS Hydropower Division will be implemented.
3) All material placed in the stream to aid low flow fish passage will be removed when stream flows increase, prior to anticipated high flows that could wash consolidation measures away or cause flow to go around them.

e. Provide Fish Passage at an Existing Facility

Description: BPA proposes to fund and review projects that; (a) re-engineer improperly designed fish passage or fish collection facilities; (b) periodic maintenance of fish passage or fish collection facilities to ensure proper functioning, *e.g*., cleaning debris buildup, replacement of parts; and (c) installation of a fish ladder at an existing facility.

Guidelines for Review.

The following proposed activities are considered ***low risk*** and will not require RRT review: Periodic Maintenance of Fish passage or Fish Collection Facilities.

All of the other the proposed activities under the **Provide Fish Passage at an Existing Facility** activity category that are not upkeep and maintenance are considered ***medium*** to ***high risk*** and will require both RRT and NMFS Hydropower review.

Prior to going to the RRT, medium to high risk projects shall address the **General Project and Data Summary Requirements (Appendix C)** in addition to the following:

Conservation Measures.

1) Fish Passage will be designed to the design benchmarks set in (NMFS 2011 or more recent version)[10].
2) Design consideration should be given for Pacific Lamprey passage[11]. Fish ladders that are primarily designed for salmonids are usually impediments to lamprey passage as they

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

do not have adequate surfaces for attachment, velocities are often too high and there are inadequate places for resting. Providing for rounded corners, resting areas or providing a natural stream channel (stream simulation) or wetted ramp for passage over the impediment have been effective in facilitating lamprey passage.

Fish Passage Restoration (Transportation Infrastructure)

The BPA proposes to review and fund maintenance, removal, or replacement of bridges, culverts and fords to improve fish passage, prevent streambank and roadbed erosion, facilitate natural sediment and wood movement, and eliminate or reduce excess sediment loading.

The BPA proposes the following activities to improve fish passage: (a) Bridge and Culvert Removal or Replacement; (b) Bridge and Culvert Maintenance; and (c) Installation of Fords.

a. Bridge and Culvert Removal or Replacement

Description. For unimpaired fish passage it is desirable to have a crossing that is a larger than the channel bankfull width, allows for a functional floodplain, allows for a natural variation in bed elevation, and provides bed and bank roughness similar to the upstream and downstream channel. In general, bridges will be implemented over culverts because they typically do not constrict a stream channel to as great a degree as culverts and usually allow for vertical movement of the streambed (see #3 below). Bottomless culverts may provide a good alternative for fish passage where foundation conditions allow their construction and width criteria can be met.

Guidelines for Review.

The following proposed activities are considered ***low risk*** and will not require RRT review: Removal or replacement of culverts and bridges that meet all of the following conservation measures.

The following proposed activities are considered ***medium* to *high risk*** and will require RRT review: Removal and replacement of culverts and bridges that do not meet all of the following conservation measures will require a RRT review and a variance from NMFS and/or FWS.

Prior to going to the RRT, medium to high risk projects shall address the **General Project and Data Summary Requirements (Appendix C)** in addition to the following:

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[11] 2010 (USFWS) Best Management Practices to Minimize Adverse Effects to Pacific Lamprey. http://www.fws.gov/pacific/Fisheries/sphabcon/lamprey/pdf/Best%20Management%20Practices%20for%20Pacific%20Lamprey%20April%202010%20Version.pdf

1) Designs shall include site sketches, drawings, aerial photographs, or other supporting specifications, calculations, or information that is commensurate with the scope of the action, that show the active channel, the 100-year floodplain, the functional floodplain, any artificial fill within the project area, the existing crossing to be replaced, and the proposed crossing.

Conservation measures.

1) Stream crossings shall be designed to the design benchmarks set in (NMFS 2011 or more recent version)[12] and restore floodplain function.
2) A crossing shall: (a) maintain the general scour prism, as a clear, unobstructed opening (i.e., free of any fill, embankment, scour countermeasure, or structural material); (b) be a single span structure that maintains a clear, unobstructed opening above the general scour elevation that is at least as wide as 1.5 times the active channel width; (c) be a multiple span structure that maintains a clear, unobstructed opening above the general scour elevation, except for piers or interior bents, that is at least as wide as 2.2 times the active channel width.[13] This criteria will restore any physical or biological processes associated with a fully functional floodplain that was degraded by the previous crossing.
3) Bridge scour and stream stability countermeasures may be applied below the general scour elevation, however, except as described above in (2), no scour countermeasure may be applied above the general scour elevation.
4) Remove all other artificial constrictions within the functional floodplain of the project area as follows: (a) remove existing roadway fill, embankment fill, approach fill, or other fills; (b) install relief conduits through existing fill; (c) remove vacant bridge supports below total scour depth, unless the vacant support is part of the rehabilitated or replacement stream crossing; and (d) reshape exposed floodplains and streambanks to match upstream and downstream conditions.
5) If the crossing will occur within 300 feet of active spawning area, only full span bridges or streambed simulation will be used.

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

[13] For guidance on how to complete bridge scour and stream stability analysis, see Lagasse *et al*. 2001a (HEC-20), Lagasse *et al*. 2001b (HEC-23), Richardson and Davis 2001 (HEC-18), ODOT 2005, and AASHTO 2007.

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

6) Projects in stream channels with gradients above six percent will utilize a bridge or if a bridge is determined to not be feasible, the crossing will be designed using the stream simulation option.
7) Culverts shall not be longer than: 150 feet for stream simulation, 75 feet for no-slope and 500 feet for any other option. Maximum culvert width shall be 20 feet, for widths greater than 20 feet a bridge will be used.
8) Designs must demonstrate that the vertical and lateral stability of the stream channel are taken into consideration when designing a crossing.
9) Designs must demonstrate that culverts and bridges shall mimic the natural stream processes and allow for fish passage, sediment transport, and flood and debris conveyance.
10) Designs must demonstrate that the crossings: (a) avoid causing local scour of streambanks and reasonably likely spawning areas; (b) allow the fluvial transport of large wood, up to a site potential tree height in size, through the project area without becoming stranded on the bridge structure; (c) allow for likely channel migration patterns within the functional floodplain for the design life of the bridge; and otherwise align with well-defined, stable channels; and (d) allow for the passage of all aquatic organisms.
11) The proponent shall include suitable grade controls to prevent culvert failure caused by changes in stream elevation. Grade control structures to prevent headcutting above or below the culvert or bridge may be built using rock or wood as outlined in the **Headcut and Grade Stabilization** criteria under the **Profile Discontinuity** activity subcategory.

b. <u>Bridge and Culvert Maintenance</u>

Conservation measures:

1) Culverts will be cleaned by working from the top of the bank, unless culvert access using work area isolation would result in less habitat disturbance. Only the minimum amount of wood, sediment and other natural debris necessary to maintain culvert function will be removed; spawning gravel will not be disturbed.
2) All large wood, cobbles, and gravels recovered during cleaning will be placed downstream of the culvert.
3) Do all routine work in the dry. If this is not possible, follow work area isolation criteria outlined in the **General Conservation Measures Applicable to all Actions**.
4) Culverts or bridge abutments will not be filled with vegetation, debris, or mud.

c. <u>Installation of Fords</u>

Description. In many streams, crossings have degraded riparian corridors and in-stream habitat resulting in increased and chronic sedimentation and reduced riparian functions including shading and recruitment of LW. Fords will be installed to allow improved stream crossing conditions only. New fords shall not be installed when there was not a previously existing stream crossing and no new fords will be constructed in salmonid spawning areas (including spawning and rearing habitat for bull trout). For the purposes of this proposed action, fords are defined as crossings for vehicles, off-highway vehicles (OHVs), bikes, pack animals, and livestock.

Guidelines for Review.

The following proposed activities are considered ***low risk*** and will not require RRT review: Fords that meet all of the following conservation measures, occur in intermittent streams, or occur in reaches not occupied by listed salmonids (salmon, steelhead, bull trout).

The following proposed activities are considered ***medium* to *high risk*** and will require RRT review: Fords that do not meet all of the following conservation measures will require a RRT review and a variance from NMFS and/or FWS.

Prior to going to the RRT, medium to high risk projects shall address the **General Project and Data Summary Requirements (Appendix C)** in addition to the following:

1) Information detailing locations of ESA-listed salmonid spawning areas within the reach.
2) Designs must demonstrate that the ford accommodate reasonably foreseeable flood risks, including associated bedload and debris, and to prevent the diversion of streamflow out of the channel and down the trail if the crossing fails.

Conservation Measures:

1) Stream crossings shall be designed to the design benchmarks set in (NMFS 2011 or more recent version)[14].
2) The ford will not create barriers to the passage of adult and juvenile fish.
3) Ford stream crossings will involve the placement of river rock along the stream bottom.
4) Existing access roads or trails and stream crossings will be used whenever possible, unless new construction would result in less habitat disturbance and the old trail or crossing is retired.
5) The ford will not be located in an area that will result in disturbance or damage to a properly functioning riparian area.
6) Fords will be placed on bedrock or stable substrates whenever possible.
7) Fords will not be placed in areas where ESA-listed salmonids (salmon, steelhead, bull trout) spawn or are suspected of spawning, or within 300 feet of such areas if spawning areas may be disturbed. For bull trout this CM applies to areas identified as spawning and rearing habitat.

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

8) Bank cuts, if any, will be stabilized with vegetation, and approaches and crossings will be protected with river rock (not crushed rock) when necessary to prevent erosion.
9) Fords will have a maximum width of 20 feet.
10) Fences will be installed (or are already existing and functioning) along with all new fords to limit access of livestock to riparian areas. Fenced off riparian areas will be maximized and planted with native vegetation. Fences will not inhibit upstream or downstream movement of fish or significantly impede bedload movement. Where appropriate, construct fences at fords to allow passage of large wood and other debris.
11) Vehicle fords will only be allowed in intermittent streams with no salmonid fish spawning.

3.5.2 Action Category 2. River, Stream, Floodplain and Wetland Restoration

The BPA proposes to review and fund river, stream, floodplain and wetland restoration actions with the objective to provide the appropriate habitat conditions required for foraging, rearing, and migrating ESA-listed fish.

Projects utilizing habitat restoration actions outlined within this activity category shall be linked to Limiting Factors identified within the appropriate sub basin plan, recovery plan or shall be prioritized by recommended restoration activities indentified within a localized region by a technical oversight and steering committee (i.e. the Columbia River Estuary). Individual projects may utilize a combination of the activities listed in the **River, Stream, Floodplain and Wetland Restoration** activity category.

The BPA proposes the following activities to improve fish passage: (a) Improve Secondary Channel and Wetland Habitats, (b) Set-back or Removal of Existing, Berms, Dikes, and Levees; (c) Protect Streambanks Using Bioengineering Methods; (d) Install Habitat-Forming Natural Material Instream Structures (Large Wood, Boulders, and Spawning Gravel); (e) Riparian Vegetation Planting; and (f) Channel Reconstruction.

a. Improve Secondary Channel and Wetland Habitats[15]

Description. The BPA proposes to review and fund projects that reconnect historical stream channels within floodplains, restore or modify hydrologic and other essential habitat features of historical river floodplain swales, abandoned side channels, spring-flow channels, wetlands, historical floodplain channels and create new self-sustaining side channel habitats which are maintained through natural processes.

Actions include the improvement and creation of secondary channels, off channel habitats and wetlands to increase the available area and access to rearing habitat; increase hydrologic

[15] For detailed descriptions of each technique refer to the WDFW Stream Habitat Restoration Guidelines: http://wdfw.wa.gov/publications/pub.php?id=00043

capacity, provide resting areas for fish and wildlife species at various levels of inundation; reduce flow velocities; and provide protective cover for fish and other aquatic species.

Reconnection of historical off- and side channels habitats that have been blocked includes the removal of plugs, which impede water movement through off- and side-channels. Excavating pools and ponds in the historic floodplain/channel migration zone to create connected wetlands; Reconnecting existing side channels with a focus on restoring fish access and habitat forming processes (hydrology, riparian vegetation); Wetland habits will be created to reestablish a hydrologic regime that has been disrupted by human activities, including functions such as water depth, seasonal fluctuations, flooding periodicity, and connectivity.

All activities intended for improving secondary channel habitats will provide the greatest degree of natural stream and floodplain function achievable and shall be implemented to address basin specified limiting factors. Up to two project adjustments, including adjusting the elevation of the created side channel habitat are included under this proposal. The long-term development of a restored side channel will depend on natural processes like floods and mainstem migration.

Guidelines for Review.

Secondary channel and wetland habitats projects are considered ***medium to high*** risk and will require that all conservation measures are met in addition to RRT review. If all conservation measures cannot be met then a variance and review from NMFS and/or FWS will be required.

Prior to going to the RRT, medium to high risk projects shall address the **General Project and Data Summary Requirements (Appendix C)** in addition to the following:

1) Designs must demonstrate a clear linkage to limiting factors identified within the appropriate sub basin plan, recovery plan or recommendations by a technical oversight and steering committee within a localized region.
2) Evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, remote sensing information, or personal observation.
3) If new side channel habitat is proposed, designs must demonstrate sufficient hydrology and that the project will be self-sustaining over time. Self-sustaining means the restored or created habitat would not require major or periodic maintenance, but function naturally within the processes of the floodplain.
4) Designs must demonstrate that the proposed action will mimic natural conditions for gradient, width, sinuosity and other hydraulic parameters.
5) Designs must demonstrate that the proposed action will not result in the creation of fish passage issues or post construction stranding of juvenile or adult fish.

Conservation Measures:

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

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

2) Excavated material removed from off- or side-channels shall be hauled to an upland site or spread across the adjacent floodplain in a manner that does not restrict floodplain capacity. Hydric soils may be salvaged to provide appropriate substrate and/or seed source for hydrophytic plant community development. Hydric soils will only be obtained from wetland salvage sites.
3) Excavation depth will never exceed the maximum thalweg depth in the main channel.
4) Restoration of existing side channels including one-time dredging and an up to two times project adjustment including adjusting the elevation of the created side channel habitat.
5) Side channel habitat will be constructed to prevent fish stranding by providing perennial flow through the constructed channel.
6) All side channel and pool habitat work will occur in isolation from waters occupied by ESA-listed salmonid species until project completion, at which time a final opening may be made by excavation to waters occupied by ESA-listed salmonid or water will be allowed to return into the area.
7) Adequate precautions will be taken to prevent the creation of fish passage issues or stranding of juvenile or adult fish.

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

Description: The BPA proposes to review and fund projects that reconnect estuary, stream and river channels with floodplains, increase habitat diversity and complexity, moderate flow disturbances, and provide refuge for fish during high flows by either removing existing berms, dikes or levees or increasing the distance that they are set back from active streams or wetlands. This action includes the removal of fill, such as dredge spoils from past channelization projects, road, trail, and railroad beds, dikes, berms, and levees to restore natural estuary and fresh-water floodplain functions. Such functions include overland flow during high flows, dissipation of flood energy, increased water storage to augment low flows, sediment and debris deposition, growth of riparian vegetation, nutrient cycling, and development of side channels and alcoves.

Techniques that are covered by this programmatic need to have the sole purpose of restoring floodplain and estuary functions or to enhance fish habitat. Covered actions in freshwater, estuarine, and marine areas include: 1) full and partial removal of levees, dikes, berms, and jetties; 2) breaching of levees, dikes, and berms; 3) lowering of levees, dikes, and berms; and, 4) setback of levees, dikes, and berms.

Guidelines for Review.

Set-back or removal of existing berms, dikes, and levees projects are considered ***medium to high*** risk and will require that all conservation measures are met and will require RRT review. If all conservation measures cannot be met then a variance and review from NMFS will be required.

Prior to going to the RRT, medium to high risk projects shall address the **General Project and Data Summary Requirements (Appendix C)** in addition to the following:

Designs must demonstrate a clear linkage to limiting factors identified within the appropriate sub-basin plan, recovery plan or recommendations by a technical oversight and steering committee within a localized region.

Conservation Measures:

1) To the greatest degree possible, nonnative fill material, originating from outside the floodplain of the action area will be removed from the floodplain to an upland site.
2) Where it is not possible to remove or set-back all portions of dikes and berms, or in areas where existing berms, dikes, and levees support abundant riparian vegetation, openings will be created with breaches.
3) Breaches shall be equal to or greater than the active channel width (as defined above) to reduce the potential for channel avulsion during flood events.
4) In addition to other breaches, the berm, dike, or levee shall always be breached at the downstream end of the project and/or at the lowest elevation of the floodplain to ensure the flows will naturally recede back into the main channel thus minimizing fish entrapment.
5) When necessary, loosen compacted soils once overburden material is removed.
6) Overburden or fill comprised of native materials, which originated from the project area, may be used within the floodplain to create set-back dikes and fill anthropogenic holes provided that does not impede floodplain function.
7) When full removal is not possible and a setback is required, the new structure locations should be prioritized to the outside of the meander belt width or to the outside or the channel meander zone margins.

c. Protect Streambanks Using Bioengineering Methods

Description. The BPA proposes to review and fund projects that restore eroding streambanks by bank shaping and installation of coir logs or other soil reinforcements – bioengineering techniques as necessary to support development of riparian vegetation and/or planting or installing large wood, trees, shrubs, and herbaceous cover as necessary to restore ecological function in riparian and floodplain habitats.

Streambank erosion often occurs within meandering alluvial rivers on the outside of meander bends. The rate of erosion and meander migration is often accelerated due to degradation of the stream side riparian vegetation and land use practices that have removed riparian woody species. Historically, as the river migrates into the adjacent riparian areas, LW would be recruited from the banks resulting in reduced near bank velocities and increased boundary roughness. Where a functional riparian area is lacking, the lateral bank erosion may occur at an unnaturally accelerated rate. The goal of streambank restoration is to reestablish long term riparian processes through re-vegetation and riparian buffer strips. Structural bank protection may be used to provide short term stability to banklines allowing for vegetation establishment.

The primary proposed structural streambank stabilization action is the use of large wood and vegetation to increase bank strength and resistance to erosion in an ecological approach to engineering streambank stabilization.

The following bioengineering techniques[16] are proposed for use either individually or in combination: (a) Woody plantings and variations (*e.g.*, live stakes, brush layering, facines, brush mattresses); (b) herbaceous cover, for use on small streams or adjacent wetlands; (c) deformable soil reinforcement, consisting of soil layers or lifts strengthened with biodegradable coir fabric and plantings that are penetrable by plant roots; (d) coir logs (long bundles of coconut fiber), straw bales and straw logs used individually or in stacks to trap sediment and provide a growth medium for riparian plants; (e) bank reshaping and slope grading, when used to reduce a bank slope angle without changing the location of its toe, to increase roughness and cross section, and to provide more favorable planting surfaces; (f) tree and LW rows, live siltation fences, brush traverses, brush rows and live brush sills in floodplains, used to reduce the likelihood of avulsion in areas where natural floodplain roughness is poorly developed or has been removed and (g) floodplain flow spreaders, consisting of one or more rows of trees and accumulated debris used to spread flow across the floodplain; and (h) use of LW as a primary structural component.

Guidelines for Review.

Projects protecting streambanks using bioengineering methods are considered ***low risk*** and will not require RRT review if the following conditions are met: Streambank projects with 1) bankfull flow less than 500 cfs; 2) height of bank less than 5 feet; and, 3) bankfull velocity less than 5 ft/sec.

The following proposed activities are considered ***medium*** to ***high risk*** and will require RRT review: Streambank projects with 1) bankfull flow greater than 500 cfs; 2) height of bank greater than 5 feet; and, 3) bankfull velocity greater than 5 ft/sec.

Prior to going to the RRT, medium to high risk projects shall address the **General Project and Data Summary Requirements (Appendix C)** in addition to the following:

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

Designs must demonstrate a clear linkage to limiting factors identified within the appropriate sub basin plan, recovery plan or recommendations by a technical oversight and steering committee within a localized region.

Conservation Measures:

1) Without changing the location of the bank toe, damaged streambanks will be restored to a natural slope, pattern, and profile suitable for establishment of permanent woody vegetation. This may include sloping of unconsolidated bank material to a stable angle of repose, or the use of benches in consolidated, cohesive soils. The purpose of bank shaping is to provide a more stable platform for the establishment of riparian vegetation, while also reducing the depth to the water table, thus promoting better plant survival.
2) Streambank restoration projects shall include the placement of a riparian buffer strip consisting of a diverse assemblage of species native to the action area or region, including trees, shrubs, and herbaceous species. Do not use invasive species.
3) Large wood will be used as an integral component of all streambank protection treatments unless restoration can be achieved with soil bioengineering techniques alone.
4) LW will be placed to maximize near bank hydraulic complexity and interstitial habitats through use of various LW sizes and configurations of the placements.
5) Structural placement of LW should focus on providing bankline roughness for energy dissipation vs. flow re-direction that may affect the stability of the opposite bankline.
6) Large wood will be intact, hard, and undecayed to partly decaying with untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or fragmented wood found lying on the ground may be used for additional roughness and to add complexity to LW placements but will not constitute the primary structural components.
7) Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.
8) LW anchoring will not utilize cable or chain. Manila, sisal or other biodegradable ropes may be used for lashing connections. If hydraulic conditions warrant use of structural connections then rebar pinning or bolting may be used. The utilization of structural connections should be used minimally and only to ensure structural longevity in high energetic systems such as (high gradient systems with lateral confinement and limited floodplain). Need for structural anchorage shall be demonstrated in the design documentation.
9) Rock will not be used for streambank restoration, except as ballast to stabilize large wood unless it is necessary to prevent scouring or downcutting of an existing flow control structure (*e.g.*, a culvert or bridge support, headwall, utility lines, or building). In this case rock may be used as the primary structural component for construction of vegetated riprap with large woody debris. Scour holes may be filled with rock to prevent damage to structure foundations but will not extend above the adjacent bed of the river. This does not include scour protection for bridge approach fills.
10) The rock may not impair natural stream flows into or out of secondary channels or riparian wetlands.

11) Any action that requires additional excavation or structural changes to a road, culvert, bridge foundation or that may affect fish passage is covered under the **Fish Passage Restoration** activity category.
12) Fencing will be installed as necessary to prevent access and grazing damage to revegetated sites and project buffer strips.
13) Riparian buffer strips associated with streambank protection shall extend from the project bankline towards the floodplain a minimum distance of 35 feet.

d. Install Habitat-Forming Natural Material Instream Structures (Large Wood, Boulders, and Spawning Gravel)[17]

Description. The BPA proposes to review and fund projects that include placement of natural habitat forming structures to provide instream spawning, rearing and resting habitat for salmonids and other aquatic species. Projects will provide high flow refugia; increase interstitial spaces for benthic organisms; increase instream structural complexity and diversity including rearing habitat and pool formation; promote natural vegetation composition and diversity; reduce embeddedness in spawning gravels and promote spawning gravel deposition; reduce siltation in pools; reduce the width/depth ratio of the stream; mimic natural input of LW (*e.g.*, whole conifer and hardwood trees, logs, root wads); decrease flow velocities; and deflect flows into adjoining floodplain areas to increase channel and floodplain function. In areas where natural gravel supplies are low (immediately below reservoirs, for instance), gravel placement can be used to improve spawning habitat.

Anthropogenic activities that have altered riparian habitats, such as splash damming and the removal of large wood and logjams, have reduced instream habitat complexity in many rivers and have eliminated or reduced features like pools, hiding cover, and bed complexity. Salmonids need habitat complexity for rearing, feeding, and migrating. To offset these impacts large wood, boulders and spawning gravel will be placed in stream channels either individually or in combination.

Large wood will be placed to increase coarse sediment storage, increase habitat diversity and complexity, retain gravel for spawning habitat, improve flow heterogeneity, provide long-term nutrient storage and substrate for aquatic macroinvertebrates, moderate flow disturbances, increase retention of leaf litter, and provide refugia for fish during high flows. Engineered log jams create a hydraulic shadow, a low-velocity zone downstream that allows sediment to settle

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[17] For detailed descriptions of each technique refer to the WDFW Stream Habitat Restoration Guidelines: http://wdfw.wa.gov/publications/pub.php?id=00043, WDFW Integrated Streambank Protection Guidelines: http://wdfw.wa.gov/publications/00046/,the USACE's EMRRP Technical Notes, Stream Restoration: http://el.erdc.usace.army.mil/publications.cfm?Topic=technote&Code=emrrp, or the NRCS National Engineering Handbook Part 654, Stream Restoration: http://policy.nrcs.usda.gov/viewerFS.aspx?id=3491

out. Scour holes develop adjacent to the log jam which can provide valuable fish and wildlife habitat by redirecting flow and providing stability to a streambank or downstream gravelbar.

Boulder placements increase habitat diversity and complexity, improve flow heterogeneity, provide substrate for aquatic vertebrates, moderate flow disturbances, and provide refuge for fish during high flows. The placement of individual large boulders and boulder clusters to increase structural diversity is important to provide holding and rearing habitat for ESA-listed salmonids where similar natural rock has been removed. This treatment will be used in streams that have been identified as lacking structural diversity and that are naturally and/or historically have had boulders.

The quality and quantity of available spawning gravel has been impacted by many anthropogenic features and activities. For example, dams and culverts can block the downstream movement of gravel and result in gravel starved reaches. Channelization, hard streambank stabilization, and diking restrict a stream from meandering and recruiting gravel. Elimination of riparian buffers and grazing up to the stream's edge introduces fines that often cause embedded or silted-in spawning gravel. Spawning gravel will be placed to improve spawning substrate by compensating for an identified loss of a natural gravel supply and may be placed in conjunction with other projects, such as simulated log jams and boulders.

All activities intended for installing habitat-forming instream structures will provide the greatest degree of natural stream and floodplain function achievable through application of an integrated, ecological approach and linkage to basin defined limiting factors. Instream structures capable of enhancing habitat forming processes and migratory corridors will be installed only within previously degraded stream reaches, where past disturbances have removed habitat elements such as LW, boulders, or spawning gravel.

Guidelines for Review.

The following proposed activities are considered ***low risk*** and will not require RRT review: Installation of habitat forming structures that meet all of the following conservation measures.

The following proposed activities are considered ***medium*** to ***high risk*** and will require RRT review: Installation of habitat forming structures that do not meet all of the following conservation measures will require a RRT review and a variance from NMFS.

Prior to going to the RRT, medium to high risk projects shall address the **General Project and Data Summary Requirements (Appendix C)** in addition to the following:

1) Designs must demonstrate a clear linkage to limiting factors identified within the appropriate sub basin plan, recovery plan or recommendations by a technical oversight and steering committee within a localized region.

2) Designs must demonstrate that the large wood placements mimic natural accumulations of large wood in the channel, estuary, or marine environment and addresses basin defined limiting factors.
3) Designs must demonstrate that boulder placements will be limited to stream reaches with an intact, well-vegetated riparian area, including trees and shrubs where those species would naturally occur, or that are part of riparian area restoration action; and a stream bed that consists predominantly of coarse gravel or larger sediments.
4) Designs must demonstrate that boulder sizing is appropriate for the size of the stream, maximum depth of flow, planform, entrenchment, and ice and debris loading.
5) For systems where boulders were not historically a component of the project stream reach, it must be demonstrated how this use of this technique will address limiting factors and provide the appropriate post restoration habitats.
6) Designs must demonstrate that LW and boulder placements will not result in a fish passage barrier.
7) Designs must demonstrate that spawning gravel augmentation is limited to areas where the natural supply has been eliminated or significantly reduced through anthropogenic means.

Conservation Measures (Large Wood).

1) LW placements for other purposes than habitat restoration or enhancement are excluded from this consultation.
2) LW will be placed in channels that have an intact, well-vegetated riparian buffer area that is not mature enough to provide large wood, or in conjunction with riparian rehabilitation or management.
3) LW may partially or completely span the channel in first order streams if the active channel top width is less than 20 feet.
4) When available and if the project is located within the appropriate morphology and sized stream, trees with rootwads attached should be a minimum length of 1.5 times the bankfull channel width, while logs without rootwads should be a minimum of 2.0 times the bankfull width.
5) Stabilizing or key pieces of large wood that will be relied on to provide streambank stability or redirect flows must be intact, hard, and undecayed to partly decaying, and should have untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or fragmented wood found lying on the ground or partially sunken in the ground is not acceptable for key pieces but may be incorporated to add habitat complexity.
6) The partial burial of LW and boulders may constitute the dominant means of placement and key boulders (footings) or LW can be buried into the stream bank or channel.
7) If LW anchoring is required, a variety of methods may be used. These include buttressing the wood between riparian trees, the use of manila, sisal or other biodegradable ropes for lashing connections or if hydraulic conditions warrant use of structural connections then rebar pinning or bolting may be used. The utilization of structural connections should be used minimally and only to ensure structural longevity in high energetic systems such as

(high gradient systems with lateral confinement and limited floodplain). Need for structural anchorage shall be demonstrated in the design documentation.
8) Rock may be used for ballast but is limited to that needed to anchor the LW.

Conservation Measures (Boulder Placement)

1) Boulder placements for other purposes than habitat restoration or enhancement are excluded from this consultation.
2) The cross-sectional area of boulder placements may not exceed 25% of the cross-sectional area of the low flow channel, or be installed to shift the stream flow to a single flow pattern in the middle or to the side of the stream.
3) Boulders will be machine-placed (no end dumping allowed) and will rely on the size of boulder for stability.
4) Boulders will be installed low in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 1.5-year flow event).
5) Permanent anchoring, including rebar or cabling, may not be used.

Conservation Measures (Spawning Gravel)

1) Spawning gravel to be placed in streams must be obtained from an upland source outside of the channel and riparian area and properly sized gradation for that stream, clean, and non-angular. When possible use gravel of the same lithology as found in the watershed. After spawning gravel placement, allow the stream to naturally sort and distribute the material.
2) A maximum of 100 cubic yards of spawning sized gravel can be imported or relocated and placed upstream of each structure when in combination with other restoration activities that address the underlying systematic problem. For example a combined project consisting of: planting streambank vegetation, placing instream LW and supplementing spawning gravel.
3) Imported gravel must be free of invasive species and non-native seeds.

e. Riparian Vegetation Planting

Description. The BPA proposes to fund vegetation planting to recover watershed processes and functions associated with native plant communities and that will help restore natural plant species composition and structure. Under this activity category, project proponents would plant trees, shrubs, herbaceous plants, and aquatic macrophytes to help stabilize soils. Large trees such as cottonwoods and conifers will be planted in areas where they historically occurred but are currently either scarce or absent. Native plant species and seeds will be obtained from local sources to ensure plants are adapted to local climate and soil chemistry.

Vegetation management strategies will be utilized that are consistent with local native succession and disturbance regimes and specify seed/plant source, seed/plant mixes, and soil preparation.

Planting will address the abiotic factors contributing to the sites' succession, *i.e*., weather and disturbance patterns, nutrient cycling, and hydrologic condition. Only certified noxious weed-free seed (99.9%), hay, straw, mulch, or other vegetation material for site stability and revegetation projects will be utilized.

Guidelines for Review.

The proposed activities are considered low risk and will not require RRT review: Riparian vegetation planting that meet all of the following conservation measures

Conservation Measures.

1) An experienced silviculturist, botanist, ecologist, or associated technician shall be involved in designing vegetation treatments.
2) Species to be planted must be of the same species that naturally occurs in the project area.
3) Tree and shrub species as well as sedge and rush mats to be used as transplant material shall come from outside the bankfull width, typically in abandoned flood plains, and where such plants are abundant.
4) Sedge and rush mats should be sized as to prevent their movement during high flow events.
5) Concentrate plantings above the bankfull elevation.
6) Species distribution shall mimic natural distribution in the riparian and floodplain areas.

f. Channel Reconstruction

Description. The BPA proposes to review and fund channel reconstruction projects to improve aquatic and riparian habitat diversity and complexity, reconnect stream channels to floodplains, reduce bed and bank erosion, increase hyporheic exchange, provide long-term nutrient storage, provide substrate for macroinvertebrates, moderate flow disturbance, increase retention of organic material, and provide refuge for fish and other aquatic species by reconstructing stream channels and floodplains that are compatible within the appropriate watershed context and geomorphic setting.

The reconstructed stream system shall be composed of a naturally sustainable and dynamic planform, cross-section, and longitudinal profile that incorporates unimpeded passage and temporary storage of water, sediment, organic material, and species. Stream channel adjustment over time is to be expected in naturally dynamic systems and is a necessary component to restore a wide array of stream functions. It is expected that for most projects that there will be a primary channel with secondary channels that are activated at various flow levels to increase floodplain connectivity and to improve aquatic habitat through a range of flows. This proposed action is not intended to artificially stabilize streams into a single location or into a single channel for the purposes of protecting infrastructure or property.

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

Due to the complexity of channel reconstruction projects, there shall be separate procedural guidelines, data and information requirements, that will be refined, amended, and updated through an iterative collaborative process with BPA, NMFS, and USFWS.

The channel reconstruction activity is considered ***high risk*** and will require RRT and NMFS Hydro review.

High Risk projects in the Channel Reconstruction activity shall address the **General Project and Data Summary Requirements (Appendix C),** the following **Conservation Measures**, and include a **Monitoring and Adaptive Management Plan.**

Conservation Measures:

Because of the complexity of channel reconstruction projects, there shall be an interdisciplinary design team minimally consisting of a biologist, engineer, and hydrologist.

Data requirements for RRT & NMFS review and analysis include:

1) Designs must demonstrate a clear linkage to limiting factors identified within the appropriate sub-basin plan, recovery plan or recommendations by a technical oversight and steering committee within a localized region.
2) Detailed construction drawings
3) Designs must demonstrate that channel reconstruction will identify, correct to the extent possible, and then account for in the project development process, the conditions that lead to the degraded condition.
4) Designs must demonstrate that the proposed action will mimic natural conditions for gradient, width, sinuosity and other hydraulic parameters.
5) Designs must demonstrate that structural elements shall fit within the geomorphic context of the stream system.
6) Designs must demonstrate sufficient hydrology and that the project will be self-sustaining over time. Self-sustaining means the restored or created habitat would not require major or periodic maintenance, but function naturally within the processes of the floodplain.
7) Designs must demonstrate that the proposed action will not result in the creation of fish passage issues or post construction stranding of juvenile or adult fish.

3.5.3 Action Category 3. Invasive and Non-Native Plant Control

The BPA proposes to fund management of vegetation using physical control and through the use of herbicides to control or eliminate non-native, invasive plant species that compete with or displace native plant communities and recover watershed processes and functions associated with native plant communities.

a. Manage Vegetation Using Physical Control

BPA proposes to use two mechanisms for vegetation management by physical control: (a) Manual control includes hand pulling and grubbing with hand tools; bagging plant residue for burning or other proper disposal; mulching with organic materials; shading or covering unwanted vegetation; controlling brush and pruning using hand and power tools such as chain saws and machetes; using grazing goats. When possible, manual control (e.g., hand pulling, grubbing, cutting) will be used in sensitive areas to avoid adverse effects to listed species or water quality. (b) Mechanical control includes techniques such as mowing, tilling, disking, or plowing. Mechanical control may be carried out over large areas or be confined to smaller areas (known as scalping). Ground-disturbing mechanical activity will be restricted in established buffer zones adjacent to streams, lakes, ponds, wetlands and other identified sensitive habitats based on percent slope. For slopes less than 20%, a buffer width of 35 feet will be used. For slopes over 20%, no ground-disturbing mechanical equipment will be used.

Guidelines for Review.

The proposed activities are considered low risk and will not require RRT review.

Conservation Measures.

1) For mechanical control that will disturb the soil, an untreated area will be maintained within the immediate riparian buffer area to prevent any potential adverse effects to stream channel or water quality conditions. The width of the untreated riparian buffer area will vary depending on site-specific conditions and type of treatment.
2) Ground-disturbing mechanical activity will be restricted in established buffer zones adjacent to streams, lakes, ponds, wetlands and other identified sensitive habitats based on percent slope. For slopes less than 20%, a buffer width of 35 feet will be used. For slopes over 20%, no ground-disturbing mechanical equipment will be used.
3) When possible, manual control (*e.g*., hand pulling, grubbing, cutting) will be used in sensitive areas to avoid adverse effects to listed species or water quality.
4) All noxious weed material will be disposed of in a manner that will prevent its spread. Noxious weeds that have developed seeds will be bagged and burned.

b. Manage Vegetation Using Herbicides

The BPA proposes to fund management of vegetation using chemical herbicides to recover watershed processes and functions associated with native plant communities.

Herbicides will be applied in liquid or granular form using wand or boom sprayers mounted on or towed by trucks, backpack equipment containing a pressurized container with an agitation device, injection, hand wicking cut surfaces, and ground application of granular formulas. Herbicides will be mixed with water as a carrier (no petroleum-based carriers will be used) and may also contain a variety of additives (see adjuvant paragraph below) to promote saturation and adherence, to stabilize, or to enhance chemical reactions. Aerial treatment is not proposed to be covered under this consultation, nor is treatment of aquatic weeds except for knotweed (*Polygonum cuspidatum*).

Conservation Measures.

1) *Maximum herbicide treatment area.* The area treated with herbicides above bankfull elevation, within riparian areas, will not exceed 10 acres above bankfull elevation and 2 acres below bankfull elevation, per 1.6-mile reach of a stream, per year.

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

3) *Herbicide transportation and safety plan.* The applicator will prepare and carry out an herbicide safety/spill response plan to reduce the likelihood of spills or misapplication, to take remedial actions in the event of spills, and to fully report the event. At a minimum, the plan will: (a) Address spill prevention and containment; (b) estimate and limit the daily quantity of herbicides to be transported to treatment sites; (c) require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling; (d) require a spill cleanup kit be readily available for herbicide transportation, storage and application; (e) outline reporting procedures, including reporting spills to the appropriate regulatory agency; (f) ensure applicators are trained in safe handling and transportation procedures and spill cleanup; (g) require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition; (h) address transportation routes so that hazardous conditions are avoided to the extent possible; (i) specify mixing and loading locations away from waterbodies so that accidental spills do not contaminate surface waters; (j) require that spray tanks be mixed or washed further than 150 feet of surface water; (k) ensure safe disposal of herbicide containers; (l) identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft; (m) all individuals involved, including any contracted applicators, will be instructed on the plan.

4) *Herbicides.* BPA proposes the use of the following herbicides in the typical application rates (see Tables 2 and 3) for invasive plant control. These products were previously evaluated in risk assessments by the US Forest Service http://www.fs.fed.us/foresthealth/pesticide/risk).

Table 3. Herbecides Proposed for Use by BPA.

Common Name	Trade Name	Typical Application Rates (ai/ac)	Maximum Label Application Rate (ai/ac)	General Geographic Application Areas
2,4-D (amine)	Many	0.5 - 1.5 lbs.	4.0 lbs	Upland & Riparian
Aminopyralid	Milestone®	0.11 - 0.22 lbs	0.375 lb	Upland & Riparian
Chlorsulfuron	Telar®	0.25 - 1.33 oz	3.0 oz	Upland
Clethodim	Select®	0.125 – 0.5 lbs	0.50 lb	Upland
Clopyralid	Transline®	0.1 - 0.375 lbs	0.5 lb	Upland & Riparian
Dicamba	Banvel® only	0.25 - 7.0 lbs	8.0 lbs	Upland & Riparian
Glyphosate 1 Glyphosate 2	Many Many	0.5 - 2.0 lbs 0.5 - 2.0 lbs	3.75 lbs 3.75 lbs	Upland & Riparian Upland
Imazapic	Plateau®	0.063 – 0.189 lbs	0.189 lb	Upland & Riparian
Imazapyr	Arsenal® Habitat®	0.5 – 1.5 lbs.	1.5 lbs	Upland & Riparian
Metsulfuron methyl	Escort®	0.33 - 2.0 oz	4.0 oz	Upland
Picloram	Tordon®	0.125 - 0.50 lb	1 lb	Upland
Sethoxydim	Poast®	0.1875 – 0.375 lb	0.375 lb	Upland
Sulfometuron methyl	Oust®	0.023 - 0.38 oz	2.25 oz	Upland
Triclopyr (TEA)	Garlon 3A®	1.0 - 2.5 lbs	9.0 lbs	Upland & Riparian

5) *2,4-D.* As a result of the National Consultation[18], this herbicide shall comply with all relevant reasonable and prudent alternatives from the 2011 Biological Opinion (NMFS 2011a):

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

a. Do not apply when wind speeds are below 2 mph or exceed 10 mph, except when winds in excess of 10 mph will carry drift away from salmonid-bearing waters.
b. Do not apply when a precipitation event, likely to produce direct runoff to salmonid bearing waters from the treated area, is forecasted by NOAA/NWS (National Weather Service) or other similar forecasting service within 48 h following application.
c. Control of invasive plants within the riparian habitat shall be by individual plant treatments for woody species, and spot treatment of less than 1/10 acre for herbaceous species per project per year.

6) *Adjuvants.* The following adjuvants are proposed for use (Table 2-2). Polyethoxylated tallow amine (POEA) surfactant and herbicides that contain POEA (e.g., Roundup) have been removed from the proposed action.
7) *Herbicide carriers.* Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil.
8) *Herbicide mixing.* Herbicides will be mixed more than 150 feet from any natural waterbody to minimize the risk of an accidental discharge and no more than three different herbicides may be mixed for any one application.
9) *Herbicide application rates.* Herbicides will be applied at the lowest effective label rates, including the typical and maximum rates given (Table 2-2). For broadcast spraying, application of herbicide or surfactant will not exceed the typical label rates.

Table 4. Adjuvants Proposed for Use by BPA.

Adjuvant Type	Trade Name	Labeled Mixing Rates per Gallon of Application Mix	General Geographic Application Areas
Colorants	Dynamark™ U.V. (red)	0.1 fl oz	Riparian
	Aquamark™ Blue	0.1 fl oz	Riparian
	Dynamark™ U.V. (blu)	0.5 fl oz	Upland
	Hi-Light® (blu)	0.5 fl oz	Upland
Surfactants	Activator 90®	0.16 – 0.64 fl oz	Upland
	Agri-Dex®	0.16 – 0.48 fl oz	Riparian
	Entry II®	0.16 – 0.64 fl oz	Upland
	Hasten®	0.16 – 0.48 fl oz	Riparian
	LI 700®	0.16 – 0.48 fl oz	Riparian
	R-11®	0.16 – 1.28 fl oz	Riparian
	Super Spread MSO®	0.16 – 0.32 fl oz	Riparian
	Syl-Tac®	0.16 – 0.48 fl oz	Upland
Drift Retardants	41-A®	0.03 – 0.06 fl oz	Riparian
	Valid®	0.16 fl oz	Upland

10) *Herbicide application methods.* Liquid or granular forms of herbicides to be applied by a licensed applicator as follows: (a) Broadcast spraying – hand held nozzles attached to back pack tanks or vehicles, or by using vehicle mounted booms; (b) spot spraying – hand held nozzles attached to back pack tanks or vehicles, hand-pumped spray, or squirt bottles to spray herbicide directly onto small patches or individual plants using; (c) hand/selective – wicking and wiping, basal bark, fill ("hack and squirt"), stem injection, cut-stump; (d) triclopyr – will not be applied by broadcast spraying.
11) *Emergent Knotweed Application.* No aquatic application of chemicals is covered by this consultation except for treating emergent knotweed. Only aquatic labeled glyphosate formulations will be used. The only application methods for emergent knotweed are stem injection (formulation up to 100% for emergent stems greater than 0.75 inches in diameter), wicking or wiping (diluted to 50% formulation), and hand-held spray bottle application of glyphosate (up to the percentage allowed by label instructions when applied to foliage using low pressure hand-held spot spray applicators).

12) *Water Transportation.* Most knotweed patches are expected to have overland access. However, some sites may be reached only by water travel, either by wading or inflatable raft (or kayak). The following measures will be used to reduce the risk of a spill during water transport: (a) No more than 2.5 gallons of glyphosate will be transported per person or raft, and typically it will be one gallon or less. (b) Glyphosate will be carried in 1 gallon or smaller plastic containers. The containers will be wrapped in plastic bags and then sealed in a dry-bag. If transported by raft, the dry-bag will be secured to the watercraft.

13) *Minimization of herbicide drift and leaching***.** Herbicide drift and leaching will be minimized as follows: (a) Do not spray when wind speeds exceed 10 miles per hour, or are less than 2 miles per hour; (b) be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind; (c) keep boom or spray as low as possible to reduce wind effects; (d) increase spray droplet size whenever possible by decreasing spray pressure, using high flow rate nozzles, using water diluents instead of oil, and adding thickening agents; (e) do not apply herbicides during temperature inversions, or when ground temperatures exceed 80 degrees Fahrenheit; (f) do not spray when rain, fog, or other precipitation is falling or is imminent. Wind and other weather data will be monitored and reported for all broadcast applications.

Tables 5 and 6 identify BPA's proposed minimum weather and wind speed restrictions (to be used in the absence of more stringent label instructions and restrictions). During application, applicators will monitor weather conditions hourly at sites where spray methods are being used.

14) *Herbicide Reporting***.** Herbicide use will follow the same approval process as other activities under the HIP III BOs, with the submittal of the Proposed Herbicide Use Table (BA, **Appendix A**) to BPA. If herbicide use is the only activity proposed under the HIP III BOs, submittal of a 120-day implementation report is not required.

Table 5. Herbicide Buffer Widths (from High Water Mark) to Minimize Impacts on Non-Target Resources.

Herbicide	**Broadcast Application[19]**		**Backpack Sprayer/Bottle[20] Spot Spray Foliar/Basal**		**Hand Application[21] Wicking/Wiping/Injection**
	Min buffer from high water mark (ft)	Max/ Min wind speed (mph)	Min buffer from high water mark (ft)	Max/ Min wind speed (mph)	Min buffer from high water mark (wind speed not a factor)
2,4-D (amine)	100	10/2	50	5/2	15 feet for aquatic labeled formulations.
Aminopyralid	100	10/2	15	5/2	Up to high water mark.
Chlorsulfuron	100	10/2	15	5/2	Up to high water mark.
Clethodim	NA	NA	50	5/2	Do not use within 50 feet of any surface water.
Clopyralid	100	10/2	15	5/2	Up to high water mark.
Dicamba (Banvel only)	100	10/2	15	5/2	Up to high water mark.
Glyphosate 1	100	10/2	15	5/2	Up to water's edge for aquatic labeled formulations. See knotweed General Herbicide Conservation Measures for emergent application restrictions.
Glyphosate 2	100	10/2	100	5/2	100 feet
Imazapic	100	10/2	15	5/2	Up to water's edge for aquatic labeled formulations.
Imazapyr	100	10/2	15	5/2	Up to water's edge for aquatic labeled formulations; otherwise, up to the high water mark.
Metsulfuron	100	10/2	15	5/2	Up to high water mark.
Picloram	100	8/2	100	5/2	Do not use within 100 feet of any surface water.
Sethoxydim	100	10/2	50	5/2	Do not use within 50 feet of any surface water.
Sulfometuron	100	10/2	15	5/2	Up to high water mark.
Triclopyr (TEA)	100	10/2	50	5/2	Up to high water mark for cut-stump application of aquatic labeled formulations; 15 feet for other

[19] Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms.
[20] Spot and localized foliar and basal/stump applications using a hand-pump backpack sprayer or field-mixed or pre-mixed hand-operated spray bottle.
[21] Hand applications to a specific portion of the target plant using wicking, wiping or injection techniques. This technique implies that herbicides do not touch the soil during the application process.

					applications.
Herbicide Mixtures	100	Most conservative of listed herbicides.	15	Most conservative of listed herbicides.	Most conservative of listed herbicides.

Table 6. Adjuvant Buffer Widths to Minimize Impacts on Non-Target Resources.

Adjuvant	**Broadcast Application[22]**	**Backpack Sprayer/Bottle[23]** **Spot Spray Foliar/Basal**	**Hand Application[24] Wicking/Wiping/Injection**
	Minimum buffer (ft)	**Minimum buffer (ft)**	**Minimum buffer (ft)** **(wind speed not a factor)**
Dynamark (red)	100	15	Up to water's edge when using herbicides labeled for aquatic uses.
Dynamark (yel)	100	15	Up to water's edge when using herbicides labeled for aquatic uses.
Dynamark (blu)	100	>50 <50 Do not use	>50 Herbicide dependent from Table 2-3. <50 Do not use.
Hi-Light (blu)	100	>50 <50 Do not use	>50 Herbicide dependent from Table 2-3. <50 Do not use.
Activator 90®	100	15	Up to water's edge for aquatic labeled formulations.
Agri-Dex	100	15	Up to water's edge for aquatic labeled formulations.
Entry II	100	<100 Do not use	<100 Do not use.
Hasten	100	15	Up to water's edge for aquatic labeled formulations.
LI 700	100	15	Up to water's edge for aquatic labeled formulations.
R-11	100	>50 <50 Do not use	>50 Herbicide dependent from Table 2-3. <50 Do not use.

[22] Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms.
[23] Spot and localized foliar and basal/stump applications using a hand-pump backpack sprayer or field-mixed or pre-mixed hand-operated spray bottle.
[24] Hand applications to a specific portion of the target plant using wicking, wiping or injection techniques. This technique implies that herbicides do not touch the soil during the application process.

Super Spread MSO	100	15	Up to water's edge for aquatic labeled formulations.
Syl-Tac	100	<50	<50 Do not use.
41-A	100	15	Up to water's edge when using herbicides labeled for aquatic uses.
Valid	100	50	<50 Do not use.

3.5.4 Action Category 4. Piling Removal

Description. The following steps will be used to minimize creosote release, sediment disturbance, and total suspended solids: (a) Installation of a floating surface boom to capture floating surface debris; (b) keeping all equipment (e.g., bucket, steel cable, vibratory hammer) out of the water, grip piles above the waterline, and complete all work during low water and low current conditions; (c) dislodging the piling with a vibratory hammer, whenever feasible—never intentionally break a pile by twisting or bending; (d) slowly lifting the pile from the sediment and through the water column; (e) placing the pile in a containment basin on a barge deck, pier, or shoreline without attempting to clean or remove any adhering sediment (a containment basin for the removed piles and any adhering sediment may be constructed of durable plastic sheeting with sidewalls supported by hay bales or another support structure to contain all sediment, and return flow may be directed back to the waterway); (f) filling the holes left by each piling with clean, native sediments; (g) disposing of all removed piles, floating surface debris, any sediment spilled on work surfaces, and all containment supplies at a permitted upland disposal site.

Conservation Measures.

1) Pollution Minimization**.** The following steps will be used to minimize creosote release, sediment disturbance, and total suspended solids:
   a) Installation of a floating surface boom to capture floating surface debris.
   b) Keeping all equipment (e.g., bucket, steel cable, vibratory hammer) out of the water, grip piles above the waterline, and complete all work during low water and low current conditions
   c) Dislodging the piling with a vibratory hammer, whenever feasible—never intentionally break a pile by twisting or bending
   d) Slowly lifting the pile from the sediment and through the water column.
   e) Placing the pile in a containment basin on a barge deck, pier, or shoreline without attempting to clean or remove any adhering sediment (a containment basin for the removed piles and any adhering sediment may be constructed of durable plastic sheeting with sidewalls supported by hay bales or another support structure to contain all sediment, and return flow may be directed back to the waterway)
   f) Filling the holes left by each piling with clean, native sediments.
   g) Disposing of all removed piles, floating surface debris, any sediment spilled on work surfaces, and all containment supplies at a permitted upland disposal site.

2) Broken piles. If a pile breaks above the surface of uncontaminated sediment, or less than 2 feet below the surface, every attempt short of excavation will be made to remove it entirely. If the pile cannot be removed without excavation, saw the stump off at least 3 feet below the surface of the sediment. If a pile breaks above contaminated sediment, saw the stump off at the sediment line; if a pile breaks within contaminated sediment, make no further effort to remove it and cover the hole with a cap of clean substrate appropriate for the site. If dredging is likely in the area of piling removal, use a global positioning device (GPS) to note the location of all broken piles for future use in site debris characterization.

3.5.5 Action Category 5. Road and Trail Erosion Control, Maintenance, and Decommissioning

a. Road Maintenance

Description. BPA proposes to fund road maintenance activities, including: (a) creating barriers to human access: gates, fences, boulders, logs, tank traps, vegetative buffers, and signs, (b) surface maintenance, such as building and compacting the road prism, grading, and spreading rock or surfacing material, (c) drainage maintenance and repair of inboard ditch lines, waterbars, sediment traps (d) removing and hauling or stabilizing pre-existing cut and fill material or slide material (e) snowplowing (f) relocating portions of roads and trails to less sensitive areas outside of riparian buffer areas. The proposed activity does not include asphalt resurfacing, widening roads, or new construction or relocation of any permanent road inside a riparian buffer area except for a bridge approach in accordance to the section on **Transportation Infrastructure.**

Road grading and shaping will maintain, not destroy, the designed drainage of the road, unless modification is necessary to improve drainage problems that were not anticipated during the design phase. Road maintenance will not be attempted when surface material is saturated with water and erosion problems could result.

Conservation Measures

1) Dust-abatement additives and stabilization chemicals (typically magnesium chloride or calcium chloride salts) will not be applied within 25 feet of water or a stream channel and will be applied so as to minimize the likelihood that they will enter streams.
    a. Additives and stabilization chemicals (typically magnesium chloride or calcium chloride salts) will not be applied within 25 feet of water or a stream channel and will be applied so as to minimize the likelihood that they will enter streams.
    b. Spill containment equipment will be available during chemical dust abatement application.
    c. Oil, oil-based, petroleum-based products will not be used for dust abatement.
    d. Dust-abatement application will be avoided during or just before wet weather and at stream crossings or other locations that could result in direct delivery to a waterbody, typically within 25 feet of a waterbody or stream channel.

   e. Spill containment equipment will be available during chemical dust abatement application.

2) Application will be avoided during or just before wet weather and at stream crossings or other locations that could result in direct delivery to a water body (typically within 25 feet of a water body or stream channel).
3) Waste material generated from road maintenance activities and slides will be disposed on stable, nonfloodplain sites approved by a geotechnical engineer or other qualified personnel.
4) Disturbance of existing vegetation in ditches and at stream crossings will be minimized to the greatest extent possible.
5) Ditches and culverts will be promptly cleaned of materials resulting from slides or other debris.
6) Berms will not be left along the outside edge of roads, unless an outside berm was specifically designed to be a part of the road, and low-energy drainage is provided.
7) Ditch back slopes will not be undercut, to avoid slope destabilization and erosion acceleration.
8) When blading and shaping roads, excess material will not be sidecast onto the fill. All excess material that cannot be bladed into the surface will be hauled to an appropriate site. Haul and prohibition of sidecasting will not be required for organic material like trees, needles, branches, and clean sod; however, fine organics like sod and grass will not be cast into water.
9) Slides and rock failures including fine material of more than approximately ½ yard at one site will be hauled to disposal sites. Fine materials (1 inch or smaller) from slides, ditch maintenance, or blading may be worked into the road. Scattered clean rocks (1 inch or larger) may be raked or bladed off the road except within 300 feet of perennial or 100 feet of intermittent streams.
10) Road grading material will not be sidecast along roads within ¼ mile of perennial streams and from roads onto fill slopes having a slope greater than 45%.
11) Road maintenance will not be attempted when surface material is saturated with water and erosion problems could result.
12) Large woody (LW >9 m in length and >50 cm in diameter) present on roads will be moved intact to downslope of the road, subject to site-specific considerations. Movement down-slope will be subject to the guidance of a natural resource specialist with experience in fish biology.
13) Snowplowing will be performed in accordance with the following criteria:
    a. No chemical additives such as salt or de-icing chemicals will be used in conjunction with snowplowing.
    b. Drainage holes will be placed in snow berms to provide drainage
    c. A minimum of two inches of snow will be left on gravel roads during plowing; paved roads may be scraped to the surface
    d. No gravel or surfacing material will be bladed off the road.
    e. No deliberate sidecasting of snow into or over drainage structures will be permitted

f. Plowing will not be allowed on gravel roads during thaw periods when the road is wet.

b. Road Decommissioning

Description. BPA proposes to decommission and obliterate roads that are no longer needed, e.g., logging roads. Water bars will be installed, road surfaces will be insloped or outsloped, asphalt and gravel will be removed from road surfaces, culverts and bridges will be altered or removed, streambanks will be recontoured at stream crossings, cross drains will be installed, fill or sidecast materials will be removed, road prism will be reshaped, and sediment catch basins will be created.

Conservation Measures

1) All surfaces will be revegetated to reduce surface erosion of bare soils.
2) Recontour the affected area to mimic natural floodplain contours and gradient to the extent possible.
3) Surface drainage patterns will be recreated, and dissipaters, chutes or rock will be placed at remaining culvert outlets.
4) Conduct activities during dry-field conditions (generally May 15 – October 15) when the soil is more resistant to compaction and soil moisture is low.
5) Slide and waste material will be disposed in stable, non-floodplain sites unless materials are to restore natural or near-natural contours, and approved by a geotechnical engineer or other qualified personnel.

3.5.6 Action Category 6. In-channel Nutrient Enhancement

Description. BPA proposes to fund the application of nutrients throughout a waterway corridor by placement of salmon carcasses into waterways, placement of carcass analogs (processed fish cakes) into waterways or placement of inorganic fertilizers into waterways.

Conservation Measures

1) In Oregon, projects are permitted through Oregon Department of Environmental Quality (ODEQ). Carcasses from the treated watershed or those that are certified disease free by an ODFW pathologist will be used.
2) In Washington, WDFW publication entitled "Salmon Carcass Analogs, and Delayed Release Fertilizers to Enhance Stream Productivity in Washington State" (WDFW 2004), will be followed.
3) Carcasses will be of species native to the watershed and placed during the normal migration and spawning times, as would naturally occur in the watershed.
4) Eutrophic or naturally oligotrophic systems will not be supplemented with nutrients.

5) Each waterway will be individually assessed for available light, water quality, stream gradient and life history of the fish present, and adaptive management will be used to derive the maximum benefits of nutrient enhancement.

3.5.7 Action Category 7. Irrigation and Water Delivery/Management Actions

The BPA proposes to fund the following activities for Irrigation and Water Delivery Management Actions: (a) Convert Delivery System to Drip or Sprinkler Irrigation, (b) Convert Water Conveyance from Open Ditch to Pipeline or Line Leaking Ditches and Canals, (c) Convert from Instream Diversions to Groundwater Wells for Primary Water Sources, (d) Install or Replace Return Flow Cooling Systems, (e) Install Irrigation Water Siphon Beneath Waterway, (f) Livestock Watering Facilities, and (g) Install New or Upgrade/Maintain Existing Fish Screens.

The criteria, plans and specifications, and operation and maintenance protocols of the following activity categories shall use the most recent versions of NRCS guidance.

The BPA HIP III will only cover irrigation efficiency actions within this activity category that use state approved regulatory mechanisms (e.g. Oregon ORS 537.455-.500, Washington RCW 90.42) for ensuring that water savings will be protected as instream water rights, or in cases where project implementers identify how the water conserved will remain instream to benefit fish without any significant loss of the instream flows to downstream diversions.

a. Convert Delivery System to Drip or Sprinkler Irrigation

Description. Flood or other inefficient irrigation systems will be converted to drip or sprinkler irrigation; education will be provided to irrigators on ways to make their systems more efficient. This proposed activity will involve the installation of pipe, possibly trenched and buried into the ground, and possibly pumps to pressurize the system.

b. Convert Water Conveyance from Open Ditch to Pipeline or Line Leaking Ditches and Canals

Description. Open ditch irrigation water conveyance systems will be replaced with pipelines to reduce evaporation and transpiration losses. Leaking irrigation ditches and canals will be converted to pipeline or lined with concrete, bentonite, or appropriate lining materials.

c. Convert from Instream Diversions to Groundwater Wells for Primary Water Source

Description. Wells will be drilled as an alternative water source to surface water withdrawals. Water from the wells will be pumped into ponds or troughs for livestock, or used to irrigate agricultural fields. Instream diversion infrastructure will be removed or downsized, if feasible. If an instream diversion is downsized, it will be covered under this programmatic consultation only by following all criteria outlined in the **Consolidate, or Replace Existing Irrigation**

Diversions section. New wells will be located more than ¼ mile from the stream and will not be hydraulically connected to the stream.

d. Install or Replace Return Flow Cooling Systems

Description. Above-ground pipes and open ditches that return tailwater from flood-irrigated fields back to the river will be replaced. Return flow cooling systems will be constructed by trenching and burying a network of perforated PVC pipes that will collect irrigation tailwater below ground, eliminating pools of standing water in the fields and exposure of the water to direct solar heating. No instream work is involved except for installing the drain pipe outfall; most work will be in uplands or in riparian buffer areas that are already plowed or grazed.

e. Install Irrigation Water Siphon Beneath Waterway

Description. Siphons transporting irrigation water will be installed beneath waterways where irrigation ditch water currently enters a stream and commingles with stream water, with subsequent withdrawal of irrigation water back into an irrigation ditch system downstream. Periodic maintenance of the siphon will be conducted. Work may entail use of heavy equipment, power tools, and/or hand tools.

Conservation Measures

1) Directional drilling to create siphon pathway will be employed whenever possible.
2) Trenching will occur in dry stream beds only; work area isolation will be employed in perennial streams.
3) Stream widths will be maintained at bankfull width or greater.
4) No part of the siphon structure will block fish passage.
5) No concrete will be placed within the bankfull width.
6) Siphon surface structures will be set back from the top of the streambank at least ten feet.
7) Minimum cover over a siphon structure within the streambed shall be three feet of natural substrate.
8) Waterway will be reconstructed to a natural streambed configuration upon completion.

f. Livestock watering facilities

Description. Watering facilities will consist of various low-volume pumping or gravity-feed systems to move the water to a trough or pond at an upland site. Either above-ground or underground piping will be installed between the troughs or ponds and the water source. Water sources may include springs and seeps, streams, or groundwater wells. Pipes will generally range from 0.5 to 4 inches, but may exceed 4 inches in diameter. Placement of the pipes in the ground will typically involve minor trenching using a backhoe or similar equipment. The off-channel watering facility will (a) avoid steep slopes; (b) ensure that each livestock water development has a float valve or similar device limiting use to demand, a return flow system, a fenced overflow area, or similar means to minimize water withdrawal and potential runoff and erosion. All pumping and gravity-feed systems within habitat occupied by listed salmonids (salmon, steelhead, bull trout) will have fish screens to avoid juvenile fish entrainment, and will be operated in accordance with NMFS's current fish screen criteria (NMFS 2011 or most recent version). If pumping rate exceeds 3 cfs, a NMFS Hydro fish passage review will be necessary.

g. Install New or Upgrade/Maintain Existing Fish Screens (Review may be required).

Description. Irrigation diversion intake and return points will be designed or replaced to prevent fish and other aquatic organisms of all life stages from swimming or being entrained into the irrigation system. Fish screens for surface water that is diverted by gravity or by pumping at a rate that exceeds 3 cfs will be submitted to NMFS for review and approval. All other diversions will have a fish screen that utilizes an automated cleaning device with a minimum effective surface area of 2.5 square feet per cfs, and a nominal maximum approach velocity of 0.4 feet per second (fps), or no automated cleaning device, a minimum effective surface area of 1 square foot per cfs, and a nominal maximum approach rate of 0.2 fps; and a round or square screen mesh that is no larger than 2.38 mm (0.094") in the narrow dimension, or any other shape that is no larger than 1.75 mm (0.069") in the narrow dimension. Each fish screen will be installed, operated, and maintained according to NMFS' fish screen criteria (NMFS 2011). Periodic maintenance, which may include temporary removal, of fish screens will be conducted to ensure their proper functioning, e.g., cleaning debris buildup, and replacement of parts.

State resource agencies may submit one PNC form for all anticipated fish screen installation, repairs, and maintenance for each field season. The PNC shall contain proposed locations (GIS map) and specific activities. PNCs shall contain actual locations, specific activities undertaken, and a statement of compliance with NMFS fish screen criteria (NMFS 2011).

3.5.8 Action Category 8. Fisheries, Hydrologic, and Geomorphologic Surveys

Description. BPA proposes to fund the collection of information in uplands, floodplains, and streambeds regarding existing on-ground conditions relative to habitat type, condition, and impairment; species presence, abundance, and habitat use; and conservation, protection, and rehabilitation opportunities or effects. Electro-shocking and fish handling for research purposes is not included, as this work must have an ESA Section 10 research permit.

Work may entail use of trucks, survey equipment, and crews using hand tools, and includes the following activities:

1) Measuring/assessing and recording physical measurements by visual estimates or with survey instruments.
2) Installing rebar or other markers along transects or at reference points.
3) Installing piezometers and staff gauges to assess hydrologic conditions and installing recording devices for stream flow and temperature.

4) Conducting snorkel surveys to determine species of fish in streams and observing interactions of fish with their habitats
5) Excavating cultural resource test pits.
6) Installing PIT detector arrays.

3.5.9 Action Category 9. Special Actions (For Terrestrial Species)

BPA proposes to enhance upland terrestrial habitats until native plant communities or other natural habitat features become established; to eliminate or reduce livestock degradation of streams, streambanks, lakeshores, riparian/wetland vegetation, and unstable upland slopes; reduce soil compaction and erosion thereby improving riparian habitat function; and to secure LW material to augment not replace, natural habitat features and processes by (a) Install/Develop Wildlife Structures, (b) Fencing Construction for Livestock Control, (c) Plant Vegetation and (d) Tree Removal for LW projects.

Install/Develop Wildlife Structures

***Description*.** This activity involves the installation or development of a variety of structures that mimic natural features and provide support for wildlife foraging, breeding, and or resting/refuge. These can include bat roosting/breeding structures, avian nest boxes, hardwood snags, brush/ cover piles, coarse woody debris, and raptor perches. Work may entail use of power tools and/or crews with hand tools.

Construct Fencing for Grazing Control

Description. Permanent or temporary livestock exclusion fences or cross-fences will be installed to assist in grazing management. Individual fence posts will be pounded or dug using hand tools or augers on backhoes or similar equipment. Fence posts will be set in the holes, backfilled, and fence wire strung or wooden rails placed. Installation may involve the removal of native or non-native vegetation along the proposed fence line. Occasionally rustic wood X-shaped fence that does not require setting posts will be used. No grazing will be allowed within riparian area fenced enclosures.

Plant Vegetation

***Description*.** Plant trees, shrubs, herbaceous plants, and aquatic macrophytes to help stabilize soils. Develop a vegetation plan that is responsive to the biological and physical factors at the site. Plant large trees such as cottonwoods and conifers in areas where they historically occurred but are currently either scarce or absent. Obtain plants and seeds from local sources to ensure plants are adapted to local climate and soil chemistry.

Pastures and rangelands will be planted or seeded with native or adapted perennial and biannual vegetation. The ground will be scarified as necessary to promote seed germination. In areas with severe erosion or high erosion potential, trees, shrubs, vines, grasses, and legumes will be planted to stabilize soils. Because noxious weeds, nonnative invasive plants, and aggressive, weedy species can take over disturbed lands and degrade range values, vegetation will be controlled through the use of herbicide applications, mechanical removal, and hand pulling.

Prepare planting sites by cutting, digging, grubbing roots, scalping sod, de-compacting soil as needed, and removing existing vegetation. Place woody debris, wood chips, or soil at select locations to alter microsites. Plants will be fertilized, mulched, and stems wrapped to protect from rodent girdling. Buds will be capped to protect plants from herbivores. Work may entail use of heavy equipment, power tools, and/or hand tools.

Conservation Measures

1) Vegetation plans shall require the use of native species and specify seed/plant source, seed/plant mixes, soil preparation, etc.
2) Vegetation Plans shall include vegetation management strategies that are consistent with local native succession and disturbance regime.
3) Vegetation Plans shall address the abiotic factors contributing to the sites' succession, i.e., weather and disturbance patterns, nutrient cycling, and hydrologic condition.

Tree Removal for LW Projects

Description. Live conifers and other trees can be felled or pulled/pushed over in a Northwest Forest Plan (USDA and USDI 1994b) Riparian Reserve or PACFISH/INFISH (USDA-Forest Service 1995; USDA and USDI 1994a) riparian habitat conservation areas (RHCA), and upland areas (e.g., late successional reserves or adaptive management areas for northern spotted owl and marbled murrelet critical habitat) for in-channel LW placement only when conifers and trees are fully stocked. Tree felling shall not create excessive stream bank erosion or increase the likelihood of channel avulsion during high flows. Trees may be removed by cable, ground-based equipment, or helicopter. Danger trees and trees killed through fire, insects, disease, blow-down and other means can be felled and used for in-channel placement regardless of live-tree stocking levels. Trees may be felled or pushed/pulled directly into a stream or floodplain. Trees may be stock piled for future instream restoration projects. The project manager for an aquatic restoration action will coordinate with an action-agency wildlife biologist in tree-removal planning efforts.

Conservation Measures

The purpose of these criteria is to ensure that there would be no removal or adverse modification of suitable habitat for marbled murrelet or spotted owl.

1) The following Conservation Measures apply to tree removal within the range of marbled murrelets and the spotted owl in Douglas-fir dominated stands less than 80 years old that are not functioning as foraging habitat within a spotted owl home range and do not contain murrelet nesting structure. It does not apply to tree selection in older stands or hardwood-dominated stands unless stated otherwise.
    a) A wildlife biologist must be fully involved in all tree-removal planning efforts, and be involved in making decisions on whether individual trees are suitable for nesting or have other important listed bird habitat value.
    b) Outside of one site potential tree height of streams, trees can be removed to a level not less than a Relative Density (RD) of approximately 35 (stand scale), which is considered as fully occupying a site. This equates to approximately 60 trees per acre in the overstory and a tree spacing averaging 26 feet. Additionally 40% canopy cover would be maintained when in spotted owl or marbled murrelet CH, when within 300 feet of occupied or unsurveyed murrelet nesting structure, and when dispersal habitat is limited in the area.
    c) Tree species removed should be relatively common in the stand (i.e., not "minor" tree species).
    d) Snags and trees with broad, deep crowns ("wolf" trees), damaged tops or other abnormalities that may provide a valuable wildlife habitat component can not be removed.
    e) No gaps (openings) greater than 0.5 acre will be created in spotted owl CH. No gaps greater than ¼ acre will be created in murrelet CH. No gaps shall be created in Riparian Reserves that contain ESA-listed fish habitat.

2) The following conservation measures applies to tree removal within the range of marbled murrelet and the spotted owl in Douglas-fir dominated stands greater than 80 years old or that are functioning as foraging habitat within a spotted owl home range, and/or do contain marbled murrelet nesting structure.
    a) Individual trees or small groups of trees should come from the periphery of permanent openings (roads etc.) or from the periphery of non-permanent openings (e.g., plantations, along recent clear-cuts etc.). Groups of trees greater than 4 trees shall 1) not be removed from within marbled murrelet suitable stands or stands buffering (300 ft.) MM suitable stands, 2) not be buffering (300 ft.) individual trees with marbled murrelet nesting structure. A minimum distance of one potential tree height feet should be maintained between individual or group removals.
    b) Trees up to 36" dbh may be felled in any stands with agreement from an FWSwildlife biologist that the trees are not providing marbled murrelet nesting structures or providing cover for nest sites. No known spotted owl nest trees or alternate nest trees are to be removed. Potential spotted owl nest trees may only be removed in limited instances when it is confirmed with the FWS wildlife biologist that nest trees will not be limited in the stand post removal.
    c) In order to minimize the creation of canopy gaps or edges, groups of adjacent trees selected should not create openings greater than ¼ acre within 0.5 miles of

marbled murrelet occupied habitat or when within murrelet CH. Within spotted owl critical habitat, stands greater than 80 years old or within stands providing foraging habitat to spotted owl home ranges, gaps will be restricted to 0.5 acre openings or less. Gaps shall not be created in Riparian Reserves where ESA-listed fish occur.

4.0 Status of the Species and Critical Habitat

4.1 Bull Trout

4.1.1 Species Description

a) Taxonomy

The bull trout is a native char found in the coastal and intermountain west of North America. Dolly Varden (*Salvelinus malma)* and bull trout were previously considered a single species and were thought to have coastal and interior forms. However, Cavender (1978) described morphometric, meristic and osteological characteristics of the two forms, and provided evidence of specific distinctions between the two. In 1980, the American Fisheries Society formally recognized bull trout and Dolly Varden as separate species (Robins et al. 1980). Despite an overlap in the geographic range of bull trout and Dolly Varden in the Puget Sound area and along the British Columbia coast, there is little evidence of introgression (Hass and McPhail 1991). The Columbia River Basin is considered the region of origin for the bull trout. From the Columbia, dispersal to other drainage systems was accomplished by marine migration and headwater stream capture. Behnke (1980) postulated dispersion to drainages east of the continental divide may have occurred through the North and South Saskatchewan Rivers (Hudson Bay drainage) and the Yukon River system. Marine dispersal may have occurred from Puget Sound north to the Fraser, Skeena and Taku Rivers of British Columbia.

b) Species Description

Bull trout have unusually large heads and mouths for salmonids. Their body colors can vary tremendously depending on their environment, but are often brownish green with lighter (often ranging from pale yellow to crimson) colored spots running along their dorsa and flanks, with spots being absent on the dorsal fin, and light colored to white under bellies. They have white leading edges on their fins, as do other species of char. Bull trout have been measured as large as 103 centimeters (41 inches) in length, with weights as high as 14.5 kilograms (32 pounds) (Fishbase 2009). Bull trout may be migratory, moving throughout large river systems, lakes, and even the ocean in coastal populations, or they may be resident, remaining in the same stream their entire lives (USFWS 2011). Migratory bull trout are typically larger than resident bull trout (USFWS 1998)

c) Current legal status, including listing history

Listing History

The coterminous United States population of the bull trout (*Salvelinus confluentus*) was listed as threatened on November 1, 1999 (64 FR 58910). The threatened bull trout generally occurs in the Klamath River Basin of south-central Oregon; the Jarbidge River in Nevada; the Willamette River Basin in Oregon; Pacific Coast drainages of Washington, including Puget Sound; major rivers in Idaho, Oregon, Washington, and Montana, within the Columbia River Basin; and the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Bond 1992, p. 4; Brewin and Brewin 1997, pp. 209-216; Cavender 1978, pp. 165-166; Leary and Allendorf 1997, pp. 715-720).

Throughout its range, the bull trout are threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, poor water quality, entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels, and introduced non-native species (64 FR 58910). Although all salmonids are likely to be affected by climate change, bull trout are especially vulnerable given that spawning and rearing are constrained by their location in upper watersheds and the requirement for cold water temperatures (Battin et al. 2007; Rieman et al. 2007b; Porter and Nelitz. 2009, pages 4-8). Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats.

Distinct Population Segments and Population Units

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 United States coterminous population of the bull trout discusses the consolidation of these DPSs with the Columbia and Klamath 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 58910):

4.1.2 Critical Habitat Description

d) Current legal status of the critical habitat

Current Designation

The Service published a final critical habitat designation for the coterminous United States population of the bull trout on October 18, 2010 (70 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, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments (also considered as interim recovery units)[25]. Rangewide, the Service designated reservoirs/lakes and stream/shoreline miles as bull trout critical habitat (Table 7). Designated bull trout critical habitat is of two primary use types: 1) spawning and rearing, and 2) foraging, migration, and overwintering (FMO).

Table 7. Stream/Shoreline Distance and Reservoir/Lake Area Designated as Bull Trout Critical Habitat.

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
*Pine Creek Drainage which falls within Oregon				

The 2010 revision 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 compared to the 2005 designation.

The final 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 main stem 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.

[25] The Service's 5 year review (USFWS 2008, pg. 9) identified 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.

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 (Act), 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 Critical Habitat Unit (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.

e) The primary constituent elements (PCEs)

Conservation Role and Description of Critical Habitat

The conservation role of bull trout critical habitat is to support viable core area populations (75 FR 63898:63943 [October 18, 2010]). 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.

Thirty-two CHUs within the geographical area occupied by the species at the time of listing are designated under the revised 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 biological features associated with Primary Constituent Elements (PCEs) 5 and 6, which relate to breeding habitat.

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 (Hard 1995, pp. 314-315; Healey and Prince 1995, p.

182; 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 (Hard 1995, pp. 321-322; MBTSG 1998, pp. 13-16; Rieman and Allendorf 2001, p. 763; Rieman and McIntyre 1993, p. 23).

Primary Constituent Elements for Bull Trout

Within the designated critical habitat areas, the PCEs for bull trout are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. Based on our current knowledge of the life history, biology, and ecology of this species and the characteristics of the habitat necessary to sustain its essential life-history functions, we have determined that the PCEs, as described within 70 FR 63898 are essential for the conservation of bull trout. A summary of those PCEs follows.

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 unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

5. Water temperatures ranging from 2 °C to 15 °C (36 °F 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 departure 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 non-native 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.

The revised PCE's are similar to those previously in effect under the 2005 designation. The most significant modification is the addition of a ninth PCE to address the presence of nonnative predatory or competitive fish species. Although this PCE applies to both the freshwater and marine environments, currently no non-native fish species are of concern in the marine environment, though this could change in the future.

Note that only PCEs 2, 3, 4, 5, and 8 apply to marine nearshore waters identified as critical habitat. Also, lakes and reservoirs within the CHUs also contain most of the physical or biological features necessary to support bull trout, with the exception of those associated with PCEs 1 and 6. Additionally, all except PCE 6 apply to FMO habitat designated as critical habitat.

Critical habitat includes the stream channels within the designated stream reaches and has a lateral extent as defined by the bankfull elevation on one bank to the bankfull elevation on the opposite bank. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge that generally has a recurrence interval of 1 to 2 years on the annual flood series. If bankfull elevation is not evident on either bank, the ordinary high-water line must be used to determine the lateral extent of critical habitat. The lateral extent of designated lakes is defined by the perimeter of the waterbody as mapped on standard 1:24,000 scale topographic maps. The Service assumes in many cases this is the full-pool level of the waterbody. In areas where only one side of the waterbody is designated (where only one side is excluded), the mid-line of the waterbody represents the lateral extent of critical habitat.

In marine nearshore areas, the inshore extent of critical habitat is the mean higher high-water (MHHW) line, including the uppermost reach of the saltwater wedge within tidally influenced freshwater heads of estuaries. The MHHW line refers to the average of all the higher high-water heights of the two daily tidal levels. Marine critical habitat extends offshore to the depth of 10 meters (m) (33 ft) relative to the mean low low-water (MLLW) line (zero tidal level or average of all the lower low-water heights of the two daily tidal levels). This area between the MHHW line and minus 10 m MLLW line (the average extent of the photic zone) is considered the habitat most consistently used by bull trout in marine waters based on known use, forage fish availability, and ongoing migration studies and captures geological and ecological processes important to maintaining these habitats. This area contains essential foraging habitat and migration corridors such as estuaries, bays, inlets, shallow subtidal areas, and intertidal flats.

Adjacent shoreline riparian areas, bluffs, and uplands are not designated as critical habitat. However, it should be recognized that the quality of marine and freshwater habitat along streams, lakes, and shorelines is intrinsically related to the character of these adjacent features, and that human activities that occur outside of the designated critical habitat can have major effects on physical and biological features of the aquatic environment.

Activities that cause adverse effects to critical habitat are evaluated to determine if they are likely to “destroy or adversely modify” critical habitat by no longer serving the intended conservation role for the species or retaining those PCEs that relate to the ability of the area to at least periodically support the species. Activities that may destroy or adversely modify critical habitat are those that alter the PCEs to such an extent that the conservation value of critical habitat is appreciably reduced (75 FR 63898:63943; USFWS 2004, Vol. 1. pp. 140-193, Vol. 2. pp. 69-114). The Service’s evaluation must be conducted at the scale of the entire critical habitat area designated, unless otherwise stated in the final critical habitat rule (USFWS and NMFS 1998, pp. 4-39). Thus, adverse modification of bull trout critical habitat is evaluated at the scale of the final designation, which includes the critical habitat designated for the Klamath River, Jarbidge River, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments. However, we consider all 32 CHUs to contain features or areas essential to the conservation of the bull trout (75 FR 63898:63901, 63944). Therefore, if a proposed action would alter the physical or biological features of critical habitat to an extent that appreciably reduces the conservation function of one or more critical habitat units for bull trout, a finding of adverse modification of the entire designated critical habitat area may be warranted (75 FR 63898:63943).

Current Critical Habitat Condition Rangewide

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 decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and the introduction of nonnative species (63 FR 31647, June 10 1998; 64 FR 17112, April 8, 1999).

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

Effects of Climate Change on Bull Trout Critical Habitat

One objective of the final rule was 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 non-native fishes).

Many of the PCEs for bull trout may be affected by the presence of toxics and/or increased water temperatures within the environment. The effects will vary greatly depending on a number of factors which include which toxic substance is present, the amount of temperature increase, the likelihood that critical habitat would be affected (probability), and the severity and intensity of any effects that might occur (magnitude).

4.1.3 Life History

The iteroparous reproductive strategy of bull trout has important repercussions for the management of this species. Bull trout require passage both upstream and downstream, not only for repeat spawning but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous salmonids (fishes that spawn once and then die, and require only one-way passage upstream). 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. Additionally, in some core areas, bull trout that migrate to marine waters must pass both upstream and downstream through areas with net fisheries at river mouths. This can increase the likelihood of mortality to bull trout during these spawning and foraging migrations.

Growth varies depending upon life-history strategy. Resident adults range from 6 to 12 inches total length, and migratory adults commonly reach 24 inches or more (Goetz 1989; Pratt 1985). The largest verified bull trout is a 32-pound specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982).

Bull trout typically spawn from August through November during periods of increasing flows and decreasing water temperatures. Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989; Pratt 1992; Rieman and McIntyre 1996). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992). After hatching, fry remain in the substrate, and time from egg deposition to emergence may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992).

Early life stages of fish, specifically the developing embryo, require the highest inter-gravel dissolved oxygen (IGDO) levels, and are the most sensitive life stage to reduced oxygen levels. The oxygen demand of embryos depends on temperature and on stage of development, with the greatest IGDO required just prior to hatching.

A literature review conducted by the Washington Department of Ecology (WDOE 2002) indicates that adverse effects of lower oxygen concentrations on embryo survival are magnified as temperatures increase above optimal (for incubation). In a laboratory study conducted in Canada, researchers found that low oxygen levels retarded embryonic development in bull trout (Giles and Van der Zweep 1996 in Stewart et al. 2007). Normal oxygen levels seen in rivers used by bull trout during spawning ranged from 8 to 12 mg/L (in the gravel), with corresponding instream levels of 10 to 11.5 mg/L (Stewart et al. 2007). In addition, IGDO concentrations, water velocities in the water column, and especially the intergravel flow rate, are interrelated variables that affect the survival of incubating embryos (ODEQ 1995). Due to a long incubation period of 220+ days, bull trout are particularly sensitive to adequate IGDO levels. An IGDO level below 8 mg/L is likely to result in mortality of eggs, embryos, and fry.

Population Structure

Bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Fraley and Shepard 1989; Goetz 1989). Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989; Goetz 1989), or saltwater (anadromous form) to rear as subadults and to live as adults (Cavender 1978; McPhail and Baxter 1996; WDFW et al. 1997). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. They are iteroparous (they spawn more than once in a lifetime). Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Fraley and Shepard 1989; Leathe and Graham 1982; Pratt 1992; Rieman and McIntyre 1996).

Migratory forms of bull trout may develop when habitat conditions allow movement between spawning and rearing streams and larger rivers, lakes or nearshore marine habitat where foraging opportunities may be enhanced (Brenkman and Corbett 2005; Frissell 1993; Goetz et al. 2004). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams, lakes, and marine waters; greater fecundity resulting in increased reproductive potential; and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Frissell 1999; MBTSG 1998; Rieman and McIntyre 1993). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbances make local habitats temporarily unsuitable. Therefore, the range of the species is diminished, and the potential for a greater reproductive contribution from larger size fish with higher fecundity is lost (Rieman and McIntyre 1993).

Whitesel et al. (2004) noted that although there are multiple resources that contribute to the subject, Spruell et al. (2003) best summarized genetic information on bull trout population structure. Spruell et al. (2003) analyzed 1,847 bull trout from 65 sampling locations, four located in three coastal drainages (Klamath, Queets, and Skagit Rivers), one in the Saskatchewan River drainage (Belly River), and 60 scattered throughout the Columbia River Basin. They concluded that there is a consistent pattern among genetic studies of bull trout, regardless of whether examining allozymes, mitochondrial DNA, or most recently microsatellite loci. Typically, the genetic pattern shows relatively little genetic variation within populations, but substantial divergence among populations. Microsatellite loci analysis supports the existence of at least three major genetically differentiated groups (or evolutionary lineages) of bull trout (Spruell et al. 2003). They were characterized as:

i. "Coastal", including the Deschutes River and all of the Columbia River drainage downstream, as well as most coastal streams in Washington, Oregon, and British Columbia. A compelling case also exists that the Klamath Basin represents a unique evolutionary lineage within the coastal group.

ii. "Snake River", which also included the John Day, Umatilla, and Walla Walla rivers. Despite close proximity of the John Day and Deschutes Rivers, a striking level of divergence between bull trout in these two systems was observed.

iii. "Upper Columbia River" which includes the entire basin in Montana and northern Idaho. A tentative assignment was made by Spruell et al. (2003) of the Saskatchewan River drainage populations (east of the continental divide), grouping them with the upper Columbia River group.

Spruell et al. (2003) noted that within the major assemblages, populations were further subdivided, primarily at the level of major river basins. Taylor et al. (1999) surveyed bull trout populations, primarily from Canada, and found a major divergence between inland and coastal populations. Costello et al. (2003) suggested the patterns reflected the existence of two glacial refugia, consistent with the conclusions of Spruell and the biogeographic analysis of Haas and McPhail (2001). Both Taylor et al. (1999) and Spruell et al. (2003) concluded that the Deschutes River represented the most upstream limit of the coastal lineage in the Columbia River Basin.

Population Dynamics

Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991). Burkey (1989) 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 for local populations may be low and probability of extinction high (Burkey 1989, 1995).

Metapopulation concepts of conservation biology theory have been suggested relative to the distribution and characteristics of bull trout, although empirical evidence is relatively scant (Rieman and McIntyre 1993, Dunham and Rieman 1999, Rieman and Dunham 2000). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994). For inland bull trout, metapopulation theory is likely most applicable at the watershed scale where habitat consists of discrete patches or collections of habitat capable of supporting local populations; local populations are for the most part independent and represent discrete reproductive units; and long-term, low-rate dispersal patterns among component populations influences the persistence of at least some of the local populations (Rieman and Dunham 2000). Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely. However, habitat alteration, primarily through the construction of impoundments, dams, and water diversions has fragmented habitats, eliminated migratory corridors, and in many cases isolated bull trout in the headwaters of tributaries (Rieman and Clayton 1997a, Dunham and Rieman 1999, Spruell et al. 1999, Rieman and Dunham 2000).

Human-induced factors as well as natural factors affecting bull trout distribution have likely limited the expression of the metapopulation concept for bull trout to patches of habitat within the overall distribution of the species (Dunham and Rieman 1999). However, despite the theoretical fit, the relatively recent and brief time period during which bull trout investigations have taken place does not provide certainty as to whether a metapopulation dynamic is occurring (e.g., a balance between local extirpations and recolonizations) across the range of the bull trout or whether the persistence of bull trout in large or closely interconnected habitat patches (Dunham and Rieman 1999) is simply reflective of a general deterministic trend towards extinction of the species where the larger or interconnected patches are relics of historically wider distribution (Rieman and Dunham 2000). Recent research (Whiteley et al. 2003) does, however, provide genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River Basin of Idaho.

f) Ecology / Habitat Characteristics

Habitat Characteristics

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Howell and Buchanan 1992; Pratt 1992; Rich 1996; Rieman and McIntyre 1993; Rieman and McIntyre 1995; Sedell and Everest 1991; Watson and Hillman 1997). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), bull trout should not be expected to simultaneously occupy all available habitats (Rieman et al. 1997b).

Migratory corridors link seasonal habitats for all bull trout life histories. The ability to migrate is important to the persistence of bull trout (Mike Gilpin in litt. 1997; Rieman et al. 1997b; Rieman and McIntyre 1993). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed or stray to nonnatal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants. However, it is important to note that the genetic structuring of bull trout indicates there is limited gene flow among bull trout populations, which may encourage local adaptation within individual populations, and that reestablishment of extirpated populations may take a long time (Rieman and McIntyre 1993; Spruell et al. 1999). Migration also allows bull trout to access more abundant or larger prey, which facilitates growth and reproduction. Additional benefits of migration and its relationship to foraging are discussed below under “Diet.”

Cold water temperatures play an important role in determining bull trout habitat quality, as these fish are primarily found in colder streams (below 15 °C or 59 °F), and spawning habitats are generally characterized by temperatures that drop below 9 °C (48 °F) in the fall (Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1993).

Thermal requirements for bull trout appear to differ at different life stages. Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Baxter et al. 1997; Pratt 1992; Rieman et al. 1997b; Rieman and McIntyre 1993). Optimum incubation temperatures for bull trout eggs range from 2 °C to 6 °C (35 °F to 39 °F) whereas optimum water temperatures for rearing range from about 6 °C to 10 °C (46 °F to 50 °F) (Buchanan and Gregory 1997; Goetz 1989; McPhail and Murray 1979). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 °C to 9 °C (46 °F to 48 °F), within a temperature gradient of 8 °C to 15 °C (4 °F to 60 °F). In a landscape study relating bull trout distribution to maximum water temperatures, Dunham et al. (2003) found that the probability of juvenile bull trout occurrence does not become high (i.e., greater than 0.75) until maximum temperatures decline to 11 °C to 12 °C (52 °F to 54 °F).

Although bull trout are found primarily in cold streams, occasionally these fish are found in larger, warmer river systems throughout the Columbia River basin (Buchanan and Gregory 1997; Fraley and Shepard 1989; Rieman et al. 1997b; Rieman and McIntyre 1993; Rieman and McIntyre 1995). Availability and proximity of cold water patches and food productivity can influence bull trout ability to survive in warmer rivers (Myrick et al. 2002). For example, in a study in the Little Lost River of Idaho where bull trout were found at temperatures ranging from 8 °C to 20 °C (46 °F to 68 °F), most sites that had high densities of bull trout were in areas where primary productivity in streams had increased following a fire (Bart L. Gamett, Salmon-Challis National Forest, pers. comm. June 20, 2002).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Pratt 1992; Rich 1996; Sedell and Everest 1991; Sexauer and James 1997; Thomas 1992; Watson and Hillman 1997). Maintaining bull trout habitat requires stability of stream channels and maintenance of natural flow patterns (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence.

Diet

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. A single optimal foraging strategy is not necessarily a consistent feature in the life of a fish, because this strategy can change as the fish progresses from one life stage to another (i.e., juvenile to subadult). Fish growth depends on the quantity and quality of food that is eaten (Gerking 1994), and as fish grow, their foraging strategy changes as their food changes, in quantity, size, or other characteristics. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987; Donald and Alger 1993; Goetz 1989). Subadult and adult migratory bull trout feed on various fish species (Brown 1994; Donald and Alger 1993; Fraley and Shepard 1989; Leathe and Graham 1982). Bull trout of all sizes other than fry have been found to eat fish half their length (Beauchamp and VanTassell 2001). In nearshore marine areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) (Goetz et al. 2004; WDFW et al. 1997).

Bull trout migration and life history strategies are closely related to their feeding and foraging strategies. Migration allows bull trout to access optimal foraging areas and exploit a wider variety of prey resources. Optimal foraging theory can be used to describe strategies fish use to choose between alternative sources of food by weighing the benefits and costs of capturing one source of food over another. For example, prey often occur in concentrated patches of abundance ("patch model" ; Gerking 1994). As the predator feeds in one patch, the prey population is reduced, and it becomes more profitable for the predator to seek a new patch rather than continue feeding on the original one. This can be explained in terms of balancing energy acquired versus energy expended. For example, in the Skagit River system, anadromous bull trout make migrations as long as 121 miles between marine foraging areas in Puget Sound and headwater spawning grounds, foraging on salmon eggs and juvenile salmon along their migration route (WDFW et al. 1997). Anadromous bull trout also use marine waters as migration corridors to reach seasonal habitats in non-natal watersheds to forage and possibly overwinter (Brenkman and Corbett 2005; Goetz et al. 2004).

4.1.4 Status

Distribution

The historical range of bull trout includes major river basins in the Pacific Northwest at about 41 to 60 degrees North latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, Bond 1992). To the west, the bull trout's range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992). Bull trout occur in portions of the Columbia River and tributaries within the basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south-central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and Montana and in the MacKenzie River system in Alberta and British Columbia, Canada (Cavender 1978, Brewin et al. 1997).

Each of the following interim recovery units (below) 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. No new local populations have been identified and no local populations have been lost since listing.

Jarbidge River Interim Recovery Unit

This interim recovery unit currently contains a single core area with six local populations. Less than 500 resident and migratory adult bull trout, representing about 50 to 125 spawning adults, are estimated to occur in the core area. The current condition of the bull trout in this interim recovery unit is attributed to the effects of livestock grazing, roads, incidental mortalities of released bull trout from recreational angling, historic angler harvest, timber harvest, and the introduction of non-native fishes (USFWS 2004b). The draft bull trout recovery plan (USFWS 2004b) identifies the following conservation needs for this interim recovery unit: 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 bull trout 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 2004b).

Klamath River Interim Recovery Unit

This interim recovery unit currently contains three core areas and seven local populations. The current abundance, distribution, and range of the bull trout in the Klamath River Basin are greatly reduced from historical levels due to habitat loss and degradation caused by reduced water quality, timber harvest, livestock grazing, water diversions, roads, and the introduction of non-native fishes (USFWS 2002b). Bull trout populations in this interim recovery unit face a high risk of extirpation (USFWS 2002b). The draft Klamath River bull trout recovery plan (USFWS 2002b) identifies the following conservation needs for this interim recovery unit: 1) maintain the current distribution of bull trout and restore distribution in previously occupied areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all life history stages and strategies, 4) conserve genetic diversity and provide the opportunity for genetic exchange among appropriate core area populations. Eight to 15 new local populations and an increase in population size from about 2,400 adults currently to 8,250 adults are needed to provide for the persistence and viability of the three core areas (USFWS 2002b).

Columbia River Interim Recovery Unit

The Columbia River interim recovery unit 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 their estimated historical range (Quigley and Arbelbide 1997, p.1177). This interim recovery unit currently contains 97 core areas and 527 local populations. About 65 percent of these core areas and local populations occur in central Idaho and northwestern Montana. The Columbia River interim recovery unit has declined in overall range and numbers of fish (63 FR 31647). Although some strongholds still exist with migratory fish present, bull trout generally occur as isolated local populations in headwater lakes or tributaries where the migratory life history form has been lost. Though still widespread, there have been numerous local extirpations reported throughout the Columbia River basin. In Idaho, for example, bull trout have been extirpated from 119 reaches in 28 streams (Idaho Department of Fish and Game in litt. 1995). The draft Columbia River bull trout recovery plan (USFWS 2002d) identifies the following conservation needs for this interim recovery unit: 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) restore and maintain suitable habitat conditions for all bull trout life history stages and strategies, and 4) conserve genetic diversity and provide opportunities for genetic exchange.

The condition of the bull trout within the 97 core areas in the Columbia River IRU varies from poor to good. All core areas have been subject to the combined effects of habitat degradation and fragmentation caused by the following activities: dewatering; road construction and maintenance; mining; grazing; the blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment into diversion channels; and introduced non-native species. The Service completed a core area conservation assessment for the 5-year status review and determined that, of the 97 core areas in this interim recovery unit, 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).

Coastal-Puget Sound Interim Recovery Unit

Bull trout in the Coastal-Puget Sound interim recovery unit exhibit anadromous, adfluvial, fluvial, and resident life history patterns. The anadromous life history form is unique to this interim recovery unit. This interim recovery unit currently contains 14 core areas and 67 local populations (USFWS 2004a). Bull trout are distributed throughout most of the large rivers and associated tributary systems within this interim recovery unit. Bull trout continue to be present in nearly all major watersheds where they likely occurred historically, although local extirpations have occurred throughout this interim recovery unit. Many remaining populations are isolated or fragmented and abundance has declined, especially in the southeastern portion of the interim recovery unit. The current condition of the bull trout in this interim recovery unit is attributed to the adverse effects of dams, forest management practices (e.g., timber harvest and associated road building activities), agricultural practices (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation), livestock grazing, roads, mining, urbanization, poaching, incidental mortality from other targeted fisheries, and the introduction of non-native species. The draft Coastal-Puget Sound bull trout recovery plan (USFWS 2004a) identifies the following conservation needs for this interim recovery unit: 1) maintain or expand the current distribution of bull trout within existing core areas, 2) increase bull trout abundance to about 16,500 adults across all core areas, and 3) maintain or increase connectivity between local populations within each core area.

St. Mary-Belly River Interim Recovery Unit

This interim recovery unit currently contains six core areas and nine local populations (USFWS 2002c). Currently, bull trout are widely distributed in the St. Mary-Belly River drainage and occur in nearly all of the waters that it inhabited historically. Bull trout are found only in a 1.2-mile reach of the North Fork Belly River within the United States. Redd count surveys of the North Fork Belly River documented an increase from 27 redds in 1995 to 119 redds in 1999. This increase was attributed primarily to protection from angler harvest (USFWS 2002c). The current condition of the bull trout in this interim recovery unit is primarily attributed to the effects of dams, water diversions, roads, mining, and the introduction of non-native fishes (USFWS 2002c). The draft St. Mary-Belly bull trout recovery plan (USFWS 2002c) identifies the following conservation needs for this interim recovery unit: 1) maintain the current distribution of the bull trout and restore distribution in previously occupied areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all life history stages and forms, 4) conserve genetic diversity and provide the opportunity for genetic exchange, and 5) establish good working relations with Canadian interests because local bull trout populations in this interim recovery unit are comprised mostly of migratory fish, whose habitat is mostly in Canada.

Reasons for Listing

Bull trout distribution, abundance, and habitat quality have declined rangewide (Bond 1992, Schill 1992, Thomas 1992, Ziller 1992, Rieman and McIntyre 1993, Newton and Pribyl 1994, McPhail and Baxter 1996). Several local extirpations have been documented, beginning in the 1950s (Rode 1990, Ratliff and Howell 1992, Donald and Alger 1993, Goetz 1994, Newton and Pribyl 1994, Berg and Priest 1995, Light et al. 1996, Buchanan et al. 1997, WDFW 1998). Bull trout were extirpated from the southernmost portion of their historic range, the McCloud River in California, around 1975 (Moyle 1976, Rode 1990). Bull trout have been functionally extirpated (i.e., few individuals may occur there but do not constitute a viable population) in the Coeur d'Alene River basin in Idaho and in the Lake Chelan and Okanogan River basins in Washington (63 FR 31647).

These declines result from the combined effects of habitat degradation and fragmentation, the blockage of migratory corridors; poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion or other device) into diversion channels and dams, and introduced nonnative species. Specific land and water management activities that depress bull trout populations and degrade habitat include the effects of dams and other diversion structures, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development (Beschta et al. 1987; Chamberlain et al. 1991; Furniss et al. 1991; Meehan 1991; Nehlsen et al. 1991; Sedell and Everest 1991; Craig and Wissmar 1993; Frissell 1993; Henjum et al. 1994; McIntosh et al. 1994; Wissmar et al. 1994; MBTSG 1995a-e, 1996a-f; Light et al. 1996; USDA and USDI 1995).

New Threats

Climate Change

Global climate change, and the related warming of global climate, have been well documented (IPCC 2007, ISAB 2007, WWF 2003). Evidence of global climate change/warming includes widespread increases in average air and ocean temperatures and accelerated melting of glaciers, and rising sea level. Given the increasing certainty that climate change is occurring and is accelerating (IPCC 2007, Battin et al. 2007), we can no longer assume that climate conditions in the future will resemble those in the past.

Patterns consistent with changes in climate have already been observed in the range of many species and in a wide range of environmental trends (ISAB 2007, Hari et al. 2006, Rieman et al. 2007). In the northern hemisphere, the duration of ice cover over lakes and rivers has decreased by almost 20 days since the mid-1800's (WWF 2003). The range of many species has shifted poleward and elevationally upward. For cold-water associated salmonids in mountainous regions, where their upper distribution is often limited by impassable barriers, an upward thermal shift in suitable habitat can result in a reduction in range, which in turn can lead to a population decline (Hari et al. 2006).

In the Pacific Northwest, most models project warmer air temperatures and increases in winter precipitation and decreases in summer precipitation. Warmer temperatures will lead to more precipitation falling as rain rather than snow. As the seasonal amount of snow pack diminishes, the timing and volume of stream flow are likely to change and peak river flows are likely to increase in affected areas. Higher air temperatures are also likely to increase water temperatures (ISAB 2007). For example, stream gauge data from western Washington over the past 5 to 25 years indicate a marked increasing trend in water temperatures in most major rivers.

Climate change has the potential to profoundly alter the aquatic ecosystems upon which the bull trout depends via alterations in water yield, peak flows, and stream temperature, and an increase in the frequency and magnitude of catastrophic wildfires in adjacent terrestrial habitats (Bisson et al. in press).

All life stages of the bull trout rely on cold water. Increasing air temperatures are likely to impact the availability of suitable cold water habitat. For example, ground water temperature is generally correlated with mean annual air temperature, and has been shown to strongly influence the distribution of other chars. Ground water temperature is linked to bull trout selection of spawning sites, and has been shown to influence the survival of embryos and early juvenile rearing of bull trout (Rieman et al. in press). Increases in air temperature are likely to be reflected in increases in both surface and groundwater temperatures.

Climate change is likely to affect the frequency and magnitude of fires, especially in warmer drier areas such as are found on the eastside of the Cascade Mountains. Bisson et al. (in press) note that the forest that naturally occurred in a particular area may or may not be the forest that will be responding to the fire regimes of an altered climate. In several studies related to the effect of large fires on bull trout populations, bull trout appear to have adapted to past fire disturbances through mechanisms such as dispersal and plasticity. However, as stated earlier, the future may well be different than the past and extreme fire events may have a dramatic effect on bull trout and other aquatic species, especially in the context of continued habitat loss, simplification and fragmentation of aquatic systems, and the introduction and expansion of exotic species (Bisson et al. in press).

Migratory bull trout can be found in lakes, large rivers and marine waters. Effects of climate change on lakes are likely to impact migratory adfluvial bull trout that seasonally rely upon lakes for their greater availability of prey and access to tributaries. Climate-warming impacts to lakes will likely lead to longer periods of thermal stratification and coldwater fish such as adfluvial bull trout will be restricted to these bottom layers for greater periods of time. Deeper thermoclines resulting from climate change may further reduce the area of suitable temperatures in the bottom layers and intensify competition for food (WWF 2003).

Bull trout require very cold water for spawning and incubation. Suitable spawning habitat is often found in accessible higher elevation tributaries and headwaters of rivers. However, impacts on hydrology associated with climate change are related to shifts in timing, magnitude and distribution of peak flows that are also likely to be most pronounced in these high elevation stream basins (Battin et al. 2007). The increased magnitude of winter peak flows in high elevation areas is likely to impact the location, timing, and success of spawning and incubation for the bull trout and Pacific salmon species. Although lower elevation river reaches are not expected to experience as severe an impact from alterations in stream hydrology, they are unlikely to provide suitably cold temperatures for bull trout spawning, incubation and juvenile rearing.

As climate change progresses and stream temperatures warm, thermal refugia will be critical to the persistence of many bull trout populations. Thermal refugia are important for providing bull trout with patches of suitable habitat during migration through or to make feeding forays into areas with greater than optimal temperatures.

There is still a great deal of uncertainty associated with predictions relative to the timing, location, and magnitude of future climate change. It is also likely that the intensity of effects will vary by region (ISAB 2007) although the scale of that variation may exceed that of States. For example, several studies indicate that climate change has the potential to impact ecosystems in nearly all streams throughout the State of Washington (ISAB 2007, Battin et al. 2007, Rieman et al. 2007). In streams and rivers with temperatures approaching or at the upper limit of allowable water temperatures, there is little if any likelihood that bull trout will be able to adapt to or avoid the effects of climate change/warming. There is little doubt that climate change is and will be an important factor affecting bull trout distribution. As its distribution contracts, patch size decreases and connectivity is truncated, bull trout populations that may be currently connected may face increasing isolation, which could accelerate the rate of local extinction beyond that resulting from changes in stream temperature alone (Rieman et al. 2007). Due to variations in land form and geographic location across the range of the bull trout, it appears that some populations face higher risks than others. Bull trout in areas with currently degraded water temperatures and/or at the southern edge of its range may already be at risk of adverse impacts from current as well as future climate change.

4.1.5 Analytical Framework for the Jeopardy and Adverse Modification Determinations for Bull Trout

Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this BO relies on four components: (1) the *Status of the Species*, which evaluates bull trout range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of 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 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 bull trout; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on 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 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 bull trout in the wild.

As discussed in this section, *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 (Director's March 6, 2006, memorandum), 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), 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 BO 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 BO conforms to the above analytical framework. The jeopardy analysis in this BO places an emphasis on consideration of the range-wide survival and recovery needs of bull trout and the role of the action area in the survival and recovery of the bull trout 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 jeopardy determination.

Adverse Modification Determination

This BO 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 ESA to complete the following analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this BO relies on four components: (1) the *Status of Critical Habitat*, which evaluates the range-wide 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; and (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 range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat range-wide 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 BO places an emphasis on using the intended range-wide 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.

4.1.6 Conservation

Conservation Needs

The conservation needs of bull trout are often generally expressed as the four "Cs": cold, clean, complex, and connected habitat. Cold stream temperatures, clean water quality that is relatively free of sediment and contaminants, complex channel characteristics (including abundant large wood and undercut banks), and large patches of such habitat that are well connected by unobstructed migratory pathways are all needed to promote conservation of bull trout at multiple scales ranging from the coterminous to local populations (a local population is a group of bull trout that spawn within a particular stream or portion of a stream system). The recovery planning process for bull trout (USFWS 2002a; 2004a; 2004b) has also identified the following conservation needs: 1) maintenance and restoration of multiple, interconnected populations in diverse habitats across the range of each interim recovery unit, 2) preservation of the diversity of life-history strategies, 3) maintenance of genetic and phenotypic diversity across the range of each interim recovery unit, and 4) establishment of a positive population trend. It has also been recognized that bull trout populations need to be protected from catastrophic fires across the range of each interim recovery unit (Rieman et al. 2003).

Central to the survival and recovery of bull trout is the maintenance of viable core areas (USFWS 2002a; 2004a; 2004b). 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. Each of the interim recovery units listed above consists of one or more core areas. There are 121 core areas recognized across the coterminous range of the bull trout (USFWS 2002a; 2004a; 2004b).

1) *Maintenance and restoration of multiple, interconnected populations in diverse habitats across the range of each interim recovery unit*

Multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events (Hard 1995, Healy and Prince 1995, Rieman and Allendorf 2001, Rieman and McIntyre 1993, Spruell et al. 1999). Current patterns in bull trout distribution and other empirical evidence, when interpreted in view of emerging conservation theory, indicate that further declines and local extinctions are likely (Dunham and Rieman 1999, Rieman and Allendorf 2001, Rieman et al. 1997b, Spruell 2003). Based in part on guidance from Rieman and McIntyre (1993), bull trout core areas with fewer than five local populations are at increased risk of extirpation; core areas with between 5 to 10 local populations are at intermediate risk of extirpation; and core areas which have more than 10 interconnected local populations are at diminished risk of extirpation.

Maintaining and restoring connectivity between existing populations of bull trout is important for the persistence of the species (Rieman and McIntyre 1993). Migration and occasional spawning between populations increases genetic variability and strengthens population variability (Rieman and McIntyre 1993). Migratory corridors allow individuals access to unoccupied but suitable habitats, foraging areas, and refuges from disturbances (Saunders et al. 1991).

Because bull trout in the coterminous United States are distributed over a wide geographic area consisting of various environmental conditions, and because they exhibit considerable genetic differentiation among populations, the occurrence of local adaptations is expected to be extensive. Some readily observable examples of differentiation between populations include external morphology and behavior (e.g., size and coloration of individuals; timing of spawning and migratory forays). Conserving many populations across the range of the species is crucial to adequately protect genetic and phenotypic diversity of bull trout (Hard 1995, Healy and Prince 1995, Leary et al. 1993, Rieman and Allendorf 2001, Rieman and McIntyre 1993, Spruell et al. 1999, Taylor et al. 1999). Changes in habitats and prevailing environmental conditions are increasingly likely to result in extinction of bull trout if genetic and phenotypic diversity is lost.

2) Preservation of the diversity of life-history strategies

The bull trout has multiple life history strategies, including migratory forms, throughout its range (Rieman and McIntyre 1993). Migratory forms appear to develop when habitat conditions allow movement between spawning and rearing streams and larger rivers or lakes where foraging opportunities may be enhanced (Frissell 1997). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem of the Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams and lakes, greater fecundity resulting in increased reproductive potential, and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Frissell 1997, MBTSG 1998, Rieman and McIntyre 1993).

3) Maintenance of genetic and phenotypic diversity across the range of each interim recovery unit

Healy and Prince (1995) reported that, because phenotypic diversity is a consequence of the genotype interacting with the habitat, the conservation of phenotypic diversity is achieved through conservation of the sub-population within its habitat. They further note that adaptive variation among salmonids has been observed to occur under relatively short time frames (e.g., changes in genetic composition of salmonids raised in hatcheries; rapid emergence of divergent phenotypes for salmonids introduced to new environments). Healy and Prince (1995) conclude that while the loss of a few sub-populations within an ecosystem might have only a small effect on overall genetic diversity, the effect on phenotypic diversity and, potentially, overall population viability could be substantial (Healy and Prince 1995). This concept of preserving variation in phenotypic traits that is determined by both genetic and environmental (i.e., local habitat) factors has also been identified by Hard (1995) as an important component in maintaining intraspecific adaptability (i.e., phenotypic plasticity) and ecological diversity within a genotype (Hard 1995). He argues that adaptive processes are not entirely encompassed by the interpretation of molecular genetic data; in other words, phenotypic and genetic variation in adaptive traits may exist without detectable variation at the molecular genetic level, particularly for neutral genetic markers. Therefore, the effective conservation of genetic diversity necessarily involves consideration of the conservation of biological units smaller than taxonomic species (or DPSs). Reflecting this theme, the maintenance of local sub-populations has been specifically emphasized as a mechanism for the conservation of bull trout (Rieman and McIntyre 1993, Taylor et al. 1999).

4) Establishment of a positive population trend

A stable or increasing population is a key criterion for recovery under the requirements of the Endangered Species Act. Measures of the trend of a population (the tendency to increase, decrease, or remain stable) include population growth rate or productivity. Estimates of population growth rate (*i.e.*, productivity over the entire life cycle) that indicate a population is consistently failing to replace itself, indicate increased extinction risk. Therefore, the reproductive rate should indicate the population is replacing itself, or growing.

Since data of the total 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 index of a spawning adult population. The direction and magnitude of a trend in the index can be used as a surrogate for the growth rate of the entire population. For instance, a downward trend in an abundance indicator may signal the need for increased protection, regardless of the actual size of the population. A population which is below recovered abundance levels but moving toward recovery would be expected to exhibit an increasing trend in the indicator.

The population growth rate is an indicator of extinction probability. The probability of going extinct cannot be measured directly; it can, however, be estimated as the consequence of the population growth rate and the variability in that rate. For a population to be considered viable, its natural productivity should be sufficient to replace itself from generation to generation. Evaluations of population status will also have to take into account uncertainty in estimates of population growth rate or productivity. For a population to contribute to recovery, its growth rate must indicate that the population is stable or increasing for a period of time (USFWS 2002e, p16)

5) Protect Bull Trout from Catastrophic Fires

Bull trout evolved under historic fire regimes in which disturbance to streams from forest fires resulted in a mosaic of diverse habitats. However, forest management and fire suppression over the past century have increased homogeneity of terrestrial and aquatic habitats, increasing the likelihood of large, intense forest fires in some areas. Because the most severe effects of fire on native fish populations can be expected where populations have become fragmented by human activities or natural events, an effective strategy to ensure persistence of native fishes against the effects of large fires may be to restore aquatic habitat structure and life history complexity of populations in areas susceptible to large fires (Gresswell 1999).

Rieman and Clayton (1997a) discussed relations among the effects of fire and timber harvest, aquatic habitats, and sensitive species. They noted that spatial diversity and complexity of aquatic habitats strongly influence the effects of large disturbances on salmonids (Rieman and Clayton 1997a). For example, Rieman et al. (1997b) studied bull trout and redband trout responses to large, intense fires that burned three watersheds in the Boise National Forest in Idaho. Although the fires were the most intense on record, there was a mix of severely burned to unburned areas left after the fires. Fish were apparently eliminated in some stream reaches, whereas others contained relatively high densities of fish. Within a few years after the fires and after areas within the watersheds experienced debris flows, fish had become reestablished in many reaches, and densities increased. In some instances, fish densities were higher than those present before the fires or in streams that were not burned (Rieman and Clayton 1997a). These responses were attributed to spatial habitat diversity that supplied refuge areas for fish during the fires, and the ability of bull trout and the redband trout to move among stream reaches. For bull trout, the presence of migratory fish within the system was also important (Rieman and Clayton 1997a, Rieman et al. 1997b).

In terms of conserving bull trout, the appropriate strategy to reduce the effects of fires on bull trout habitat is to emphasize the restoration of watershed processes that create and maintain habitat diversity, provide bull trout access to habitats, and protect or restore migratory life-history forms of bull trout. Both passive (e.g., encouraging natural riparian vegetation and floodplain processes to function appropriately) and active (e.g., reducing road density, removing barriers to fish movement, and improving habitat complexity) actions offer the best approaches to protect bull trout from the effects of large fires.

Changes in Status since Listing within the Coastal-Puget Sound Interim Recovery Unit

Although the status of bull trout in Coastal-Puget Sound interim recovery unit has been improved by certain actions, it continues to be degraded by other actions, and it is likely that the overall status of the bull trout in this population segment has not improved since its listing on November 1, 1999. Improvement has occurred largely through changes in fishing regulations and habitat-restoration projects. Fishing regulations enacted in 1994 either eliminated harvest of bull trout or restricted the amount of harvest allowed, and this likely has had a positive influence on the abundance of bull trout. Improvement in habitat has occurred following restoration projects intended to benefit either bull trout or salmon, although monitoring the effectiveness of these projects seldom occurs. On the other hand, the status of this population segment has been adversely affected by a number of Federal and non-Federal actions, some of which were addressed under section 7 of the Act. Most of these actions degraded the environmental baseline; all of those addressed through formal consultation under section 7 of the Act permitted the incidental take of bull trout.

Section 10(a)(1)(B) permits have been issued for Habitat Conservation Plans (HCP) completed in the Coastal-Puget Sound population segment. These include: 1) the City of Seattle's Cedar River Watershed HCP, 2) Simpson Timber HCP, 3) Tacoma Public Utilities Green River HCP, 4) Plum Creek Cascades HCP, 5) Washington State Department of Natural Resources HCP, 6) West Fork Timber HCP (Nisqually River), and 7) Forest Practices HCP. These HCPs provide landscape-scale conservation for fish, including bull trout. Many of the covered activities associated with these HCPs will contribute to conserving bull trout over the long-term; however, some covered activities will result in short-term degradation of the baseline. All HCPs permit the incidental take of bull trout.

Changes in Status since Listing within the Columbia River Interim Recovery Unit

The overall status of the Columbia River interim recovery unit has not changed appreciably since its listing on June 10, 1998. Populations of bull trout and their habitat in this area have been affected by a number of actions addressed under section 7 of the Act. Most of these actions resulted in degradation of the environmental baseline of bull trout habitat, and all permitted or analyzed the potential for incidental take of bull trout. The Plum Creek Cascades HCP, Plum Creek Native Fish HCP, and Forest Practices HCP addressed portions of the Columbia River interim recovery unit of bull trout.

Changes in Status since Listing within the Klamath River Interim Recovery Unit

Improvements in the Threemile, Sun, and Long Creek local populations have occurred through efforts to remove or reduce competition and hybridization with non-native salmonids, changes in fishing regulations, and habitat-restoration projects. Population status in the remaining local populations (Boulder-Dixon, Deming, Brownsworth, and Leonard Creeks) remains relatively unchanged. Grazing within bull trout watersheds throughout the recovery unit has been curtailed. Efforts at removal of non-native species of salmonids appear to have stabilized the Threemile and positively influenced the Sun Creek local populations. The results of similar efforts in Long Creek are inconclusive. Mark and recapture studies of bull trout in Long Creek indicate a larger migratory component than previously expected.

Although the status of specific local populations has been slightly improved by recovery actions, the overall status of Klamath River bull trout continues to be depressed. Factors considered threats to bull trout in the Klamath Basin at the time of listing – habitat loss and degradation caused by reduced water quality, past and present land use management practices, water diversions, roads, and non-native fishes – continue to be threats today.

Changes in Status since Listing within the Saint Mary-Belly River Interim Recovery Unit

The overall status of bull trout in the Saint Mary-Belly River interim recovery unit has not changed appreciably since its listing on November 1, 1999. Extensive research efforts have been conducted since listing, to better quantify populations of bull trout and their movement patterns.

Limited efforts in the way of active recovery actions have occurred. Habitat occurs mostly on Federal and Tribal lands (Glacier National Park and the Blackfeet Nation). Known problems due to instream flow depletion, entrainment, and fish passage barriers resulting from operations of the U.S. Bureau of Reclamation's Milk River Irrigation Project (which transfers Saint Mary-Belly River water to the Missouri River Basin) and similar projects downstream in Canada constitute the primary threats to bull trout and to date they have not been adequately addressed under section 7 of the Act. Plans to upgrade the aging irrigation delivery system are being pursued, which has potential to mitigate some of these concerns but also the potential to intensify dewatering. A major fire in August 2006 severely burned the forested habitat in Red Eagle and Divide Creeks, potentially affecting three of nine local populations and degrading the baseline.

State Conservation Actions

Idaho*:* Conservation actions by the State of Idaho include: (1) the development of a management plan for bull trout in 1993 (Conley 1993); (2) the approval of the State of Idaho Bull Trout Conservation Plan (Idaho Plan) in July 1996 (Batt 1996); (3) the development of 21 problem assessments involving 59 key watersheds; (4) the implementation of conservation actions identified in the problem assessments; and, (5) the implementation of more restrictive angling regulations.

Montana: Conservation actions by the State of Montana include: (1) development of the Montana Bull Trout Restoration Plan issued in 2000 (MBTRT 2000), which defines strategies for ensuring the long-term persistence of bull trout in Montana; (2) formation of the Montana Bull Trout Restoration Team (MBTRT) and Montana Bull Trout Scientific Group (MBTSG) to produce a plan for maintaining, protecting, and increasing bull trout populations; (3) the development of watershed groups to initiate localized bull trout restoration efforts; (4) funding of habitat restoration projects, recovery actions, and genetic studies throughout the state; (5) the abolition of brook trout stocking programs; and, (6) restrictive angling regulations.

Nevada: Conservation actions by the State of Nevada include: (1) the preparation of a Bull Trout Species Management Plan that recommends management alternatives to ensure that human activities will not jeopardize the future of bull trout in Nevada (Johnson 1990); (2) implementation of more restrictive State angling regulations in an attempt to protect bull trout in the Jarbidge River in Nevada; and, (3) the abolition of a rainbow trout stocking in the Jarbidge River.

Oregon: Since 1990, the State of Oregon has taken extensive action to address the conservation of bull trout, including: (1) Establishing bull trout working groups in the Klamath, Deschutes, Hood, Willamette, Odell Lake, Umatilla and Walla Walla, John Day, Malheur, and Pine Creek river basins for the purpose of developing bull trout conservation strategies; (2) establishment of more restrictive harvest regulations in 1990; (3) reduced stocking of hatchery-reared rainbow trout and brook trout into areas where bull trout occur; (4) angler outreach and education efforts are also being implemented in river basins occupied by bull trout; (5) research to further examine life history, genetics, habitat needs, and limiting factors of bull trout in Oregon; (6)

reintroduction of bull trout fry from the McKenzie River watershed to the adjacent Middle Fork of the Willamette River, which is historic but currently unoccupied, isolated habitat; (7) the Oregon Department of Environmental Quality (DEQ) established a water temperature standard such that surface water temperatures may not exceed 10 degrees Celsius (50 degrees Fahrenheit) in waters that support or are necessary to maintain the viability of bull trout in the State (Oregon 1996); (8) expansion of the Oregon Plan for Salmon and Watersheds (Oregon 1997) to include all at-risk wild salmonids throughout the State; and, (9) reintroduction of bull trout to the Clackamas River, and important recovery action for the Willamette River Basin as identified in the Service's 2002 draft recovery plan.

Washington: Conservation actions by the State of Washington include: (1) establishment of the Salmon Recovery Act (ESHB 2496) and Watershed Management Act (ESHB 2514) by the Washington State legislature to assist in funding and planning salmon recovery efforts; (2) abolition of brook trout stocking in streams or lakes connected to bull trout-occupied waters; (3) changing angling regulations in Washington prohibit the harvest of bull trout, except for a few areas where stocks are considered "healthy"; (4) collecting and mapping updated information on bull trout distribution, spawning and rearing areas, and potential habitat; and, (5) adopting new emergency forest practice rules based on the "Forest and Fish Report" process. These rules address riparian areas, roads, steep slopes, and other elements of forest practices on non-Federal lands.

Tribal Conservation Activities

Many Tribes throughout the range of the bull trout are participating on bull trout conservation working groups or recovery teams in their geographic areas of interest. Some tribes are also implementing projects which focus on bull trout or that address anadromous fish but benefit bull trout (e.g., habitat surveys, passage at dams and diversions, habitat improvement, and movement studies).

4.2 Oregon Chub

4.2.1 Species Description

The Oregon chub was first described in scientific literature in 1908 (Snyder 1908), however it was not identified as a unique species until 1991 (Markle et al. 1991). The Oregon chub is a small minnow (Family: Cyprinidae) with an olive-colored back grading to silver on the sides and white on the belly. Scales are relatively large with fewer than forty occurring along the lateral line and scales near the back are outlined with dark pigment (Markle et al. 1991). While young of the year range in length from 7 to 32 millimeters (mm) (0.3 to 1.3 inches), adults can be up to 90 mm (3.5 inches) in length (Pearsons 1989). The species is distinguished from its closest relative, the Umpqua chub (*Oregonichthys kalawatseti*), by Oregon chub's longer caudal peduncle (the narrow part of a fish's body to which the tail is attached), mostly scaled breast, and more terminal mouth position (Markle et al. 1991).

The Service listed the Oregon chub as an endangered species in 1993 (USFWS 1993) and a final recovery plan for the Oregon chub was published in 1998 (USFWS 1998). The Oregon chub recovery plan established the following criteria for downlisting the species from endangered to threatened status:

> Establish and manage 10 populations of at least 500 adults each; (2) All of these populations must exhibit a stable or increasing trend for 5 years; and (3) At least three populations must be located in each of the three sub-basins of the Willamette River identified in the plan (Mainstem Willamette River, Middle Fork, and Santiam River).

The recovery plan established the following criteria for delisting (i.e., removing the species from the List of Endangered and Threatened Wildlife):

> Establish and manage 20 populations of at least 500 adults each; (2) All of these populations must exhibit a stable or increasing trend for 7 years; (3) At least four populations must be located in each of the three sub-basins (Mainstem Willamette River, Middle Fork, and Santiam River); and (4) Management of these populations must be guaranteed in perpetuity.

In 2008, the Service completed a 5-year review of the Oregon chub, concluding that downlisting criteria had been met and the species should be downlisted to threatened status (USFWS 2008a). The final rule designating critical habitat (USFWS 2010a, b) and the final rule to downlist Oregon chub were published in 2010 (USFWS 2010c). The Service recently announced the initiation of another 5-year review of the status of Oregon chub (USFWS 2013).

4.2.2 Critical Habitat Description

Critical habitat was designated for Oregon chub in 2010 (USFWS 2010b, c). In the final rule, the Service determined that 25 units totaling approximately 53.5 hectares (ha) (132.1 acres) in Benton, Lane, Linn and Marion Counties met the proposed definition of critical habitat (Figure 1). Land ownership of the proposed critical habitat is as follows: 13.3 ha (32.9 acres) private, 12.2 ha (30.11 acres) state, 26.8 ha (66.3 acres) Federal and 1.2 ha (2.8 acres) other public lands.

The Primary Constituent Elements (PCEs) of Oregon chub critical habitat are the habitat components that provide the following:

1. Off-channel water bodies such as beaver ponds, oxbows, side-channels, stable backwater sloughs, low-gradient tributaries, and flooded marshes, including at least 500 continuous square meters (m^2) (0.12 acres) of aquatic surface area at depths between approximately 0.5 and 2.0 meters (m) (1.6 and 6.6 feet)
2. Aquatic vegetation covering a minimum of 250 m^2 (0.06 acres) (or between approximately 25 and 100 percent) of the total surface area of the habitat. This vegetation is primarily submergent for purposes of spawning, but also includes emergent and floating vegetation, and algae, which are important for cover throughout the year. Areas with sufficient vegetation are likely to also have the following characteristics.
    a. Gradient less than 2.5 percent;

   b. No or very low water velocity in late spring and summer;
   c. Silty, organic substrate; and
   d. Abundant minute organisms such as rotifers, copepods, cladocerans, and chironomid larvae.

3. Late spring and summer subsurface water temperatures between 15 and 25 °C (59 and 78 °F), with natural diurnal and seasonal variation.

4. No or negligible levels of non-native aquatic predatory or competitive species. Negligible is defined for the purpose of this rule as a minimal level of non-native species that will still allow the Oregon chub to continue to survive and recover.

4.2.3 Life History

Oregon chub reach maturity at about 2 years of age (Scheerer and McDonald 2003, p. 78) and in wild populations can live up to 9 years. Most individuals over 5 years old are females (Scheerer and McDonald 2003, p. 68). Oregon chub spawn from May through August; individuals are not known to spawn more than once a year. Spawning activity has only been observed at water temperatures exceeding 16 °C (61 °F). Males over 35 mm (1.4 inches) have been observed exhibiting spawning behavior (Pearsons 1989, p. 4). Egg masses have been found to contain 147-671 eggs (Pearsons 1989, p.17).

Oregon chub are found in slack water off-channel habitats such as beaver (*Castor Canadensis*) ponds, oxbows, side channels, backwater sloughs, low gradient tributaries, and flooded marshes. These habitats usually have little or no water flow, are dominated by silty and organic substrate, and contain considerable aquatic vegetation providing cover for hiding and spawning (Pearsons 1989, p. 27; Markle *et al.* 1991, p. 289; Scheerer and McDonald 2000, p. 1). The average depth of habitat utilized by Oregon chub is less than 1.8 m (6 ft), and summer water temperatures typically exceed 16 °C (61 °F).

Adult chub seek dense vegetation for cover and frequently travel in the mid-water column in beaver channels or along the margins of aquatic plant beds. Larval chub congregate in shallow near-shore areas in the upper layers of the water column, whereas juveniles venture farther from shore into deeper areas of the water column (Pearsons 1989, p. 16). In the winter months, Oregon chub can be found buried in the detritus or concealed in aquatic vegetation (Pearsons 1989, p. 16). Fish of similar size school and feed together. In the early spring, Oregon chub are most active in the warmer, shallow areas of the ponds.

Oregon chub are obligatory sight feeders (Davis and Miller 1967, p. 32). They feed throughout the day and stop feeding after dusk (Pearsons 1989, p. 23). Chub feed mostly on water column fauna. The diet of Oregon chub adults collected in a May sample consisted primarily of minute crustaceans including copepods, cladocerans, and chironomid larvae (Markle *et al.* 1991, p. 288). The diet of juvenile chub also consists of minute organisms such as rotifers and cladocerans (Pearsons 1989, p. 2).

Of the known Oregon chub populations, the sites with the highest diversity of native fish, amphibian, and reptile species have the largest populations of Oregon chub (Scheerer and

McDonald 2000, p. 24). Beavers appear to be especially important in creating and maintaining habitats that support these diverse native species assemblages (Scheerer and Apke 1998, p. 45).

4.2.4 Status

Distribution

The Oregon chub is endemic to the Willamette River drainage of western Oregon. Historical records show Oregon chub were found as far downstream as Oregon City and as far upstream as Oakridge. At the time of listing in 1993, there were only eight known populations of Oregon chub. These locations represented a small fraction (estimated as two percent based on stream miles) of the species' formerly extensive distribution within the Willamette River drainage.

Since the time of listing, several Oregon chub populations have been extirpated, a number of new populations have been discovered, and there have been a number of successful introductions (Bangs *et al.* 2012). In 2012, the ODFW confirmed the continued existence of Oregon chub at 61 locations in the North and South Santiam River, McKenzie River, Middle Fork and Coast Fork Willamette River, and several tributaries to the mainstem Willamette River downstream of the Coast Fork/Middle Fork Willamette River confluence (Bangs *et al.* 2012). These included 42 naturally occurring and 19 introduced populations. Twelve new populations of Oregon chub were also discovered in connected sloughs in the Middle Fork Willamette and Mainstem Willamette drainages (Bangs *et al.* 2012). Thirty-six of these Oregon chub populations have an estimated abundance of over 500 fish; and 20 of these populations have also exhibited a stable or increasing trend over the last seven years (Bangs *et al.* 2012). The current status of Oregon chub populations meets the goals of the recovery plan for delisting. The distribution of these sites is shown in Table 8.

Table 8. Distribution of Oregon Chub Populations Meeting Recovery Criteria for Delisting

Subbasin	# of populations	# of large populations (>500 fish)	# of large populations with stable/increasing trend	Total chub in subbasin	Size range of populations
Santiam	17	11	5	29,070	10 to 5,730
Mainstem Willamette (+ McKenzie)	25	9	6	146,509	4 to 82,800
Middle Fork Willamette	33	15	9	44,999	1 to 13,460
Coast Fork Willamette	4	1	0	962	2 to 700

Although certain populations of Oregon chub have remained relatively stable from year to year, substantial fluctuations in population abundance are normal. For instance, the largest known population at Ankeny National Wildlife Refuge had an estimated abundance of 21,790 chub in 2010 and increased to 96,810 chub in 2011.

Threats

Historically, the mainstem of the Willamette River was a braided channel with many side channels, meanders, oxbows, and overflow ponds that provided habitat for the chub. Periodic flooding of the river created new habitat and transported the chub into new areas to create new populations. The construction of flood control projects and dams, however, changed the Willamette River significantly and prevented the formation of chub habitat and the natural dispersal of the species. Other factors responsible for the decline of the chub include habitat alteration; the proliferation of nonnative fishes; desiccation of habitats; sedimentation resulting from timber harvesting in the watershed; and possibly the demographic risks that result from a fragmented distribution of small, isolated populations.

Elevated levels of nutrients and pesticides have been found in some Oregon chub habitats (Materna and Buck 2007, p. 67). The source of the contamination is likely agricultural runoff from adjacent farm fields (Materna and Buck 2007, p. 68). Water quality investigations at sites in the Middle Fork and mainstem Willamette subbasins have found some adverse effects to Oregon chub habitats caused by changes in nutrient levels. Elevated nutrient levels at some Oregon chub locations, particularly increased nitrogen and phosphorus, may result in anoxic (absence of oxygen) conditions unsuitable for chub, or increased plant and algal growth that severely reduce habitat availability because of succession.

Many populations of chub are currently isolated from other chub populations due to the reduced frequency and magnitude of flood events and the presence of migration barriers such as impassible culverts and permanent, high beaver dams. Managing Oregon chub in isolation may have genetic consequences (DeHaan *et al.* 2010, p. 20). Burkey (1989) 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 for local populations may be low and probability of extinction high (Burkey 1989, 1995). A genetic analysis completed in 2010 shows that while gene flow is limited among Oregon chub populations, most of the populations in isolated ponds are currently genetically viable and have remained so over several years (1997 to 2005)(DeHaan *et al*. 2010). However, the data were collected over only a 3 to 4-generation time period and it may be too soon to see evidence of negative genetic effects. Additionally, genetic data from historic populations (pre-Willamette project) is not available to compare with these results.

Climate change presents substantial uncertainty regarding the future environmental conditions in the Willamette Basin and is expected to place an added stress on the species and its habitats. The Intergovernmental Panel on Climate Change (IPCC) has concluded that recent warming is already strongly affecting aquatic biological systems; this is evident in increased runoff and earlier spring peak discharge in many glacier- and snow-fed rivers (IPCC 2007, p. 8). Projections for climate change in North America include decreased snowpack, more winter flooding, and reduced summer flows (IPCC 2007, p. 14). Projections for climate change in the Willamette Valley in the next century include higher air temperatures that will lead to lower soil moisture and increased evaporation from streams and lakes (Climate Leadership Initiative (CLI) and the National Center for Conservation Science and Policy 2009, p. 9). While there is high uncertainty in the total precipitation projections for the region, effective precipitation (precipitation that contributes to runoff) may be reduced significantly even if there is no decline in total precipitation (CLI and the National Center for Conservation Science and Policy 2009, p. 9).

Although climate change is almost certain to affect aquatic habitats in the Willamette Basin (CLI 2009, p. 1), there is great uncertainty about the specific effects of climate change on the Oregon chub. The Service has developed a strategic plan to address the threat of climate change to vulnerable species and ecosystems; goals of this plan include maintaining ecosystem integrity by protecting and restoring key ecological processes such as nutrient cycling, natural disturbance cycles, and predator-prey relationships (USFWS 2010d; p. 23). The Oregon chub recovery program will strive to achieve these goals by working to establish conditions that allow populations of Oregon chub to be resilient to changing environmental conditions and to persist as viable populations into the future. Our recovery program for the species focuses on maintaining large populations distributed across the species' entire historical range in a variety of ecological settings (e.g., across a range of elevations). This approach is consistent with the general principles of conservation biology. In their review of minimum population viability literature, Traill et al. (2009, p. 3) found that maintenance of large populations across a range of ecological settings increases the likelihood of species persistence under the pressures of environmental variation and facilitates the retention of important adaptive traits through the maintenance of genetic diversity. Maintaining multiple populations across a range of ecological settings, as described in the recovery plan, will also increase the likelihood that at least some of these populations persist under the stresses of a changing climate.

4.2.5 Conservation

Needs

In the past, the recovery strategy focused on improving Oregon chub habitats in isolation due to the loss and fragmentation of suitable habitats and the threats posed by non-native fishes.

Increasing the abundance and distribution of Oregon chub in isolation has proven to be effective at halting the decline of Oregon chub populations and in meeting the recovery criteria for downlisting. However, managing Oregon chub in isolation does not allow genetic transfer between populations and may have future genetic consequences. Floodplain connectivity at many sites near mainstem rivers is not well understood. Recent hydrological data were collected by ODFW at sites that are influenced by the operation of dams in the Willamette Basin to determine the point of connectivity at each site and the duration of floodplain connection. They found that several sites connect to the river more frequently or for longer periods than previously known. Additionally, in 2012, ODFW detected upstream movement of two marked Oregon chub between habitats in the Middle Fork Willamette River. This is the first documentation of upstream movement of Oregon chub. Although, it is not known how frequently Oregon chub are moving between habitats, the connectivity study shows that the mechanism for dispersal does exist. Future studies will include monitoring for movement of Oregon chub between connected populations in other subbasins. Genetic studies are also needed to determine whether the populations in these periodically connected sites are operating as a metapopulation.

Additionally, some populations are persisting even in the presence of nonnatives, although many of these populations are less abundant than populations without nonnatives present. Understanding what habitat characteristics allow Oregon chub to coexist with nonnatives in these connected habitats will be useful in determining whether chub can be reintroduced in connected habitats.

Current Actions

The Oregon Chub Working Group was formed in 1991 and has been proactive in conserving and restoring habitat for the Oregon chub and raising public awareness of the species since before the Federal listing in 1993 (USFWS 2008a, p. 11).

In 1992, an interagency Conservation Agreement for the Oregon Chub in the Willamette Valley, Oregon was completed and signed by the Service, the U.S. Forest Service, the Bureau of Land Management, the ODFW, and Oregon Parks and Recreation Department (USFWS 1998). The purpose of the coordinated plan was to facilitate Oregon chub protection and recovery and to serve as a guide for all agencies to follow as they conduct their missions.

In February 1997, a Memorandum of Understanding was signed by the Service and the City of Salem to protect and enhance the population of Oregon chub located in the drinking water treatment facility at Geren Island in the North Santiam River.

In 1996, a no-spray agreement with the Oregon Department of Transportation was formalized to protect Oregon chub sites located in the Middle Fork Willamette River drainage adjacent to Highway 58 in Lane County. The agreement prohibits spraying of herbicides in the vicinity of Oregon chub sites and limits vegetation control to mechanical methods if necessary.

The Service has completed three individual safe harbor agreements (SHA) for Oregon chub. To streamline the process for landowners to enter into a SHA in the future, a programmatic SHA was prepared by the Service and ODFW in 2009 (USFWS 2009). Under a SHA, property owners who undertake management activities that attract listed species onto their property or that increase the numbers or distribution of listed species already present on their property will not incur future property-use restrictions. SHAs provide assurances to the property owner that allow alterations or modifications to enrolled property, even if such action results in the incidental take of the covered listed species or, in the future, returns the species back to an originally agreed-upon baseline condition.

In 2008, the Service signed a biological opinion on the continued operation and maintenance of the Willamette River Basin Project and effects to Oregon chub, bull trout, and bull trout critical habitat (Service 2008b). To address specific terms and conditions outlined in the opinion, ODFW initiated a study in 2009 to determine the current status of chub populations, fish assemblages, and habitat conditions in habitats potentially affected by the operation of Willamette River Basin Project dams. They are assessing relationships between pond bathymetry, pond elevations, pond temperatures, river flow levels, site connectivity, and fish assemblages. Data from this study will be used to provide the USACE with flow management recommendations that will contribute to Oregon chub recovery and minimize incidental take of chub.

The improvement in status of Oregon chub is due largely to the implementation of actions identified in the Oregon chub recovery plan. This includes habitat restoration, the discovery of many new populations as a result of ODFW's surveys of the basin, and the establishment of additional populations via successful reintroductions within the species' historical range. Introduced populations have been established in suitable habitats with low connectivity to other aquatic habitats to reduce the risk of invasion by nonnative fishes.

Figure 2. Locations of Oregon Chub Critical Habitat

4.3 Marbled Murrelet

The murrelet is a small diving seabird that nests mainly in coniferous forests and forages in near-shore marine habitats. Males and females have sooty-brown upperparts with dark bars. Underparts are light, mottled brown. Winter adults have brownish-gray upperparts and white scapulars. The plumage of fledged young is similar to that of adults in winter. Chicks are downy and tan colored with dark speckling.

4.3.1 Legal Status

The murrelet was listed as a threatened species on September 28, 1992, in Washington, Oregon, and northern California (57 FR 45328 [October 1, 1992]). Since the species' listing, the FWS has completed two 5-yr status reviews of the species: September 1, 2004 (USFWS 2004e) and June 12, 2009 (USFWS 2009d). The 2004 5-year review determined that the California, Oregon, and Washington distinct population segment of the murrelet did not meet the criteria outlined in the FWS 1996 Distinct Population Segment (DPS) policy (USFWS and USDC NMFS 1996, USFWS 2004e). However, the 2009 5-year review concluded the 2004 analysis of the DPS question was based on a flawed assumption regarding discreteness at the international border with Canada (USFWS 2009d, pages 3-12). The legal status of the murrelet remains unchanged from the original designation.

4.3.2 Life history

i. *Reproduction*

Murrelets produce one egg per nest and usually only nest once a year, however re-nesting has been documented. Nests are not built, but rather the egg is placed in a small depression or cup made in moss or other debris on the limb. Incubation lasts about 30 days, and chicks fledge after about 28 days after hatching. Both sexes incubate the egg in alternating 24-hour shifts. The chick is fed up to eight times daily, and is usually fed only one fish at a time. The young are semiprecocial, capable of walking but not leaving the nest. Fledglings fly directly from the nest to the ocean. If a fledgling is grounded before reaching the ocean, they usually die from predation or dehydration, as murrelets need to take off from an elevated site to obtain flight.

Generally, estimates of murrelet fecundity are directed at measures of breeding success, either from direct assessments of nest success in the terrestrial environment, marine counts of hatch-year birds, or computer models. Telemetry estimates are typically preferred over marine counts for estimating breeding success due to fewer biases (McShane et al. 2004, p. 3-2). However, because of the challenges of conducting telemetry studies, estimating murrelet reproductive rates with an index of reproduction, referred to as the juvenile ratio (Ŕ),[26] continues to be important, despite the debate over use of this index (see discussion in Beissinger and Peery 2007, p. 296).

Although difficult to obtain, nest success rates[27] are available from telemetry studies conducted in California (Hebert and Golightly 2006; Peery et al. 2004) and Washington (Bloxton and Raphael 2006). In northwestern Washington, Bloxton and Raphael (2005, p. 5) documented a nest success rate of 0.20 (2 chicks fledging from 10 nest starts). In central California, murrelet nest success is 0.16 (Peery et al. 2004, p. 1098) and in northern California it is 0.31 to 0.56 (Hebert and Golightly 2006, p. 95). No studies or published reports from Oregon are available.

Unadjusted and adjusted values for annual estimates of murrelet juvenile ratios at sea suggest extremely low breeding success in Conservation Zone 4 (mean ratio for 2000-2011 of 0.046, range 0.01 to 0.1, CCR 2012, p. 11), northern California (0.003 to 0.029 - Long et al. 2008, pp. 18-19; CCR 2012, p. 11), central California (0.035 and 0.032 - Beissinger and Peery 2007, pp. 299, 302), and in Oregon (0.0254 - 0.0598 - CCR 2008, p. 13). Estimates for Ŕ (adjusted) in the San Juan Islands in Washington have been below 0.15 every year since surveys began in 1995, with three of those years below 0.05 (Raphael et al. 2007a, p. 16).

These current estimates of Ŕ are assumed to be below the level necessary to maintain or increase the murrelet population. Demographic modeling suggests murrelet population stability requires a minimum reproductive rate of 0.18 to 0.28 (95 % CI) chicks per pair per year (Beissinger and Peery 2007, p. 302; USFWS 1997). The estimates for Ŕ discussed above from individual studies, as well as estimates for the listed range (0.02 to 0.13) are all below the lowest estimated value (0.18) identified as required for population stability (USFWS 1997, Beissinger and Peery 2007, p. 302).

The current estimates for Ŕ also appear to be well below what may have occurred prior to the murrelet population decline. Beissinger and Peery (2007, p. 298) performed a comparative analysis using historic data from 29 bird species to predict the historic Ŕ for murrelets in central California, resulting in an estimate of 0.27 (95% CI: 0.15 - 0.65). Therefore, the best available scientific information of current murrelet fecundity from model predictions, and from juvenile ratios and trend

[26] The juvenile ratio (Ŕ) for murrelets is derived from the relative abundance of hatch-year (HY; 0-1 yr-old) to after-hatch-year (AHY; 1+ yr-old) birds (Beissinger and Peery 2007, p. 297) and is calculated from marine survey data.

[27] Nest success here is defined by the annual number of known hatchlings departing from the nest (fledging) divided by the number of nest starts.

analyses based on population survey data appear to align well; both indicate that the murrelet reproductive rate is generally insufficient to maintain stable population numbers throughout all or portions of the species' listed range.

ii. *Population structure*

Murrelets are long-lived seabirds that spend most of their life in the marine environment, with breeding adult birds annually nesting in the forest canopy of mature and old-growth forests from about March 24 through September 15. Murrelets have a naturally low reproductive rate. Murrelets lay just one egg and are thought to usually first breed at age 3.

iii. *Recovery Zones*

The Recovery Plan identified six Conservation Zones (Figure 4) throughout the listed range of the species: Puget Sound (Conservation Zone 1), Western Washington Coast Range (Conservation Zone 2), Oregon Coast Range (Conservation Zone 3), Siskiyou Coast Range (Conservation Zone 4), Mendocino (Conservation Zone 5), and Santa Cruz Mountains (Conservation Zone 6). Recovery zones are the functional equivalent of recovery units as defined by FWS policy (USFWS 1997, p. 115).

iv. *Recovery Zones in Oregon*

1. *Conservation Zone 3 (Oregon Coast Range Zone)*: This zone extends from the Columbia River, south to North Bend, Coos County, Oregon. Conservation zone 3 includes waters within 2 km (1.2 miles) of the Pacific Ocean shoreline and extends inland a distance of up to 56 km (35 miles) from the Pacific Ocean shoreline and coincides with the zone 1 boundary line. This zone contains the majority of murrelet sites in Oregon. Murrelet sites along the western portion of the Tillamook State Forest are especially important to maintaining well-distributed murrelet populations. Maintaining suitable and occupied murrelet habitat on the Elliot State Forest, Tillamook State Forest, Siuslaw NF, and BLM-administered forests is an essential component for the stabilization and recovery of murrelets (USFWS 1997). Beissinger and Peery (2003, page 22) estimated a 2.8 to 13.4 percent annual population decline for this zone. Miller et al. (2012, page 775) estimated a 1.5 percent population decline for this zone, with a 95 percent confidence limit of 5.4 percent decline to 2.6 percent increase in the population.

2. *Conservation Zone 4 (Siskiyou Coast Range Zone):* The Siskiyou Coast Range zone extends from North Bend, Coos County, Oregon south to the southern end of Humboldt County, California. It includes waters within 1.2 miles of the Pacific Ocean shoreline (including Humboldt and Arcata bays) and, generally extends inland a distance of 56 km (35 miles) from the Pacific shoreline. This zone contains populations in Redwood National Park and several state parks. It contains nesting habitat on private lands in southern Humboldt County and at

lower elevations in the western portions of Smith River National Recreation Area (USFWS 1997). Beissinger and Peery (2003, page 22) estimated a 2.5 to 13.2 percent annual population decline for this zone. Miller et al. (2012, page 775) estimated a 0.9 percent population decline for this zone, with a 95 percent confidence limit of 3.8 percent decline to 2.0 percent increase in the population.

3. *Ecology / Habitat Characteristics:* Murrelets are long-lived seabirds that spend most of their life in the marine environment, but use old-growth forests for nesting. Courtship, foraging, loafing, molting, and preening occur in near-shore marine waters. Throughout their range, murrelets are opportunistic feeders and utilize prey of diverse sizes and species. They feed primarily on fish and invertebrates in near-shore marine waters although they have also been detected on rivers and inland lakes.

   Murrelets spend most of their lives in the marine environment where they forage in near-shore areas and consume a diversity of prey species, including small fish and invertebrates. In their terrestrial environment, the presence of platforms (large branches or deformities) used for nesting is the most important characteristic of their nesting habitat. Murrelet habitat use during the breeding season is positively associated with the presence and abundance of mature and old-growth forests, large core areas of old-growth, low amounts of edge habitat, reduced habitat fragmentation, proximity to the marine environment, and forests that are increasing in stand age and height. Additional information on murrelet taxonomy, biology, and ecology can be found in Ralph et al. (1995), McShane et al. (2004), and Piatt et al. (2007).

4. *Aquatic Habitat Use*
   Murrelets are usually found within 5 miles (8 km) from shore, and in water less than 60 meters deep (Ainley et al. 1995; Burger 1995; Strachan et al. 1995; Nelson 1997; Day and Nigro 2000; Raphael et al. 2007b). In general, birds occur closer to shore in exposed coastal areas and farther offshore in protected coastal areas (Nelson 1997). Courtship, foraging, loafing, molting, and preening occur in marine waters.

   Murrelets are wing-propelled pursuit divers that forage both during the day and at night (Carter and Sealy 1986; Henkel et al. 2003; Kuletz 2005). Murrelets can make substantial changes in foraging sites within the breeding season, but many birds routinely forage in the same general areas and at productive foraging sites, as evidenced by repeated use over a period of time throughout the breeding season (Carter and Sealy 1990, Whitworth et al. 2000; Becker 2001; Hull et al. 2001; Mason et al. 2002; Piatt et al. 2007). Murrelets are also known to forage in freshwater lakes (Nelson 1997). Activity patterns and foraging locations are influenced by biological and physical processes that concentrate prey, such as weather, climate, time of day, season, light intensity, up-wellings, tidal rips, narrow passages between island, shallow banks, and kelp (*Nereocystis* spp.) beds (Ainley et al. 1995; Burger 1995; Strong et al. 1995; Speckman 1996; Nelson 1997).

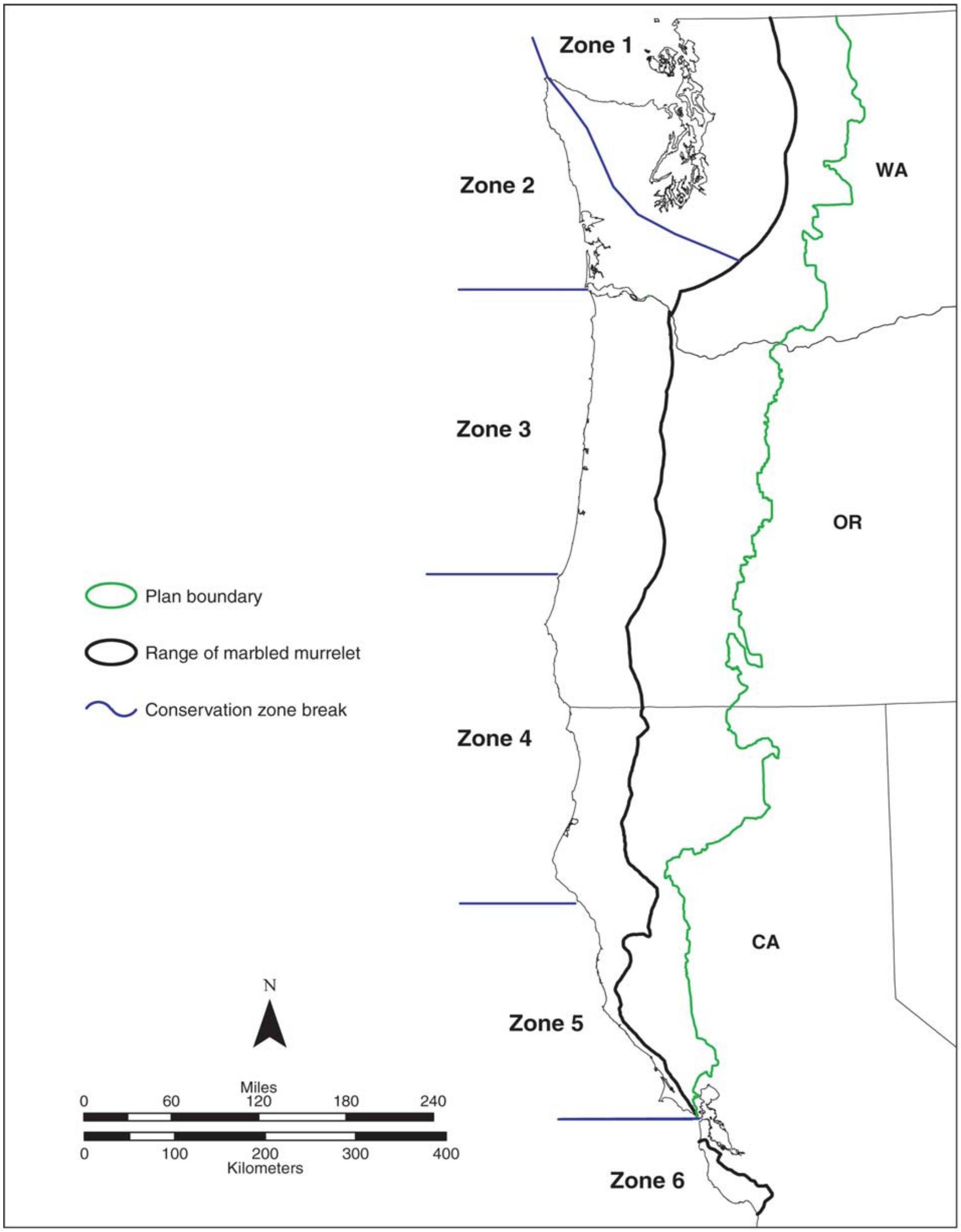


Figure 3. The six geographical areas identified as Conservation Zones in the recovery plan for the murrelet (USFWS 1997). Note: "Plan Boundary" refers to the Northwest Forest Plan. Figure adapted from Huff et al. (2006, p. 6).

Within the area of use, murrelets usually concentrate feedings in shallow, near-shore water less than 98 feet (30 m) deep (Huff et al. 2006), but are thought to be able to dive up to depths of 157 feet (47 m) (Mathews and Burger 1998). During the non-breeding season, murrelets disperse and can be found farther from shore (Strachan et al. 1995). Although little information is available outside of the nesting season, limited information on winter distribution also suggests they do move farther offshore (Craig Strong, Biologist, Crescent Coast Research, Crescent City, California, pers. comm., 2007). In areas with protective waters, there may be a general opportunistic shift from exposed outer coasts into more protected waters during the winter (Nelson 1997); for example many murrelets breeding on the exposed outer coast of Vancouver Island appear to congregate in the more sheltered waters within the Puget Sound and the Strait of Georgia in fall and winter (Burger 1995). In many areas, murrelets also undertake occasional trips to inland nesting habitat during the winter months (Carter and Erickson 1992). Throughout the listed range, murrelets do not appear to disperse long distances, indicating they are year-round residents (McShane et al. 2004).

Throughout their range, murrelets are opportunistic feeders and utilize prey of diverse sizes and species. They feed primarily on fish and invertebrates in marine waters although they have also been detected on rivers and inland lakes (Carter and Sealy 1986; 57 FR 45328). In general, small schooling fish and large pelagic crustaceans are the main prey items. Pacific sand lance (*Ammodytes hexapterus*), northern anchovy (*Engraulis mordax*), immature Pacific herring (*Clupea harengus*), capelin (*Mallotus villosus*), Pacific sardine (*Sardinops sagax*), juvenile rockfishes (*Sebastas* spp.), and surf smelt (Osmeridae) are the most common fish species taken. Squid (*Loligo* spp.), euphausiids, mysid shrimp, and large pelagic amphipods are the main invertebrate prey. Murrelets are able to shift their diet throughout the year and over years in response to prey availability (Becker et al. 2007). However, long-term adjustment to less energetically-rich prey resources (such as invertebrates) appears to be partly responsible for poor murrelet reproduction in California (Becker and Beissinger 2006).

Breeding adults exercise more specific foraging strategies when feeding chicks, usually carrying a single, relatively large (relative to body size) energy-rich fish to their chicks (Burkett 1995; Nelson 1997), primarily around dawn and dusk (Nelson 1997, Kuletz 2005). Freshwater prey appears to be important to some individuals during several weeks in summer and may facilitate more frequent chick feedings, especially for those that nest far inland (Hobson 1990). Becker et al. (2007) found murrelet reproductive success in California was strongly correlated with the abundance of mid-trophic level prey (e.g., sand lance, juvenile rockfish) during the breeding and postbreeding seasons. Prey types are not equal in the energy they provide; for example parents delivering fish other than age-1 herring may have to increase deliveries by up to 4.2 times to deliver the same energy value (Kuletz 2005).

Therefore, nesting murrelets that are returning to their nest at least once per day must balance the energetic costs of foraging trips with the benefits for themselves and their young. This may result in murrelets preferring to forage in marine areas in close proximity to their nesting habitat. However, if adequate or appropriate foraging resources (i.e., “enough” prey, and/or prey with the optimum nutritional value for themselves or their young) are unavailable in close proximity to their nesting areas, murrelets may be forced to forage at greater distances or to abandon their nests (Huff et al. 2006). As a result, the distribution and abundance of prey suitable for feeding chicks may greatly influence the overall foraging behavior and location(s) during the nesting season, may affect reproductive success (Becker et al. 2007), and may significantly affect the energy demand on adults by influencing both the foraging time and number of trips inland required to feed nestlings (Kuletz 2005).

v. *Nesting Biology*

Incubation is shared by both sexes, and incubation shifts are generally one day, with nest exchanges occurring at dawn (Nelson 1997, Bradley 2002). Hatchlings appear to be brooded by a parent for one or two days and then left alone at the nest for the remainder of the chick period (from hatching until fledging) while both parents spend most of their time foraging at sea. Both parents feed the chick (usually a single fish carried in the bill) and the chick typically receives 1-8 meals per day (mean 3.2) (Nelson 1997). About two-thirds of feedings occur early in the morning, usually before sunrise, and about one-third occur at dusk. Feedings are sometimes scattered throughout the day (Hamer and Nelson 1995a). Chicks fledge 27-40 days after hatching, at 58-71 percent of adult mass (Nelson 1997). Fledging has seldom been documented, but it typically appears to occur at dusk (Nelson 1997).

vi. *Nest Tree Characteristics*

Lank et al. (2003) states that murrelets “occur during the breeding season in near-shore waters along the north Pacific coastline from Bristol Bay in Alaska to central California”, nesting in single platform trees generally within 20 miles of the coast and older forest stands generally within 50 miles of the coast. Unlike most auks, murrelets nest solitarily on mossy platforms of large branches in old-forest trees (Lank et al. 2003). Suitable murrelet habitat may include contiguous forested areas with conditions that contain potential nesting structure. These forests are generally characterized by large trees greater than 18 inches dbh, multi-storied canopies with moderate canopy closure, sufficient limb size and substrate (moss, duff, etc.) to support nest cups, flight accessibility, and protective cover from ambient conditions and potential avian predators (Manley 1999, Burger 2002, Nelson and Wilson 2002). Over 95 percent of measured nest limbs were ≥15 cm diameter, with limb diameter ranges from 7-74 cm diameter (Burger 2002). Nelson and Wilson (2002) found that all 37 nest cups identified were in trees containing at least seven platforms. All trees in their study were climbed, however, and ground-based estimates of platforms per tree in the study were not analyzed. Lank et al. (2003) emphasizes that murrelets do not select nest sites based on tree species, but rather they select those individual trees that offer suitable nest platforms. Nest cups have been found in deciduous trees, albeit rarely and nest trees may be scattered or clumped throughout a forest stand.

vii. *Nest Stand Characteristics*

Nest stands are typically composed of low elevation conifer species. In California, nest sites have been located in stands containing old-growth redwood and Douglas-fir, while nests in Oregon and Washington have been located in stands dominated by Douglas-fir, western hemlock and Sitka spruce. Murrelets appear to select forest stands greater than 123.6 acres (50 ha) (Burger 2002), but nest in stands as small as one acre (Nelson and Wilson 2002). In surveys of mature or younger second-growth forests in California, murrelets were only found in forests where there were nearby old-growth stands or where residual older trees remained (USFWS 1992c, Singer et al. 1995).

At the stand level, vertical complexity is correlated with nest sites (Meekins and Hamer 1998, Manley 1999, Waterhouse et al. 2002, Nelson and Wilson 2002), and flight accessibility is probably a necessary component of suitable habitat (Burger 2002). Some studies have shown higher murrelet activity near stands of old-forest blocks over fragmented or unsuitable forest areas (Paton et al. 1992, Rodway et al. 1993, Burger 1995, Deschesne and Smith 1997, Rodway and Regehr 2002), but this correlation may be confounded by ocean conditions, distance inland, elevation, survey bias and disproportionately available habitat. Nelson and Wilson (2002) found that potential nest platforms per acre were a strong correlate for nest stand selection by murrelets in Oregon.

Adjacent forests can contribute to the conservation of the murrelet by reducing the potential for windthrow during storms by providing area buffers and creating a landscape with a higher probability of occupancy by murrelets (USFWS 1996, Burger 2001, Meyer et al. 2002, and Raphael et al. 2002). Trees surrounding and within the vicinity of a potential nest tree(s) may provide protection to the nest platform and potentially reduce gradations in microclimate (Chen et al. 1993).

Consulted on effects from October 1, 2003 to January 31, 2013 that impact nest stands are summarized in Table 9.

Table 9. Aggregate Results of All Suitable Habitat (acres) Affected by Section 7 Consultation for the Murrelet; Summary of Effects by Conservation Zone and Habitat Type from October 1st, 2003 to January 31, 2013.

Conservation Zone[1]	Authorized Habitat Effects In Acres[2]		Reported Habitat Effects in Acres[2]	
	Stands[3]	Remnants[4]	Stands[3]	Remnants[4]
Puget Sound	-69	0	-1	0
Western Washington	-43	0	-12	0
Outside CZ Area in WA	0	0	0	0
Oregon Coast Range	-702	-150	-137	0
Siskiyou Coast Range	-1,765	0	-137	0
Outside CZ Area in OR	-2	0	0	0
Mendocino	0	0	0	0
Santa Cruz Mountains	0	0	0	0
Outside CZ Area in CA	0	0	0	0
Total	**-2,581**	**-150**	**-287**	

Notes:

1. Conservation Zones (CZ) six zones were established by the 1997 Recovery Plan to guide terrestrial and marine management planning and monitoring for the Murrelet. *Marbled Murrelet Recovery Plan, September, 1997*
2. Habitat includes all known occupied sites, as well as other suitable habitat, though it is not necessarily occupied. Importantly, there is no single definition of suitable habitat, though the Murrelet Effectiveness Monitoring Module is in the process. Some useable working definitions include the Primary Constituent Elements as defined in the Critical Habitat Final Rule, or the criteria used for Washington State by Raphael et al. (2002).
3. Stand: A patch of older forest in an area with potential platform trees.
4. Remnants: A residual/remnant stand is an area with scattered potential platform trees within a younger forest that lacks, overall, the structures for murrelet nesting.

viii. Landscape Characteristics

Studies have determined the characteristics of murrelet nesting habitat at a landscape-scale using a variety of methods, including predictive models, radio telemetry, audio-visual surveys, and radar. McShane et al. (2004, pg. 4-103) reported, "At the landscape level, areas with evidence of occupancy tended to have higher proportions of large, old-growth forest, larger stands and greater habitat complexity, but distance to the ocean (up to about 37 miles [60 km]) did not seem important." Elevation had a negative association in some studies with murrelet habitat occupancy (Burger 2002). Hamer and Nelson (1995b) sampled 45 nest trees in British Columbia, Washington, Oregon, and California and found the mean elevation to be 1,089 feet (332 m).

Multiple radar studies (e.g., Burger 2001, Cullen 2002, Raphael et al. 2002, Steventon and Holmes 2002) in British Columbia and Washington have shown that radar counts of murrelets are positively associated with total watershed area, increasing amounts of late-seral forests, and with increasing age and height class of associated forests. Murrelet radar counts are also negatively associated with increasing forest edge and areas of logged and immature forests (McShane et al. 2004). Several studies have concluded that murrelets do not pack into higher densities within remaining habitat when nesting habitat is removed (Burger 2001, Manley et al. 2001, Cullen 2002).

There is a relationship between proximity of human-modified habitat and increased avian predator abundance. However, increased numbers of avian predators does not always result in increased predation on murrelet nests. For example, Luginbuhl et al. (2001, pg. 565) report, in a study using simulated murrelet nests, that "Corvid numbers were poorly correlated with the rate of predation within each forested plot". Luginbuhl et al. (2001, pg. 569), conclude, "that using measurements of corvid abundance to assess nest predation risk is not possible at the typical scale of homogenous plots (0.5-1.0 km^2 in our study). Rather this approach should be considered useful only at a broader, landscape scale on the order of 5-50 km^2 (based on the scale of our fragmentation and human-use measures)."

Artificial murrelet nest depredation rates were highest in western conifer forests where stand edges were close to human development (Luginbuhl et al. 2001), and Bradley (2002) found increased corvid densities within three miles of an urban interface, probably due to supplemental feeding opportunities from anthropogenic activities. Golightly et al. (2002) found extremely low reproductive success for murrelets nesting in large old-growth blocks of redwoods in the California Redwoods National and State Parks. Artificially high corvid densities from adjacent urbanization and park campgrounds are suspected to be a direct cause of the high nesting failure rates for murrelets in the redwoods parks.

If the surrounding landscape has been permanently modified to change the predators' numbers or densities through, for example, agriculture, urbanization, or recreation, and predators are causing unnaturally high nest failures, murrelet reproductive success may remain depressed. Because corvids account for the majority of depredations on murrelet nests and corvid density can increase with human development, corvid predation on murrelet habitat is a primary impact consideration. The threat of predation on murrelet populations (both nests and adults) appears to be greater than previously anticipated (McShane et al. 2004).

4.3.3 Population Status

i. *Historical status and distribution*

Murrelet abundance during the early 1990s in Washington, Oregon, and California was estimated at 18,550 to 32,000 birds (Ralph et al. 1995).

The historical breeding range of the murrelet extends from Bristol Bay, Alaska, south to the Aleutian Archipelago, northeast to Cook Inlet, Kodiak Island, Kenai Peninsula and Prince William Sound, south coastally throughout the Alexander Archipelago of Alaska, and through British Columbia, Washington, Oregon, to northern Monterey Bay in central California. Birds winter throughout the breeding range and also occur in small numbers off southern California.

At the time of listing, the distribution of active nests in nesting habitat was described as non-continuous (USFWS 1997, p. 14). The at-sea extent of the species currently encompasses an area similar in size to the species' historic distribution, but with the extremely low density of murrelets in Conservation Zone 5, and the small population in Conservation Zone 6, the southern end of the murrelet distribution is sparsely populated compared to Conservation Zones 1-4 (Table 10).

ii. *Current status and distribution of the listed species in rangewide (summary)*

Based primarily on the results from the NWFP Effectiveness Monitoring (EM) Program, the 2010 murrelet population for the listed range (Table 21) is estimated at 16,691 birds (95 percent confidence interval [CI]: 13,075 – 20,307;Table 21). Based on the 2010 estimates, Conservation Zones 3 and 4 support approximately 65 percent of the murrelet population within the U.S., and consistently have the highest – at-sea densities during the nesting season (Falxa et al. 2011). As with the historic status, murrelets continue to occur in the lowest abundance in Conservation Zones 5 and 6.

Table 10. Estimates of murrelet density and population size (95% CI) in Conservation Zones 1 through 5 during the 2010 breeding season (Falxa et al. 2011), and in Conservation Zone 6 during the 2009 breeding season (Perry and Henry 2010).

Conservation Zone	**Density** (birds/km^2)	**Coefficient of Variation** (% Density)	**Population Size Estimates with 95% CI**			**Survey Area** (km^2)
			Number of Birds	Lower	Upper	
1	1.26	20.4	4393	2,689	6,367	3,497
2	0.18	25.7	1,286	650	1946	1,650
3	4.53	16.9	7,223	4,605	9,520	1,595
4	3.16	27.3	3,668	2,196	6,140	1,159
5	0.14	-	121	-	242	883
6	-	-	631	449	885	-
Zones 1-6	-	-	17,322	13,524	21,192	-

The at-sea distribution also exhibits discontinuity within Conservation Zones 1, 2, 5, and 6, where five areas of discontinuity are noted: a segment of the border region between British Columbia, Canada and Washington, southern Puget Sound, WA, Destruction Island, WA to Tillamook Head, OR, Humboldt County, CA to Half Moon Bay, CA, and the entire southern end of the breeding range in the vicinity of Santa Cruz and Monterey Counties, CA (McShane et al. 2004, p. 3-70).

The current breeding range of the murrelet is the same as the historic breeding range. Birds winter throughout the breeding range and also occur in small numbers off southern California.

iii. *Trend*

There are two general approaches that researchers use to assess murrelet population trend: at-sea surveys and population modeling based on demographic data. In general, the FWS assigns greater weight to population trend and status information derived from at-sea surveys than estimates derived from population models because survey information generally provides more reliable estimates of trend and abundance.

iv. *Marine Surveys*

Researchers from the EM Program detected a statistically significant decline ($p < 0.001$) in the abundance of the population in Conservation Zones 1 through 5 combined, for the 2001-2010 sample period (Falxa et al. 2011). The estimated average annual rate of decline for this period was 3.7 percent (95 percent CI: -4.8 to -2.7 percent). This rate of annual decline suggests a total population decline of about 29 percent between 2001 and 2010 (Miller et al. 2012).

At the scale of individual conservation zones, the murrelet population declined at an estimated average rate of 7.4 percent per year (95 percent CI: -11.2 to -3.5) in Conservation Zone 1 (Falxa et al. 2011, Miller et al. 2012). In that same analysis, statistically significant trends were not detected elsewhere at the single-zone scale, but evidence of a declining trend was strong in Zone 2 (6.5% rate of decline, $P = 0.06$). For Washington State (Conservation Zones 1 and 2 combined) there was a 7.31 percent (standard error = 1.31 percent) annual rate of decline in murrelet density for the 2001-2010 period (Pearson et al. 2011, p. 10), which equates to a loss of approximately 47 percent of the murrelet population since 2001.

In Conservation Zone 6, the 2008 population estimate for Conservation Zone 6 suggested a decline of about 55 percent from the 2007 estimate and a 75 percent decline from the 2003 estimate (Peery et al. 2008). However, in the most recent population estimate available, the 2009 estimate was similar to estimates from 1999-2003 (Peery and Henry 2010). Peery and Henry (2010) speculated that their 2009 results may have indicated murrelets in central California moved out of the survey area in 2007 and 2008, and then returned in 2009, or the higher estimate in 2009 may have been due to immigration from larger populations to the north. Results from 2010 and 2011 surveys from Zone 6 are currently not available.

v. Population Models

Prior to the use of survey data to estimate trend, demographic models were more heavily relied upon to generate predictions of trends and extinction probabilities for the murrelet population (Beissinger 1995; Cam et al. 2003; McShane et al. 2004; USFWS 1997). However, murrelet population models remain useful because they provide insights into the demographic parameters and environmental factors that govern population stability and future extinction risk, including stochastic factors that may alter survival, reproductive, and immigration/emigration rates.

In a report developed for the 5-year Status Review of the Murrelet in Washington, Oregon, and California (McShane et al. 2004, p. 3-27 to 3-60), computer models were used to forecast 40-year murrelet population trends. A series of female-only, multi-aged, discrete-time stochastic Leslie Matrix population models were developed for each conservation zone to forecast decadal population trends over a 40-year period and extinction probabilities beyond 40 years (to 2100). The authors incorporated available demographic parameters (Table 11) for each conservation zone to describe population trends and evaluate extinction probabilities (McShane et al. 2004, p. 3-49).

Table 11. Rangewide murrelet demographic parameter values based on four studies all using Leslie Matrix models.

Demographic Parameter	Beissinger 1995	Beissinger and Nur 1997*	Beissinger and Peery (2007)	McShane et al. 2004
Juvenile Ratio (Ŕ)	0.10367	0.124 or 0.131	0.089	0.02 - 0.09
Annual Fecundity	0.11848	0.124 or 0.131	0.06-0.12	-
Nest Success	-	-	0.16-0.43	0.38 - 0.54
Maturation	3	3	3	2 - 5
Estimated Adult Survivorship	85 % – 90%	85 % – 88 %	82 % - 90 %	83 % – 92 %

*In USFWS (1997).

McShane et al. (2004) used mark-recapture studies conducted in British Columbia by Cam et al. (2003) and Bradley et al. (2004) to estimate annual adult survival and telemetry studies or at-sea survey data to estimate fecundity. Model outputs predicted 3.1 to 4.6 percent mean annual rates of population decline per decade the first 20 years of model simulations in murrelet Conservation Zones 1 through 5

(McShane et al. 2004, p. 3-52). Simulations for all zone populations predicted declines during the 20 to 40-year forecast, with mean annual rates of 2.1 to 6.2 percent decline per decade (McShane et al. 2004, p. 3-52). These reported rates of decline are similar to the estimates of 4 to 7 percent per year decline reported in the Recovery Plan (USFWS 1997, p. 5).

McShane et al. (2004, pp. 3-54 to 3-60) modeled population extinction probabilities beyond 40 years under different scenarios for immigration and mortality risk from oil spills and gill nets. Modeled results forecast different times and probabilities for local extirpations, with an extinction risk[28] of 16 percent and mean population size of 45 individuals in 100 years in the listed range of the species (McShane et al. 2004, pp. 3-58).

4.3.4 Threats; including reasons for listing, current rangewide threats

When the murrelet was listed under the Endangered Species Act (57 FR 45333-45336 [October 1, 1992]) and threats summarized in the Recovery Plan (USFWS 1997, pp. 43-76), several anthropogenic threats were identified as having caused the dramatic decline in the species.

- habitat destruction and modification in the terrestrial environment from timber harvest and human development caused a severe reduction in the amount of nesting habitat
- unnaturally high levels of predation resulting from forest “edge effects” ;
- the existing regulatory mechanisms, such as land management plans (in 1992), were considered inadequate to ensure protection of the remaining nesting habitat and reestablishment of future nesting habitat; and
- manmade factors such as mortality from oil spills and entanglement in fishing nets used in gill-net fisheries.

There have been changes in the levels of these threats since the 1992 listing (USFWS 2004e, pp. 11-12; USFWS 2009d, pp. 27-67). The regulatory mechanisms implemented since 1992 that affect land management in Washington, Oregon, and California (for example, the NWFP) and new gill-netting regulations in northern California and Washington have reduced the threats to murrelets (USFWS 2004e, pp. 11-12). The levels for the other threats identified in 1992 listing (57 FR 45333-45336 [October 1, 1992]) including the loss of nesting habitat, predation rates, and mortality risks from oil spills and gill net fisheries (despite the regulatory changes) remained

[28] Extinction was defined by McShane et al. (2004, p. 3-58) as any murrelet conservation zone containing less than 30 birds.

unchanged following the FWS's 2004, 5-year, range-wide status review for the murrelet (USFWS 2004e, pp. 11-12).

However, new threats were identified in the FWS's 2009, 5-year review for the murrelet (USFWS 2009d, pp. 27-67). These new stressors are due to several environmental factors affecting murrelets in the marine environment. These new stressors include:

- Habitat destruction, modification, or curtailment of the marine environmental conditions necessary to support murrelets due to:
    - elevated levels of polychlorinated biphenyls in murrelet prey species;
    - changes in prey abundance and availability;
    - changes in prey quality;
    - harmful algal blooms that produce biotoxins leading to domoic acid and paralytic shellfish poisoning that have caused murrelet mortality; and
    - climate change in the Pacific Northwest.

- Manmade factors that affect the continued existence of the species include:
    - derelict fishing gear leading to mortality from entanglement;
    - energy development projects (wave, tidal, and on-shore wind energy projects) leading to mortality; and
    - disturbance in the marine environment (from exposures to lethal and sub-lethal levels of high underwater sound pressures caused by pile-driving, underwater detonations, and potential disturbance from high vessel traffic; particularly a factor in Washington state).

The Service also believes climate change is likely to further exacerbate some existing threats such as the projected potential for increased habitat loss from drought-related fire, mortality, insects and disease, and increases in extreme flooding, landslides and windthrow events in the short-term (10 to 30 years). However, while it appears likely that the murrelet will be adversely affected, we lack adequate information to quantify the magnitude of effects to the species from the climate change projections described above (USFWS 2009d, page 34).

Several threats to murrelets, present in both the marine and terrestrial environments, have been identified. These threats collectively comprise a suite of environmental stressors that, individually or through interaction, have significantly disrupted or impaired behaviors which are essential to the reproduction or survival of individuals. When combined with the species naturally low reproductive rate, these stressors have led to declines in murrelet abundance, distribution, and reproduction at the population scale within the listed range.

Detailed discussions of the above-mentioned threats, life-history, biology, and status of the murrelet are presented in the Federal Register, listing the murrelet as a threatened species (57 FR 45328 [October 1, 1992]); the Recovery Plan, Ecology and Conservation of the Murrelet (Ralph et al. 1995); the final rule designating murrelet critical habitat (61 FR 26256 [May 24, 1996]); the Evaluation Report in the 5-Year Status Review of the Murrelet in Washington, Oregon, and California (McShane et al. 2004); the 2004 and 2009, 5-year Reviews for the Murrelet (USFWS 2004e; USFWS 2009d), and the final rule revising critical habitat for the murrelet (76 FR 61599 [October 5, 2011]).

4.3.5 Conservation

i. *Needs*

Reestablishing an abundant supply of high quality murrelet nesting habitat is a vital conservation need given the extensive habitat removal during the 20th century. However, there are other conservation imperatives. Foremost among the conservation needs are those in the marine and terrestrial environments to increase murrelet fecundity by increasing the number of breeding adults, improving murrelet nest success (due to low nestling survival and low fledging rates), and reducing anthropogenic stressors that reduce individual fitness[29] or lead to mortality.

The overall reproductive success (fecundity) of murrelets is directly influenced by nest predation rates (reducing nestling survival rates) in the terrestrial environment and an abundant supply of high quality prey in the marine environment during the breeding season (improving potential nestling survival and fledging rates). Anthropogenic stressors affecting murrelet fitness and survival in the marine environment are associated with commercial and tribal gillnets, derelict fishing gear, oil spills, and high underwater sound pressure (energy) levels generated by pile-driving and underwater detonations (that can be lethal or reduce individual fitness).

General criteria for murrelet recovery (delisting) were established at the inception of the Plan and they have not been met. More specific delisting criteria are expected in the future to address population, demographic, and habitat based recovery criteria (USFWS 1997, p. 114-115). The general criteria include:

- documenting stable or increasing population trends in population size, density, and productivity in four of the six Conservation Zones for a 10-year period and
- implementing management and monitoring strategies in the marine and terrestrial environments to ensure protection of murrelets for at least 50 years.

Thus, increasing murrelet reproductive success and reducing the frequency, magnitude, or duration of any anthropogenic stressor that directly or indirectly

[29] Fitness is measure of the relative capability of individuals within a species to reproduce and pass its' genotype to the next generation.

affects murrelet fitness or survival in the marine and terrestrial environments are the priority conservation needs of the species. The FWS estimates recovery of the murrelet will require at least 50 years (USFWS 1997).

ii. *Current Actions*

On Federal lands under the NWFP surveys are required for all timber sales that remove murrelet habitat. If habitat outside of mapped Late-Successional Reserves (LSRs) is found to be used by murrelets, then the habitat and recruitment habitat (trees at least 0.5 site potential tree height) within a 0.5-mile radius of the occupied behavior is designated as a new LSR. Timber harvest within LSRs is designed to benefit the development of late-successional conditions, which should improve future conditions of murrelet nesting habitat. Designated LSRs not only protect habitat currently suitable to murrelets (whether occupied or not), but will also develop future suitable habitat in large blocks.

4.3.6 Status of Murrelet Critical Habitat

Critical habitat consists of geographic areas essential to the conservation of a listed species. Under the Act, conservation means to use and the use of all methods and procedures which are necessary to bring an endangered species or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary.

Critical habitat is provided protection under section 7 of the Act by ensuring that activities funded, authorized, or carried out by Federal agencies do not adversely modify such habitat to the point that it no longer remains functional (or retains its current ability for primary constituent elements to be functionally established) to serve the intended conservation role for the species.

On May 24, 1996, the USFWS designated critical habitat for the murrelet within 104 critical habitat Units (CHUs) encompassing approximately 3.9 million acres across Washington (1.6 million), Oregon (1.5 million), and California (0.7 million). The final rule became effective June 24, 1996. The final rule intended the scope of the section 7(a)(2) analysis to evaluate impacts of an action on critical habitat at the conservation zone(s) or even a major part of a conservation zone (USFWS 1996, page 26271).

On October 5, 2011, the final rule revising critical habitat for the murrelet was published (76 FR 61599). The Service reduced critical habitat in Northern California and Oregon. New information indicates that these areas do not meet the definition of critical habitat and 189,671 acres were removed from the network (USFWS 2011e, page 61599).

4.3.7 Primary Constituent Elements

The PCEs are physical and biological features the USFWS determines are essential to a species' conservation (i.e., recovery) and require special management considerations. The PCEs for the murrelet are: (1) individual trees with potential nesting platforms; and (2) forested lands of at least one half site potential tree height regardless of contiguity within 0.8 kilometers (0.5 miles) of individual trees with potential nesting platforms, and that are used or potentially used by murrelets for nesting or roosting (USFWS 1996, page 26264). The site-potential tree height is the average maximum height for trees given the local growing conditions, and is based on species-specific site index tables. These primary constituent elements are intended to support terrestrial habitat for successful reproduction, roosting and other normal behaviors.

4.3.8 Conservation Strategy and Objectives

The Service's primary objective in designating critical habitat was to identify existing terrestrial murrelet habitat that supports nesting, roosting, and other normal behaviors that require special management considerations and to highlight specific areas where management should be given highest priority. The Service designated critical habitat to protect murrelets and their habitat in a well-distributed manner throughout the three states. Critical habitat is primarily based on the LSRs identified in the NWFP (approximately 3 million acres of critical habitat are located within the 3.9 million acre LSR boundary designation). These LSRs were designed to respond to the problems of fragmentation of suitable murrelet habitat, potential increases in predation due to fragmentation, and reduced reproductive success of murrelets in fragmented habitat. The LSR system identifies large, contiguous blocks of late-successional forest that are to be managed for the conservation and development of the older forest features required by the murrelet, and as such, serve as an ideal basis for murrelet critical habitat. Where Federal lands were not sufficient to provide habitat considered crucial to retain distribution of the species, other lands were identified, including state, county, city and private lands (USFWS 1996, page 26265).

4.3.9 Current Condition

The majority (77 percent) of designated critical habitat occurs on Federal lands in LSRs as identified in the Northwest Forest Plan. Because of this high degree of overlap with LSRs and LSR management guidelines, the condition of most of the range-wide network of murrelet critical habitat has experienced little modification of habitat since designation. Consultation data, from October 1, 2003 – January 31, 2013 (Table 12), indicates 261 acres of PCE 1 and 462 acres of PCE 2 were planned for removal in CH, of which 137 acres of PCE 1 and 234 acres of PCE 2 removal was associated with Tribal activities in the Siskiyou Coast Range Zone. All other impacts are associated with Federal activities.

Table 12. Aggregate Results of All Critical Habitat (acres) Affected by Section 7 Consultation for the Murrelet; Baseline and Summary Effects by Conservation Zone and Habitat Type from October 1, 2003 to Janauary 31, 2013.

	Designated Acres[2]	Authorized Habitat Effects in Acres[3]			Reported Habitat Effects in Acres[3]		
Conservation Zone[1]	**Total CHU Acres**	**Stands[4]**	**Remnants[5]**	**PCE 2[6]**	**Stands[4]**	**Remnants[5]**	**PCE 2[6]**
Puget Sound	1,271,782	-16	0	-21	0	-1	0
Western Washington	414,050	0	0	0	0	0	0
Outside CZ Area in WA	0	0	0	0	0	0	0
Oregon Coast Range	1,024,122	-5	0	-208	0	0	0
Siskiyou Coast Range	1,055,788	-240	0	-234	0	-97	0
Outside CZ Area in OR	0	0	0	0	0	0	0
Mendocino	122,882	0	0	0	0	0	0
Santa Cruz Mountains	47,993	0	0	0	0	0	0
Outside CZ Area in CA	0	0	0	0	0	0	0
Total	**3,936,617**	**-261**	**0**	**-463**	**0**	**-98**	**0**

Notes:

1. Conservation Zones (CZ) six zones were established by the 1997 Recovery Plan to guide terrestrial and marine management planning and monitoring for the Murrelet (USFWS 1997).
2. Critical Habitat Unit acres within each Conservation zones, as presented in the Marbled Murrelet Recovery Plan Figure 8, page 114.
3. Habitat includes all known occupied sites, as well as other suitable habitat, though it is not necessarily occupied. Importantly, there is no single definition of suitable habitat, though the Murrelet Effectiveness Monitoring Module is in the process. Some useable working definitions include the Primary Constituent Elements as defined in the Critical Habitat Final Rule, or the criteria used for Washington State by Raphael et al. (2002).
4. Stand: A patch of older forest in an area with potential platform trees.
5. Remnants: A residual/remnant stand is an area with scattered potential platform trees within a younger forest that lacks, overall, the structures for murrelet nesting.
6. PCE 2: trees with a ½ site-potential tree height within .5 mile of a potential nest tree.

4.3.10 Analytical Framework for analyzing impacts to critical habitat

A "may affect, likely to adversely affect" determination for critical habitat that triggers the need for completing an adverse modification analysis under formal consultation is warranted in cases where a proposed Federal action will cause: (1) Removal or degradation of individual trees with potential nesting platforms, or removal or degrade the nest platforms themselves, as this results in a significant decrease in the value of the trees for future nesting use. Moss may be an important component of nesting platforms in some areas; (2) Removal or degradation of trees adjacent to trees with potential nesting platforms that provide habitat elements essential to the suitability of the potential nest tree or platform, such as trees providing cover from weather or predators; (3) Removal or degradation of forested areas with a canopy height of at least one half the site-potential tree height and regardless of contiguity, within 0.5 mile of individual trees containing potential nest platforms. This includes removal or degradation of trees currently unsuitable for nesting that contribute to the structure/integrity of the potential nest area (i.e., trees that contribute to the canopy of the forested area). These trees provide the canopy and stand conditions important for murrelet nesting (USFWS 1996, page 26271).

A "may affect, not likely to adversely affect" determination for murrelet critical habitat is warranted in cases where a proposed Federal action will include, but are not limited to: (1) certain recreational use and personal-use commodity production (e.g., mushroom picking, Christmas tree cutting, rock collecting, recreational fishing along inland rivers) and certain commercial commodity production (e.g., mushroom picking, brush picking); (2) Actions that affect forest stands not within 0.5 miles of individual trees with potential nesting platforms; (3) Activities that do not affect the primary constituent elements. However, even though an action may not adversely affect critical habitat, it may still affect murrelets (e.g. through disturbance) and may, therefore, still be subject to consultation under section 7 of the Act. Activities conducted according to the standards and guidelines for Late Successional Reserves, as described in the ROD for the Northwest Forest Plan would be unlikely to result in the destruction or adverse modification of murrelet critical habitat. Activities in these areas would be limited to manipulation of young forest stands that are not currently murrelet nesting habitat. These forest management activities would be conducted in a manner that would not be likely to slow the development of these areas into future nesting habitat, and should speed the development of some characteristics of older forest (USFWS 1996, pages 26271-26272).

5.0 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section

7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

5.1 Columbia River Basin

The action area for this consultation is located within the Columbia River Basin and Oregon coastal river basins. The Columbia River Basin occupies approximately 220,000 square miles in seven states: Washington, Oregon, Idaho, Montana, Wyoming, Utah, and Nevada. The river and its tributaries are the primary hydrologic features in the Pacific and inland Northwest. The Columbia River runs for more than 1,200 miles from its origin at Columbia Lake in British Columbia to its estuary on the Oregon-Washington coast. The largest major tributary of the Columbia is the Snake River, which is 1,036 miles long. Average annual runoff at the mouth of the Columbia River is approximately 198 million acre-feet.

The entire Columbia River basin is too large and variable to describe its baseline conditions as a whole. However, the factors influencing the baseline conditions in the varied provinces and subbasins of the Columbia River basin are similar throughout the basin and can be discussed for the basin as a whole. Within the action area, many stream, estuarine and riparian areas have been degraded by the effects of land and water use, including road construction, forest management, agriculture, mining, urbanization, and water development. Each of these economic activities has contributed to a myriad of interrelated factors for the decline of ESA-listed fish. Among the most important of these are changes in stream channel morphology, degradation of spawning substrates, reduced instream roughness and cover, loss and degradation of estuarine rearing habitats, loss of wetlands, loss and degradation of riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants) degradation, blocked fish passage, direct take, and loss of habitat refugia.

Columbia River Estuary

The Columbia River estuary, through which all the basin’s anadromous species must pass, has also been changed by human activities. Historically, the downstream half of the estuary was a dynamic environment of multiple channels, extensive wetlands, sandbars, and shallow areas. Historically, the mouth of the Columbia River was about four miles wide; today it is two miles wide. Previously, winter and spring floods, low flows in late summer, large woody debris floating downstream, and a shallow bar at the mouth of the Columbia River kept the environment dynamic. Today, navigation channels have been dredged, deepened, and maintained; jetties and pile-dike fields have been constructed to stabilize and concentrate flow in navigation channels; marsh and riparian habitats have been filled and diked; and causeways have been constructed across waterways. These actions have decreased the width of the mouth of the Columbia River to two miles and increased the depth of the Columbia River channel at the bar from less than 20 to more than 55 feet.

More than 50% of the original marshes and spruce swamps in the estuary have been converted to industrial, transportation, recreational, agricultural, or urban uses. More than 3,000 acres of intertidal marsh and spruce swamps have been converted by human use since 1948 (LCREP 1999). Many wetlands along the shore in the upper reaches of the estuary have been converted to industrial and agricultural lands after levees and dikes were constructed. Furthermore, water storage and release patterns from reservoirs upstream of the estuary have changed the seasonal pattern and volume of discharge. The peaks of spring/summer floods have been reduced and the amount of water discharged during winter has increased.

Land Use Practices

Land ownership has also played its part in the region's habitat and land-use changes. Federal lands, which compose 50% of the basin, are generally forested and situated in upstream portions of the watersheds. While there is substantial habitat degradation across all land ownerships, in general, habitat in many headwater stream sections is in better condition than in the largely non-Federal lower portions of tributaries (Doppelt et al. 1993, Frissell 1993, Henjum et al. 1994, Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in the basin (Stanford and Ward 1992, Spence et al. 1996, ISG 1996). Today, agricultural and urban land development and water withdrawals have significantly altered the habitat for fish and wildlife in these valley bottoms. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

At the same time some habitats were being destroyed by water withdrawals in the Columbia basin, water *impoundments* in other areas dramatically reduced habitat by inundating large amounts of spawning and rearing habitat and reducing migration corridors, for the most part, to a single channel. Floodplains have been reduced in size, off-channel habitat features have been lost or disconnected from the main channel, and the amount of large woody debris (large snags/log structures) in rivers has been reduced. Most of the remaining habitats are affected by flow fluctuations associated with reservoir management.

Hydropower

Since the 1880s, numerous dams—both federal and private—have been built for flood control, hydropower, fish and wildlife, navigation, recreation, irrigation, and municipal and industrial water supply and quality. As the region's population increased, the Federal government developed storage projects to capture water from rain and snowmelt for flood control, as well as for power generation, irrigation, and other purposes. Storage dams have eliminated spawning and rearing habitat (loss of spawning gravels and access to spawning and rearing areas) while altering the natural hydrograph of the Snake and Columbia Rivers (decreasing spring and summer flows and increasing fall and winter flows).

The mainstem lower Columbia and Snake River projects were designed to enable navigation from the mouth of the Columbia to the Port of Lewiston in Idaho, as well as for hydropower generation and other purposes. These run-of-river projects have minimal storage capacity, and are not considered flood storage projects. These dams have converted the once-swift river into a series of slow-moving reservoirs—slowing the smolts' journey to the estuary and ocean and creating habitat for predators. Because most of the ESA-listed salmonids must navigate at least one, and up to nine major hydroelectric projects during their up- and downstream migrations (and experience the effects of other dam operations occurring upstream from their ESU boundary), they experience the influence of all the impacts listed above.

However, ongoing consultations between NMFS and the BPA, the USACE, USFWS, and the Bureau of Reclamation (Reclamation) have brought about numerous beneficial changes in the operation and configuration of the Columbia River hydropower system. BOs outlining a number of proposed operations and structural configuration changes to FCRPS dams were issued in 1993, 1994, 1995, 1998, 2000, 2004, 2008, and 2010. As a result of these operations and configuration improvements, juvenile and adult survival through the FCRPS migration corridor has improved significantly since the early 1990s. For example, increased spill at the dams allows smolts to avoid both turbine intakes and bypass systems; increased flow in the mainstem Snake and Columbia Rivers provides better in-river conditions for smolts; and better smolt transportation (through the addition of new barges and by modifying existing barges) helps young salmonids make their way down to the ocean.

Within the habitat currently accessible by ESA-listed salmonids the quality and quantity of fresh water habitat in much of the Columbia River basin have declined dramatically in the last 150 years. Forestry, farming, grazing, road construction, hydropower system development, mining, and urban development have radically changed the historical habitat conditions of the basin. Consumptive water losses resulting from agricultural, industrial, or municipal purposes have changed water temperature (including generally warmer minimum winter temperatures and cooler maximum summer temperatures), altered water velocity (reduced spring flows and increased crosssectional areas of the river channel), affected food resources (alteration of food webs, including the type and availability of prey species), and reduced safe passage (increased mortality rates of migrating juveniles) (Williams *et al*. 2005; Ferguson *et al*. 2005).

Water Quality

More than 2,500 streams, river segments, and lakes in the Northwest do not meet Federally-approved, state, and/or tribal water quality standards and are now listed as water-quality-limited under Section 303(d) of the Clean Water Act. Both point (industrial and municipal waste) and nonpoint sources (agriculture, forestry, urban activities, etc.) contribute to poor water quality when sediment and contaminants from the tributaries settle in mainstem reaches and the estuary. The types and amounts of compounds found in runoff are often correlated with land use patterns: fertilizers and pesticides are found frequently in agricultural and urban settings, and nutrients are found in areas with human and animal waste. People contribute to chemical pollution in the basin, but natural and seasonal factors also influence pollution levels in various ways. Nutrient and pesticide concentrations vary considerably from season to season, as well as among regions with different geographic and hydrological conditions. Natural features (such as geology and soils) and land-management practices (such as storm water drains, tile drainage and irrigation) can influence the movement of chemicals over both land and water.

Most of the water bodies in Oregon, Washington, and Idaho on the 303(d) list do not meet water quality standards for temperature. Bull trout and salmon require different stream temperatures depending on the life stages and life form. Bull trout are in stream all year round as are juvenile Chinook and steelhead and generally require colder temperatures for incubation, rearing, and spawning. High water temperatures adversely affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that cause high stream temperatures are the removal of trees or shrubs that directly shade streams, water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals contribute to lower base-stream flows that, in turn, contribute to temperature increases.

Water Quantity

Water quantity problems are also a significant cause of habitat degradation and reduced fish production. Millions of acres in the Columbia River basin are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion of it. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, urban consumption, and other uses increases temperatures, smolt travel time, and sedimentation. Return water from irrigated fields can introduce nutrients and pesticides into streams and rivers. Deficiencies in water quantity have been a problem in the major production subbasins for some ESUs that have seen major agricultural development over the last century. Water withdrawals (primarily for irrigation) have lowered summer flows in nearly every stream in the basin and thereby profoundly decreased the amount and quality of rearing habitat. In fact, in 1993, fish and wildlife agency, tribal, and conservation group experts estimated that 80% of 153 Oregon tributaries had low-flow problems, two-thirds of which were caused (at least in part) by irrigation withdrawals (OWRD 1993). The Northwest Power Planning Council (NWPPC 1992) found similar problems in many Idaho, Oregon, and Washington tributaries.

On the landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density that, in turn, affect runoff timing and duration. Many riparian areas, flood plains, and wetlands that once stored water during periods of high runoff have been destroyed by development that paves over or compacts soil—thus increasing runoff and altering natural hydrograph patterns.

Recovery and Restoration Programs

Federal, state, tribal, and private entities have—singly and in partnership—begun recovery efforts to help slow and, eventually, reverse the decline of federally listed fish populations. Notable efforts within the range of the 13 listed salmon and steelhead ESUs are the NWPPC's Fish and Wildlife Program, Basinwide Salmon Recovery Strategy (both of which the activities proposed in this HIP III consultation are based on), the Northwest Forest Plan, PACFISH, the Washington Wild Stock Restoration Initiative, the Washington Wild Salmonid Policy, and the Oregon Plan for Salmon and Watersheds. (These are all large programs; for details on these efforts please see the websites for ODFW, WDFW, the USFS, and the BPA). Full discussions of these efforts can be found on the referenced websites and in the Federal Columbia River Power System biological opinions (NMFS 2000e, NOAA Fisheries 2004a). Despite these efforts, however, much remains to be done to recover listed fish populations in the Columbia River basin.

The environmental baseline also includes the anticipated impacts of all Federal projects in the action area that have already undergone formal consultation. From 2003 to 2006, the BPA covered 218 projects under the HIP I consultation. Most projects involved use of multiple HIP I activity categories with improvement of fish passage and treatment of non-native plants with herbicides as the most common actions. During the same time period, BPA completed 28 individual formal consultations on habitat improvement actions that were not covered by the HIP I consultation. Channel reconstruction, complex fish passage improvement projects, and streambank stabilization were the most common activity types.

Other Federal Projects that have undergone consultation in the action area include various transportation, natural resource management, and water management projects. The USACE and Federal Highway Administration have consulted on numerous transportation projects, primarily bridge and culvert replacement projects. These actions typically improve fish passage at road-stream crossings and reduce the hydraulic effects of culverts and bridges by replacing them with larger structures. The USACE has consulted on projects permitted under the section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. These actions include installation or improvement of docks and bulkheads, streambank stabilization, and improvements to other navigational and transportation infrastructure. Some stream restoration projects are also permitted under these authorities.

The USDA Forest Service and USDI Bureau of Land Management have consulted on restoration and natural resource management projects throughout Oregon, Washington, Idaho and Montana. These projects include stream restoration actions, commercial timber harvest, authorization of livestock grazing, and issuance of special use permits. These actions, as implemented in conjunction with these agencies' aquatic conservation strategies, are designed to avoid or minimize effects on ESA-listed salmonids and their habitat. The restoration actions are designed to restore natural stream habitat forming processes.

The Bureau of Reclamation has completed consultation on a few large tributary water management projects such as the Umatilla Project and Deschutes Project. These projects are operated in manner consistent with the recovery of ESA-listed salmonids. As more information on the recovery needs of ESA-listed salmonids becomes available, operation of these projects can be adjusted accordingly.

It is very likely that a small number of action areas for some of these previously consulted upon actions will overlap with action areas for restoration projects covered under this HIP III consultation. Impacts to the environmental baseline from these previous projects vary from short-term adverse effects to long-term beneficial effects. When considered as whole, these actions are likely to have a small beneficial effect on the environmental baseline over time.

Under the current environmental baseline, the biological needs of ESA-listed fish are generally not being met on lands in Oregon, Washington, Idaho and western Montana where the BPA would fund projects covered by this consultation. The purpose of the actions proposed in this consultation is to improve degraded habitat conditions. In areas with high quality habitat, the BPA proposes to protect this habitat through land acquisition or lease and conservation easements. Because the HIP III program is intended to correct or ameliorate existing habitat problems, rather than enhancing habitats that are not impaired, program activities would generally occur in areas where the environmental baseline is degraded to the extent that the biological needs are not met.

5.2 Environmental Baseline of Species in the Action Area

Oregon Chub

The species range of Oregon chub is completely within the action area of this programmatic consultation thus the status of the species previously discussed also adequately represents the environmental baseline of the species. As such there will be no discussion of Oregon chub in this Environmental Baseline section.

Bull Trout

The preamble to the implementing regulations for section 7 (51 FR 19932; third paragraph, left column) contemplates that the evaluation of "…the present environment in which the species or critical habitat exists, as well as the environment that will exist when the action is completed, in terms of the totality of factors affecting the species or critical habitat…will serve as the baseline for determining the effects of the action on the species or critical habitat." The regulations at 50 CFR 402.02 define the environmental baseline to include "the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process." The analyses presented in this section supplement the above *Status of the Species* and *Status of Critical Habitat* evaluations by focusing on the current condition of the bull trout and its critical habitat in the action area, the factors responsible for that condition (inclusive of the factors cited above in the regulatory definition of environmental baseline), and the role the action area plays in the survival and recovery of the bull trout and in the recovery support function of designated critical habitat. Relevant factors on lands surrounding the action area that are influencing the condition of the bull trout and its critical habitat were also considered in completing the status and baseline evaluations herein.

As previously noted, the action area of this programmatic consultation includes the Columbia River Basin in Oregon, Washington, Idaho and western Montana, as well as coastal watersheds in Oregon from the Columbia River confluence with the Pacific Ocean south to Cape Blanco in southwestern Oregon. Bull trout are not present in the coastal watersheds of Oregon thus their distribution within the action area is limited to the Columbia River Basin (Figure 4 and 5 below). As previously stated, the five draft interim recovery units (IRUs) for bull trout in the coterminous U.S. include: 1) Saint Mary Belly; 2) Klamath; 3) Jarbidge; 4) Columbia River; and 5) Coastal-Puget Sound. The action area of this programmatic consultation encompasses just one of the five IRUs - the Columbia River IRU. The Status of the Species section (above) provides a fairly comprehensive assessment of the environmental baseline of bull trout in the Columbia Basin.

Within the Columbia River IRU there are 23 management units and 97 core areas. The status of bull trout populations within affected core areas varies widely, and resident, adfluvial, and fluvial migratory populations can all be found within the action area. The only systematic analysis of status in recent years at the DPS or IRU scale is found in the Service's 5-year status review of bull trout that was completed in 2008 (USFWS 2008). The assessment concluded that the original threats to bull trout still existed for the most part in all core areas within the Columbia River IRU, but no substantial new and widespread threats were identified. This finding indicates the baseline conditions overall rangewide and within the Columbia River IRU had not changed substantially in the last 5 years and that the trend and magnitude of the rangewide population and Columbia River IRU had not worsened nor did it improve measurably.

Figure 4. Bull Trout Core Areas and Occupied Habitat in the Columbia River Basin and Columbia River Interim Recovery Unit

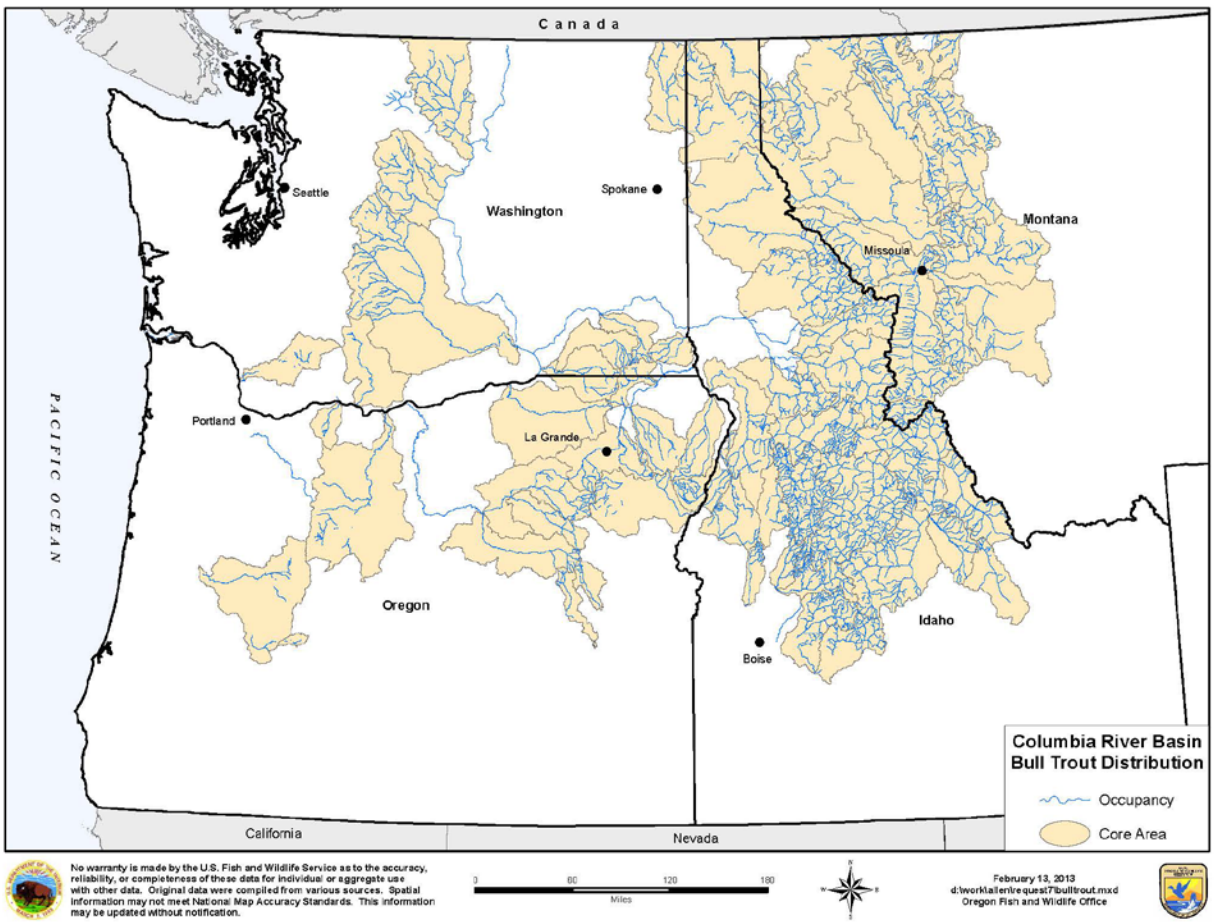
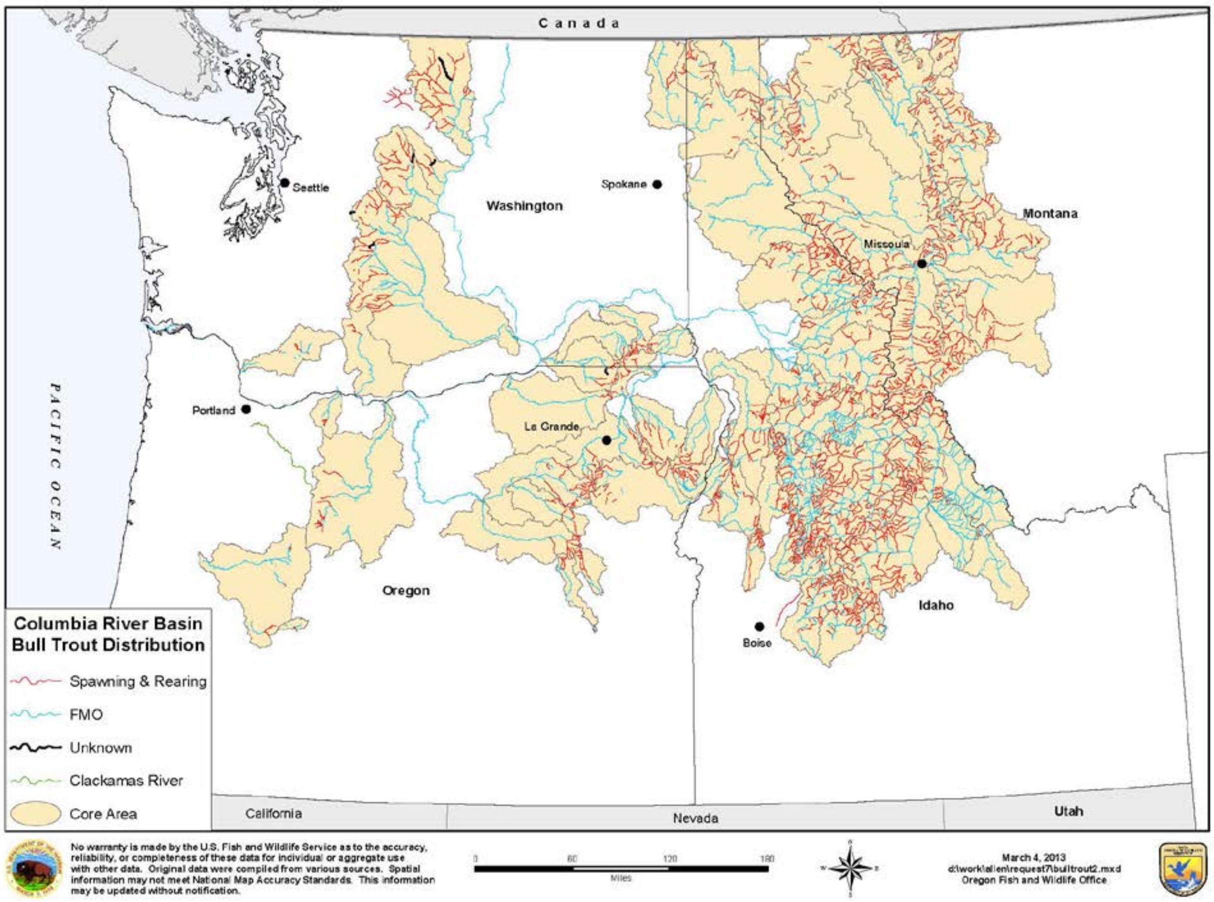


Figure 5. Spawning and Rearing (SR) and Foraging, Migration and Overwintering (FMO) Habitat in the Columbia River Interim Recovery Unit



The Service's 5-year review contains extensive analyses by core area of bull trout status, trends and threats range-wide in the coterminous U.S. These analyses were not rolled up into larger units for assessment, such as management units or interim recovery units that could easily be incorporated into this BO. For this reason we choose to incorporate this information by reference. The 5-year review can be found at the following link: http://www.fws.gov/pacific/bulltrout/5yrreview.html

Marbled Murrelet

The environmental baseline of marbled murrelets was adequatetly covered in the Status of the Species section.

6.0 Effects of the Action

'Effects of the action' means the direct and indirect effects of an action on the listed species and critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02).

The actions covered by this consultation have predictable effects. The FWS has conducted individual and programmatic consultations on activities similar to those in the proposed action throughout Oregon, Washington and Idaho over the past 15 years, and the information gained from monitoring and feedback has been applied by the FWS, NMFS and BPA to refine project design criteria and conservation measures for this consultation. Habitat improvement activities that are less predictable will either be reviewed by the RRT prior to approval, or will require an individual consultation.

The implementation of the proposed action is intended to increase the quality and quantity of restoration projects over the long term. In general, ephemeral effects are expected to last for hours or days, short-term effects are expected to last for weeks, and long-term effects are expected to last for months, years or decades. The activities covered by this program will have some ephemeral or minor, unavoidable, short-term adverse effects such as increased stream turbidity and riparian disturbance, in order to gain the more permanent habitat improvements associated with BPA's HIP program. The FWS and NMFS worked closely with BPA to incorporate conservation measures (general conservation measures, and activity specific conservation measures) into the proposed action to reduce these short-term effects. However, short-term adverse effects are reasonably certain to occur, and are generally associated with near and instream construction or the application of chemical herbicides. The direct physical and chemical effects of the construction of each project will vary depending on the type of action being performed, but will all be based on a common set of effects related to construction. The effects to habitat that are common to many of the activity categories are discussed first, followed by a discussion of habitat effects specific to each activity category and the resulting effects on listed fish.

6.1 Effects to Habitat

The habitat improvement actions will have long-term beneficial effects to the habitat of listed fish species at the project-site scale and the watershed scale. As stated above, many of the actions will include activities that result in short-term adverse effects to habitat. Some projects proposed for authorization under this BO require one or more actions related to pre-construction, construction, operation and maintenance, and site restoration. The direct chemical and physical effects of these activities typically begin with pre-construction activity, such as surveying, minor vegetation clearing, placement of stakes and flagging guides, and minor movements of machines and personnel within the action area. The next stage, site preparation, typically requires development of access roads, construction staging areas, and materials storage areas that affect more of the project area, and clear vegetation that will allow rainfall to strike the bare earth surface. Additional earthwork follows to clear, excavate, fill and shape the site for its eventual use, frequently with activity in the active channel, and reshaping banks as necessary for successful revegetation.

The effects associated with construction, operation or maintenance depend on the purpose and location of each activity category, and will be analyzed in subsequent sections. The final stage for actions that involve construction is site restoration; this stage involves the restoration of ecological function and habitat-forming processes to maintain or promote the site along a trajectory toward conditions that support functional aquatic habitats.

Pre-construction. Pre-construction activity includes planning, design, permit acquisition, and surveying. Vegetation and fluvial geomorphic processes at a project site provide for natural creation and maintenance of habitat function. Pre-construction activities that result in removal of vegetation will reduce or eliminate those habitat values (Darnell 1976, Spence *et al*. 1996). Denuded areas lose organic matter and dissolved minerals, such as nitrates and phosphates. The microclimate becomes drier and warmer with a corresponding increase in soil and water temperatures. Loose soil can temporarily accumulate in the construction areas and, in dry weather, this soil can be dispersed as dust. In wet weather, loose soil is transported to stream by erosion and runoff, particularly in steep areas. Erosion and runoff increase the supply of soil to lowland areas, and eventually to aquatic habitats where they increase turbidity and sedimentation. This effect is amplified during high frequency and high duration flow events.

Loss of vegetation on the project site will increase the rate of transport of water to streams during rain events, which can lead to higher peak flows. Higher stream flows increase stream energy that scours stream bottoms and transport greater sediment loads farther downstream than would otherwise occur. Sediments in the water column reduce light penetration, increase water temperature, and modify water chemistry. Once deposited, sediments can alter the distribution and abundance of important instream habitats, such as pool and riffle areas. During dry weather, the physical effects of increased runoff appear as reduced ground water storage, lowered stream flows, and lowered wetland water levels.

The combination of erosion and mineral loss can reduce soil quality and site fertility in upland and riparian areas. Concurrent in-water work can compact or dislodge channel sediments, thus increasing turbidity and allowing currents to transport sediment downstream where it is eventually redeposited. Continued operations when the construction site is inundated can significantly increase the likelihood of severe erosion and contamination.

Implementation of conservation measures can reduce, but not eliminate, the risk of soil erosion and increased sediment inputs to streams, thus reducing the likelihood of impacts to stream habitats. At watershed scale, this risk is not expected to be significant because of the localized nature of the impacts and the dispersed location of project sites in multiple watersheds across the landscape.

Construction, Operation and Maintenance Activities. The effects of construction, operation, and maintenance activities are similar to those described above for pre-construction, but involve significantly greater use of heavy equipment for vegetation removal and earthwork. New impervious surfaces allow for faster and more delivery of soil and contaminants in stormwater runoff, causing impaired water quality. It is also likely that in-water work will be required to complete some activities (fish passage restoration, river, stream restoration, etc); isolation of the work area may result in the injury or death of fish due to handling.

Heavy equipment. Additional heavy equipment use compacts soil, thus reducing soil permeability and infiltration of stormwater. Use of heavy equipment also creates a risk that accidental spills of fuel, lubricants, and hydraulic fluid and similar contaminants may occur. Discharge of construction water used for vehicle washing, concrete washout, pumping for work area isolation, and other purposes can carry sediments and a variety of contaminants to the riparian area and stream.

***Pilings*.** Piles are removed using a vibratory hammer, direct pull, clam shell grab, or cutting/breaking the pile below the mudline. Vibratory pile removal causes sediments to slough off at the mudline, resulting in some suspension of sediments and, possibly, contaminants. Old and brittle piles may break under the vibrations and require use of another method. The direct pull method involves placing a choker around the pile and pulling upward with a crane or other equipment. When the piling is pulled from the substrate, sediments clinging to the piling slough off as it is raised through the water column, producing a plume of turbidity, contaminants, or both. The use of a clamshell may suspend additional sediment if it penetrates the substrate while grabbing the piling. If a piling breaks, the stub is often removed with a clam shell and crane. Sometimes, pilings are cut, broken, or driven below the mudline, and the buried section left in place. This may suspend small amounts of sediment, providing the stub is left in place and little digging is required to reach the pile. Direct pull or use of a clamshell to remove broken piles is likely to suspend more sediment and contaminants.

***In-water work*.** Although the most lethal biological effects of the proposed action on individual listed species will likely be caused by the isolation of in-water areas, lethal and sublethal effects would be greater than without isolation. In-water work area isolation is itself a conservation measure intended to reduce the adverse effects of erosion and runoff on the population. Any individual fish present in the work isolation area will be captured and released.

Post-construction Site Restoration. The direct physical and chemical effects of post-construction site restoration included as part of the proposed activities are essentially the reverse of the construction activities that go before it. Bare earth is protected by seeding, planting woody shrubs and trees, and mulching. This quickly dissipates erosive energy associated with precipitation and increases soil infiltration. It also accelerates vegetative succession necessary to restore the delivery of large wood to the riparian area and stream, root strength necessary for slope and bank stability, leaf and other particulate organic matter input, sediment filtering and nutrient absorption from runoff, and shade. Microclimate will become cooler and moister, and wind speed will decrease.

Besides revegetation, site restoration may include restoring or repairs to streambanks. Streambank restoration activities require bioengineered solutions that include vegetation and large wood as the major structural elements to increase bank strength and resistance to erosion stabilization (Mitsch 1996, WDFW *et al.* 2003). The intent of these activities is to restore riparian function and allow habitat to develop, and allow the banks to respond more favorably to hydraulic disturbance than conventional hard alternatives.

Fish Passage Restoration Effects (Category 1). BPA has divided this activity category into two sections: transportation infrastructure and profile discontinuities. Under transportation infrastructure, BPA has proposed activities to improve fish passage, prevent bank erosion, and facilitate natural sediment and wood movement. Included activities are bridge and culvert removal or replacement, bridge and culvert maintenance, and the installation of fords. The effects related to general pre-construction and construction described above apply.

In addition, the periodic maintenance of culverts and ditches will ensure fish passage and floodplain connectivity; allow for dynamic flow conditions; and maintain access to spawning, rearing and resting habitats for fish. The installation of properly designed culverts and bridges will increase the fluvial transport of sediment that is needed to form diverse habitats. The culverts will enable additional recruitment of wood to downstream reaches compared to current conditions. The new culverts will reduce the probability of catastrophic damage to aquatic habitats that is often associated with undersized culverts during extreme high flows and large movement of wood. The installation of new culverts should also increase the stability of the streambed.

Fish passage restoration activities that address profile discontinuities include: removal of a dam, water control, or legacy structures; consolidation or replacement of existing irrigation diversions; headcut and grade stabilization; removal of trash, artificial debris dams, sediment bars or terraces that block or delay fish passage; low flow consolidation; and providing fish passage at an existing facility. These activities involve significant in-water work, and general pre-construction and construction effects to habitat are discussed above. However, increases in irrigation system efficiencies will result in increased consumptive use (Upendram and Peterson 2007; Samani and Skaggs 2008; Ward and Pulido-Velazquez 2008) which will reduce flow in downstream reaches, which will impair the quality and availability of habitat.

In addition, these activities will benefit habitat by removing impediments to passage for flow, sediment, wood, and fish. Removing barriers allows access to unoccupied spawning and rearing habitat, or allows occupancy during more flow conditions. Removing or consolidating large instream structures will facilitate the release of bedload materials as the structures are notched or removed; this will cause immediate increases in suspended sediment and turbidity, and may degrade downstream habitat for a short period of time. Long-term effects include increased access to spawning, rearing and migration habitat above the site, increased gravel recruitment for spawning downstream of the diversion site, and increased floodplain connectivity and channel migration capacity.

River, Stream, Floodplain, and Wetland Restoration (Category 2). BPA proposes to fund improvements to secondary channels and wetland habitats; set back or remove existing berms, dike, and levees; protect streambanks using bioengineering methods; install habitat-forming instream structures using native materials; plant riparian vegetation; and reconstruct channels. These activities will aid in the re-establishment of hydrologic regimes, increase the area available for rearing habitat, improve access to rearing habitat, increase the hydrologic capacity of side channels, increase channel diversity and complexity, provide resting areas for fish at various levels of inundation, provide flood water attenuation, nutrient and sediment storage, and establish and augment native plant communities. General construction-related effects are described above, and will be short-term.

The long-term effects of this activity category will be improved habitat conditions, and habitat-forming processes. Increased vegetation and habitat complexity will improve thermal regulation, hydrologic and nutrient cycling, channel formation and sediment storage, floodplain development and energy dissipation. Streambank stabilization will use large wood and vegetation to improve bank strength and resistance to erosion (Mitsch 1996, WDFW *et al*. 2000). Bioengineered bank treatments develop root systems that are flexible and regenerative, and respond more favorably to hydraulic disturbance than conventional hard alternatives. This type of bank treatment and the installation on instream wood structures promote channel complexity, through pool formation, gravel and organic material retention, velocity disruption, and cover (Carlson *et al*. 1990, Bilby and Ward 1989, Beechie and Sibley 1997). Instream structures dissipate stream energy, thus reducing the erosive force of the stream on vulnerable banks, and provide areas for pools and gravel bars to form.

Excavating new channels or reconnecting historic stream channels risk failure during high flows; they could be filled with sediment, or supporting structures washed downstream. The risk of channel avulsion will be greatest during the first year after channel construction, and will decrease as riparian vegetation becomes established and floodplain roughness increases. These projects will be reviewed by the RRT to ensure strong designs to achieve restoration goals and to minimize the risk of failure. Also, all projects that involve streambank excavation resulting in bare earth exposure must include erosion controls, revegetation plans, and riparian fencing if appropriate. All in-water construction will occur during the site-specific, in-water work windows to minimize effects to spawning and migration. Despite implementation of minimization measures, these projects will likely cause minor pulses of suspending sediment which could result in localized areas of fine sediment deposition.

Invasive and Non-native Plant Control (Category 3). BPA proposes to fund activities to control or eliminate non-native, invasive plant species that compete with or displace native plant communities. The goal of this activity category is to maximize habitat processes and functions through diverse communities of native plants. This was the most common activity category funded under HIP II; 35 percent of all project activities funded and implemented were vegetation management projects. Under the HIP II consultation between BPA and NMFS, a total of 23,887 acres were treated with herbicides (primarily eastern Oregon, eastern Washington, and Idaho), and of these, 3,186 acres were within riparian areas. The herbicides and adjuvants that are proposed for use under the HIP III proposed action are provided in Table 2.1 in BPA's BA.

BPA's proposed use of chemicals to control non-native plants is designed to minimize the risk of adverse effects on aquatic habitat. Chemical (including fuel) transport, storage, and emergency spill plans will be implemented to reduce the risk of an accidental spill of fuel or chemicals. A catastrophic spill would have the potential for significant adverse effects to water quality. No spills occurred during the implementation of the HIP I or HIP II consultation between BPA and NMFS and thus we consider the risk of an accidental spill to be low as long as conservation measures included in the proposed action and reiterated in this BO are followed strictly.

In Appendix B of the BA, BPA provided an environmental fate and transport analysis to evaluate the risk of effects to water quality from this vegetation management program. In addition, NMFS has recently analyzed the effects of these activities using the similar active ingredients and conservation measures for proposed Forest Service and BLM invasive plant control programs (NMFS 2010, NMFS 2012). The types of plant control actions analyzed here are a conservative (*i.e.*, less aggressive) subset of the types of actions considered in those analyses, and the effects presented here are summarized from those analyses. Each type of treatment is likely to affect fish and aquatic macrophytes through a combination of pathways, including disturbance, chemical toxicity, dissolved oxygen and nutrients, water temperature, sediment, instream habitat structure, forage, and riparian and emergent vegetation (Table 8 below).

Table 13. Potentail Pathways of Effects of Invasive and Non-Native Plant Control

	Pathways of Effects							
Treatment Methods	**Disturbance***	**Chemical toxicity**	**Dissolved oxygen and nutrients**	**Water temperature**	**Fine sediment and turbidity**	**Instream habitat structure**	**Forage**	**Riparian and emergent vegetation**
Manual	X					X	X	X
Mechanical	X			X	X		X	X
Biological				X	X			
Herbicides		X	X	X	X	X	X	X

*****Stepping on redds, displacing fish, interrupting fish feeding, or disturbing banks.

Mechanical and herbicidal treatments of invasive plant species in riparian areas are not likely to substantially decrease shading of streams. Significant shade loss is likely to be rare, occurring primarily from treating streamside knotweed and blackberry monocultures, and possibly from cutting streamside woody species (tree of heaven, scotch broom, etc.). Most invasive plants are understory species of streamside vegetation that do not provide the majority of streamside shade and furthermore and will be replaced by planted native vegetation or vegetation. The loss of shade would persist until native vegetation reaches and surpasses the height of the invasive plants that were removed. Shade recovery may take one to several years, depending on the success of invasive plant treatment, stream size and location, topography, growing conditions for the replacement plants, and the density and height of the invasive plants when treated. However, short-term shade reduction is likely to occur due to removal of riparian weeds, which could slightly affect stream temperatures or dissolved oxygen levels. Effects pathways are described in detail below.

Manual and mechanical treatments are likely to result in mild restoration construction effects (discussed above). Hand pulling of emergent vegetation is likely to result in localized turbidity and mobilization of fine sediments. Treatment of knotweed and other streamside invasive species with herbicides (by stem injection or spot spray) or heavy machinery is likely to result in short-term increases in fine sediment deposition or turbidity when treatment of locally extensive streamside monocultures occurs. Thus, these treatments are likely to affect a definite, broad area, and to produce at least minor damage to riparian soil and vegetation. In some cases, this will decrease stream shade, increase suspended sediment and temperature in the water column, reduce organic inputs (*e.g.*, insects, leaves, woody material), and alter streambanks and the composition of stream substrates. However, these circumstances are likely to occur only in rare circumstances, such as treatment of an invasive plant monoculture that encompasses a small stream channel. This effect would vary depending on site aspect, elevation, and amount of topographic shading, but is likely to decrease over time at all sites as shade from native vegetation is reestablished.

Herbicide applications. In NMFS' HIP III BO they identified three scenarios for the analysis of herbicide application effects: (1) Runoff from riparian application; (2) application within perennial stream channels; and (3) runoff from intermittent stream channels and ditches. All three scenarios are relevant to Oregon chub and bull trout. Herbicides 2,4-D and triclopyr, which are proposed, as well as many other herbicides and pesticides are detected frequently in freshwater habitats within the four western states where listed fish are distributed (NMFS 2011).

Spray and vapor drift are important pathways for herbicide entry into aquatic habitats. Several factors influence herbicide drift, including spray droplet size, wind and air stability, humidity and temperature, physical properties of herbicides and their formulations, and method of application. For example, the amount of herbicide lost from the target area and the distance the herbicide moves both increase as wind velocity increases. Under inversion conditions, when cool air is near the surface under a layer of warm air, little vertical mixing of air occurs. Spray drift is most severe under these conditions, since small spray droplets will fall slowly and move to adjoining areas even with very little wind. Low relative humidity and high temperature cause more rapid evaporation of spray droplets between sprayer and target. This reduces droplet size, resulting in increased potential for spray drift. Vapor drift can occur when herbicide volatilizes. The formulation and volatility of the compound will determine its vapor drift potential. The potential for vapor drift is greatest under high air temperatures and low humidity and with ester formulations. For example, ester formulations of triclopyr are very susceptible to vapor drift, particularly at temperatures above 80°F. When temperatures go above 75˚F, 2,4-D ester chemicals evaporate and drift as vapor. Even a few days after spraying, ester-based phenoxytype herbicides still release vapor from the leaf surface of the sprayed weed (DiTomaso *et al.*2006).

When herbicides are applied with a sprayer, nozzle height controls the distance a droplet must fall before reaching the weeds or soil. Less distance means less travel time and less drift. Wind velocity is often greater as height above ground increases, so droplets from nozzles close to the ground would be exposed to lower wind speed. The higher that an application is made above the ground, the more likely it is to be above an inversion layer that will not allow herbicides to mix with lower air layers and will increase long distance drift. Several proposed conservation measures address these concerns by ensuring that herbicide treatments will be made using ground equipment or by hand, under calm conditions, preferably when humidity is high and temperatures are relatively low. Ground equipment reduces the risk of drift, and hand equipment nearly eliminates it.

Surface water contamination with herbicides can occur when herbicides are applied intentionally or accidentally into ditches, irrigation channels or other bodies of water, or when soil-applied herbicides are carried away in runoff to surface waters. Direct application into water sources is generally used for control of aquatic species. Accidental contamination of surface waters can occur when irrigation ditches are sprayed with herbicides or when buffer zones around water sources are not wide enough. In these situations, use of hand application methods will greatly reduce the risk of surface water contamination.

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

Groundwater contamination is another important pathway. Most herbicide groundwater contamination is caused by "point sources," such as spills or leaks at storage and handling facilities, improperly discarded containers, and rinses of equipment in loading and handling areas, often into adjacent drainage ditches. Point sources are discrete, identifiable locations that discharge relatively high local concentrations. Proposed conservation measures minimize these concerns by ensuing proper calibration, mixing, and cleaning of equipment. Non-point source groundwater contamination of herbicides is relatively uncommon but can occur when a mobile herbicide is applied in areas with a shallow water table. Proposed conservation measures minimize this danger by restricting the formulas used, and the time, place and manner of their application to minimize offsite movement.

Piling Removal (Category 4). BPA proposes to fund projects that may include piling removal. Turbidity generated during piling removal will be temporary will only extend a few meters downstream (the distance will depend on flow and size fraction of streambed material). If sediment in the vicinity of a piling is contaminated, or if the piling had been treated with creosote, PAH will be released during removal, particularly if the piling breaks. To minimize the potential for adverse effects, BPA has imposed measures that will limit the extent of sediment plumes or surface debris and contaminant exposure. The potential long-term benefits of piling removal include reduced predation from piscivorous birds and fish; reduced ongoing contamination from treated pilings; and increased area for benthic production and juvenile salmon rearing.

Road and Trail Erosion Control, Maintenance, and Decommissioning (Category 5). BPA proposes to fund projects that include activities that maintain or decommission roads and trails with the goal of eliminating or reducing erosion and mass wasting of sediment. Roads and their drainage systems cause accelerated runoff of sediment. However, with proper maintenance and design, the amount of sediment that enters a stream from roads and trails can be small, infrequent, and of short duration.

Asphalt used during road resurfacing leach hydrocarbons, which can be toxic if it reaches a stream. Maintenance activities in this category would be patches to small road segments applied during dry conditions. Therefore, the potential for hydrocarbons impacting water quality is very low.

Likewise, dust abatement programs can affect water quality if not applied properly. The most common dust abatement compounds are calcium chloride, magnesium chloride and ligninsulfonates (oil-based products cannot be used in this program). Proper implementation of conservation measures (no application within 25 feet of a water body, or before or during rainfall) will minimize the risk of these chemicals reaching streams or negatively affecting riparian vegetation. Thus the risk of effects to water quality from dust abatement activities is insignificant.

Road maintenance activities are expected to benefit stream channels because these activities will minimize the risk of catastrophic road failure, and mass wasting of soil into stream channels, and will minimize the risk of more minor types of erosion and sediment delivery to channels. Road obliteration and decommissioning will also benefit streams because nearly all sediment delivery from road surfaces should be eliminated from those areas. Long-term benefits include reduced risk of washouts and landslides and improved fish passage by removing fish barriers caused by roads. Watershed conditions will be improved as road densities are reduced and riparian areas at old road crossings are revegetated. Floodplain connectivity may also be improved when the road had been built in the floodplain. Decommissioning a road reconnects natural habitat, and allows for the recolonization of native vegetation.

In-channel Nutrient Enhancement (Category 6). This category includes the addition of salmon carcasses, processed fish cakes or placement of inorganic fertilizers into stream channels.

In-channel nutrient supplementation may introduce piscine diseases into streams as well as the chemicals applied that are used to control those diseases, and may also introduce too many nutrients to stream channels causing algal blooms or other eutrophication problems downstream (Compton *et al*. 2006). Because of the lack of science associated with the ecosystems effects from nutrient enhancements, BPA-funded nutrients enhancements will follow measures to minimize the risk of adverse effects. For example, projects will not place carcasses in naturally oligotrophic systems where nutrient levels would be natural low, and they will not add nutrients to eutrophic systems where nutrient levels are anthropogenically elevated. The benefit of nutrient supplementation includes the delivery of marine nutrients into freshwater that will enhance primary and secondary production, thus enhancing the prey base for juvenile fish (Reeves *et al*. 1991, Ward *et al*. 2003).

Irrigation and Water Delivery/Management Actions (Category 7). BPA proposes to fund the following activities in this category: convert water delivery system to drip or sprinkler irrigation; convert water conveyance from an open ditch to a pipeline or line-leaking ditch/canal; convert from instream diversion to a groundwater well for primary water source; install or replace return flow cooling systems; install irrigation water siphon beneath the waterway; install livestock water facilities; and; maintain, upgrade, or install a new fish screen. The purpose of all these activities is to increase the amount of instream flow and to improve riparian function through irrigation efficiencies. Less water is needed to irrigate crops via drip or sprinkler irrigation than via flood irrigation because less water is lost through evaporation, and the application is more precise. The delivery of water can be controlled to meet the needs of plants with less waste. Drip irrigation technology can also incorporate agricultural wastewater and water from retention/detention basins, serving to further reduce the amount of water that must be withdrawn from streams (Trooien *et al*. 2000, Venhuizen 1998). Drip and sprinkler irrigation can also reduce the amount of soil erosion, and nutrient and pesticide runoff that is normally associated with furrow irrigation systems (Ebbert and Kim 1998).

However, converting from flood to drip or sprinkler irrigation may enable a water user to conduct more irrigation events with less water applied per event. This could increase the amount of water consumptively used per acre of irrigation (Upendram and Peterson 2007; Ward and Pulido-Velazquez 2008). Conversion from flood to drip irrigation could increase consumptive use by 22% to 29% (Ward and Pulido-Velazquez 2008) and conversion from flood to sprinkler irrigation could increase consumptive use by 24% to 39% (Upendram and Peterson 2007). Assuming a consumptive use of 1.45 acre feet per acre for flood irrigation (Lemhi Decree), an acre converted from flood irrigation to drip or sprinkler irrigation could reduce the amount of water flowing downstream to the ocean by 0.32 acre feet to 0.56 acre feet.

Irrigation water delivery via pipes or lined ditches/canals also uses less water, although the reduction in water loss is less than described above. The replacement of canals with pipelines will reduce the amount of herbicides and fertilizers entering streams, as these substances can easily drain to streams through open ditch networks in agricultural fields (Louchart *et al*. 2001). If these activities require instream construction the general effects of construction on stream and riparian habitat discussed above are applicable.

Fisheries, Hydrologic, and Geomorphologic Surveys (Category 8). BPA will fund activities that collect habitat information; collect data on fish presence, abundance, and habitat use; and conservation, protection and rehabilitation opportunities or effects. NMFS expects these activities could cause minor erosion and sedimentation, and minor compaction and disturbance to the streambed. Some riparian vegetation may be trampled, and excavated material from cultural resource excavation may contribute sediment to streams and increase turbidity. Implementation of conservation measures and the limited extent of this work will minimize the potential for effects to stream channels. The amount of soil disturbed will be negligible.

6.2 Effects to Bull Trout

Potential effects on bull trout may occur as the result of multiple activities described in the proposed action; these effects are described below by categories of activities.

Each project will be reviewed by BPA staff to determine whether the proposed work is covered under the HIP III consultation. This will include a review of whether the proposed work incorporates the appropriate general and species-specific conservation measures and project design standards that have been designed to reduce or avoid impacts to listed species. Projects which cannot meet these standards or that have the likelihood of causing effects beyond the scope of the analysis within this Biological Opinion will require a separate ESA Section 7 consultation.

The biological effects included as part of the proposed action are primarily the result of physical and chemical changes in the environment caused by activities funded under the HIP III program. These effects are complex, and vary in magnitude and severity between individuals, local populations, core areas, and DPSs. Our analysis of effects at the bull trout local population level is not considered in detail because projects are initiated at the discretion of non-federal applicants and site-specific locations and types of projects are not readily predictable.

We do not expect that all projects implemented under the HIP III programmatic within the range of bull trout will have adverse effects. 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 project, the nature of bull trout that use the site, the ability of fish to escape to unaffected areas, the type of habitat at the project 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. In other circumstances, such as projects that occur in spawning and rearing habitat, the short-term effects are likely to be adverse.

Preconstruction Activities. The primary habitat effect from preconstruction activities is a temporary and localized increased in turbidity and suspended sediment. Turbidity may have beneficial or detrimental effects on fish, depending on the intensity, duration, and frequency of exposure (Newcombe and MacDonald 1991). Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are presumably adapted to high pulse exposures. Adults and larger juvenile salmonids may be little affected by high concentrations of suspended sediments that occur during storm and snowmelt runoff (Bjorn and Reiser 1991) although these events may produce behavioral effects, such as gill flaring and feeding changes (Berg and Northcote 1985).

Deposition of fine sediments reduces egg incubation success (Bell 1991), interferes with primary and secondary production (Spence *et al*. 1996), and degrades cover for juvenile salmonids (Bjornn and Reiser 1991). Chronic, moderate turbidity can harm new-emerged salmonid fry, juveniles, and even adults by causing physiological stress that reduces feeding and growth, and increases basal metabolic requirements (Redding *et al*. 1987, Lloyd 1987, Bjornn and Reiser 1991, Servizi and Martens 1991, Spence *et al*. 1996). Juveniles avoid chronically turbid streams, such as glacial streams or those disturbed by human activities, unless those streams must be traversed along a migration route (Lloyd *et al*. 1987). Older salmonids typically move laterally and downstream to avoid turbidity plumes (McLeay et al. 1984, 1987, Sigler *et al*. 1984, Lloyd 1987, Scannel 1988, Servizi and Martens 1991).

Fish exposed to moderately high turbidity levels in natural settings are able to feed, although at a lower rate and with increased energy expenditure due to a more active foraging strategy. Over a period of several days or more, reduced feeding resulting from increased turbidity can translate into reduced growth rates. Turbidity also limits fish vision which can interfere with social behavior (Berg and Northcote 1985), foraging (Gregory and Northcote 1993, Vogel and Beauchamp 1999) and predator avoidance (Miner and Stein 1996, Meager *et al*. 2006). This can have varying effects on fish growth and survival, depending on a range factors such as ambient light levels and depth; relative visual sensitivities of predators and prey; and non-visual sensory abilities. Conversely, salmon may benefit from increased turbidity; predation on salmonids may be reduced in water turbidity equivalent to 23 Nephalometric Turbidity Units (NTU) (Gregory 1993, Gregory and Levings 1998) which may improve survival.

Therefore, as a result of preconstruction activities, fish will be exposed to elevated turbidity and suspended sediment. Some juvenile bull trout may decrease feeding, experience increased stress, or may be unable to use the action area, depending on the severity of the increase in suspended sediments.

Construction, Operation and Maintenance Activities. All of the activity categories require some level of construction, operation, and/or maintenance adjacent to, or within, streams or rivers with listed fish. These activities can have direct biological effects on individual bull trout by altering development, bioenergetics, growth and behavior. Actions that increase flows can disturb gravel in bull trout redds and can also agitate or dislodge developing young, which can impair survival. Similarly, actions that result in water quality changes can result in altered behavior and death. Actions that reduce subsurface or surface flows, reduce shade, deposit silt in streams, or otherwise reduce the velocity, temperature, or oxygen concentration of surface water as it cycles through a redd can adversely affect the survival, timing and size of emerging fry (Warren 1971). Once bull trout arrive at a spawning area, their successful reproduction is dependent on the same environmental conditions that affect survival of embryos in the redd.

BPA has imposed conservation measures to minimize the risk of direct or indirect impact to redds. If any redds are impacted, scope of the impacted will be very limited in space and time, and is not expected to affect population viability.

Heavy Equipment. Heavy equipment used in spawning areas will disturb or compact gravel and other channel materials, making it harder for fish to excavate redds and decrease the oxygen concentration in existing redds. Heavy equipment used in streams in any occupied habitat may inhibit fish passage, or kill or injure individual fish; because of the scale of the program (HIP II had 114 construction projects with in-water work from 2008 through March of 2012 in the Columbia Basin) this effect is not expected to be significant at the population scale. Cederholm *et al*. (1997) recommend that heavy equipment work should be performed from the bank and that work within bedrock or boulder/cobble bedded channels should be viewed as a last resort. They also recommended using equipment such as spider harvesters and log loaders that are less disturbing to the streambed. BPA has incorporated similar measures into their proposed action. Bull trout generally spawn in high elevation headwaters of streams and based on the locations of projects previously funded through the BPA's HIP, we anticipate few HIP III funded actions will occur in spawning and rearing habitats. As suspended fine sediment settles out downstream from the construction areas, minor increases in stream substrate embeddedness occurs. Suttle *et al*. (2004) report that increases in fine sediments in stream substrates can decrease productivity and habitat quality for juvenile salmonids. Waters (1995) described how elevated fine sediment in streams impair both physical and biological processes; significant increases in fine sediment reduces interstitial spaces between substrate particles, leads to shifts in invertebrate community structure, fills pools, and can entomb redds. In such cases, eggs are smothered, and prey availability for juveniles is reduced.

When heavy equipment is operating within a stream or in a riparian area, there is always the potential for fuel or other contaminant spills. Operation of bulldozers, excavators, and other equipment requires the use of fuel and lubricants which, if spilled, can injure or kill aquatic organisms. Petroleum-based contaminants such as fuel, oil and some hydraulic fluids contain PAHs, which can be acutely toxic to salmonids at high levels of exposure and can cause acute and chronic sublethal effects to aquatic organisms (Neff 1985). BPA will require an erosion and pollution control plan for all projects that require soil disturbance; this includes all projects using heavy equipment near streams and rivers. This measure will minimize the risk of a hazardous spill, and if a spill occurs, will minimize the risk of it reaching the water. BPA reports from the implementation of HIP I and HIP II demonstrate the effectiveness of the conservation measures; a spill has never been reported. Therefore, the risk of a spill during the implementation of HIP III is low, and no population level effects to bull trout or Oregon chub from hazardous spills are expected from the implementation of this program.

Pilings**.** Turbidity from piling removal is temporary and confined to the area close to the activity. Given the preferred habitat of bull trout, we anticipated few if any individuals would be adversely affected by this activity category. The proposed requirements for completing the work during the preferred in-water work window will further minimize the effects of turbidity on these two species.

In-water work. Adverse effects to listed fish from in-water work are generally avoided and minimized through use of: (1) In-water work isolation strategies that often involve capture and release of trapped fish, and (2) performing the work during work windows when the fewest individuals of a species are present.

Direct effects on fish from work area isolation and relocation include mechanical injury during capture, holding, or release, and potential horizontal transmission of disease and pathogens and stress-related phenomena. Stress approaching or exceeding the physiological tolerance limits of individual fish can impair reproductive success, growth, resistance to infectious diseases, and survival (Wedemeyer *et al*. 1990). If electrofishing is used to salvage fish, it will add to increased stress loads. Harmful effects of electrofishing are detailed by Snyder (2003) and include internal and external hemorrhage, fractured spines, and death. The primary contributing factors to stress and death from handling are differences in water temperatures (between the river and the holding tank), dissolved oxygen concentrations, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18ºC or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps if the traps are not emptied on a regular basis. Debris buildup at traps can also kill or injure fish if the traps are not monitored and cleared on a regular basis. Although some listed bull trout may die from electroshocking, fish will only be exposed to the stress caused by work area isolation once, and the fish relocation is only expected to last a few hours for each project. The risk of injury or death to individual fish would be greater if construction occurred without work area isolation.

It is unlikely that individual adult or embryonic bull trout will be adversely affected by the proposed action because all in-water construction will occur during in-water work periods before spawning season occurs and after fry have emerged from gravel. However, in some locations, adult bull trout may be present (either due to migration, or residency) during part of the in-water work, and fry may still be emerging from the gravel.

In contrast to migratory adult and embryonic fish that will likely be absent during implementation of projects, resident adults and juvenile bull trout may be present at some portion of the restoration sites, particularly those located in spawning and rearing habitat, and those located where bull trout exhibit the resident life form. At in- or-near-water construction projects (*i.e.*, stream crossing replacement projects, channel reconstruction/relocation, *etc.),* some direct effects of the proposed actions are likely to be caused by the isolation of in-water work areas, although other combined lethal and sublethal effects would be greater without the isolation. An effort will be made to capture all bull trout (all life stages) present within the work isolation area and to release them at a safe location, although some juveniles will likely evade capture and later die when the area is dewatered. Fish that are captured and transferred to holding tanks can experience trauma if care is not taken in the transfer process. Fish can also experience stress and injury from overcrowding in traps, if the traps are not emptied on a regular basis. The primary contributing factors to stress and death from handling are: (1) water temperatures difference between the river and holding buckets; (2) dissolved oxygen conditions; (3) the amount of time that fish are held out of the water; and (4) physical trauma. Stress from handling increases rapidly if water temperature exceeds 18ºC (64ºF), or if dissolved oxygen is below saturation. Debris buildup at traps can also kill or injure fish if the traps are not monitored and cleared on a regular basis. PDC related to the capture and release of fish during work area isolation will avoid most of these consequences, and ensure that most of the resulting stress is short-lived (Portz 2007).

Juvenile fish compensate for, or adapt to, some of these disturbances so that they continue to perform necessary physiological and behavioral functions, although in a diminished capacity. However, fish that are subject to prolonged, combined, or repeated stress by the effects of the actions, combined with poor environmental baseline conditions, will likely suffer metabolic costs that are sufficient to impair their rearing, migrating, feeding, and sheltering behaviors and thereby increase the likelihood of injury or death. Because juvenile fish in the project areas are already subject to stress as a result of degraded watershed conditions, it is likely that a small number of those individuals will die due to increased competition, disease, and predation, and reduced ability to obtain food necessary for growth and maintenance (Moberg 2000; Newcombe and Jensen 1996; Sprague and Drury 1969).

Because juvenile-to-adult survival rate for bull trout is thought to be quite low, the effects of a project would have to occur to a large proportion of juvenile fish in a single area or local population before those effects would be equivalent even to a single adult, and would have to kill many times more than that to affect the abundance or productivity of the entire local population over a full life cycle. Moreover, because the geographic area that will be affected by the proposed programmatic action is so large for bull trout, the small numbers of juvenile fish that are likely to be killed are spread out across many local populations. The adverse effects of each proposed individual action will be too infrequent, short-term, and limited to kill more than a very small number of juvenile bull trout at a particular site or even across the range of a single local population, much less when that number is even partly distributed among all local populations within the action area. Thus, the proposed action will simply kill too few fish, as a function of the size of the affected populations and the habitat carrying capacity after each action is completed, to meaningfully affect the primary attributes of abundance or population growth rate for any single local population of bull trout.

The remaining population attributes are within-population spatial structure, a characteristic that depends primarily on spawning group distribution and connectivity, and diversity, which is based on a combination of genetic and environmental factors (McElhany *et al.* 2000). Because the proposed actions are only likely to have short-term adverse effects to spawning sites, if any, and in the long-term will improve spawning habitat attributes, they are unlikely to adversely affect spawning group distributions or within-population spatial structure. Actions that restore fish passage will improve population spatial structure. Similarly, because the proposed action does not affect basic demographic processes through human selection, alter environmental processes by reducing environmental complexity, or otherwise limit a population's ability to respond to natural selection, the action will not adversely affect population diversity.

At the species level, biological effects are synonymous with those at the population level or, more likely, are the integrated demographic response of one or more subpopulations (McElhany *et al.* 2000). Because the likely adverse effects of any action funded or carried out under this opinion will not adversely affect the overall population characteristics of any ESA-listed fish population, the proposed actions also will not have any a measurable effect on species-level abundance, productivity, or ability to recover bull trout across its range.

NMFS' HIP III BO (NMFS 2013) assumed up to 150 projects per year may be funded or carried out under BPA's HIP III programmatic based on the BA and information from the HIP I and II consultations between BPA and NMFS. For the purposes of our analysis, and for consistency between our HIP III biological opinion and NMFS', we will assume the same. Based on information from the HIP I and II consultations, which included many of the same project activity categories as the HIP III proposed action, at most half of the predicted 150 annual projects under HIP III will involve near or in-water work (n=75).

The past pattern of project activities (HIP I and II) has been used to infer the expected level of activity under the HIP III proposed action. Given the general locations of projects implemented under BPA's HIP program from 2003 to 2012, we estimate that 50 of the estimated 75 near or in-stream projects implemented annually under HIP III could occur within the range of the bull trout (SR or FMO habitat). While we expect the majority of ESA-listed fish captured as part of these projects would be salmon and steelhead, a portion of these fish are likely to be bull trout.

In the absence of empirical data, and for programmatic assessments where there is uncertainty as to where projects will be implemented across the action area, we often rely on professional judgment to develop formulas that help predict the likelihood of a listed species occurrence and rate of occurrence within a project area. Given that bull trout are an apex predator and generally persist in much lower abundance than other sympatric salmonids such as salmon, steelhead and other species of trout, we believe bull trout would comprise a relatively low percentage of the overall catch of salmonids within a given project area; probably somewhere between three and four percent for migratory populations, although there will be wide variation between project locations. Areas where resident bull trout populations exist may comprise a slightly higher proportion of the overall number of salmonids, somewhere near ten percent or possibly higher in some cases. While the overall percentage of bull trout to other salmonids may increase in SR habitat during summer and fall, the converse is true for FMO habitats during this time period because of warmer water temperatures and generally poorer water quality. Because the ratio of bull trout to other salmonids varies considerably across their range, and to err conservatively, we estimate a ratio of bull trout to salmon and steelhead of .05 to 1 (i.e., bull trout are estimated to comprise on average five percent of all salmonids captured during isolation and capture efforts). Therefore based on NMFS' anticipated capture of 100 salmon and steelhead per in-stream project as described previously, we anticipate an average capture of five bull trout for each project within the range of bull trout where isolation and dewatering could be required.
We anticipate injury or mortality to five percent of the fish that are captured and released, with the remainder (95 percent) likely to survive with no long-term adverse effects (McMichael *et al*.

1998; Cannon 2012). Thus, we anticipate up to 250 individual bull trout will be captured on average per year (estimated 50 in-stream projects within the range of bull trout x 5 bull trout captured per project on average) of which an estimated 13 (rounded up from 12.5) individual bull trout (.05 percent x 250 fish) will be injured or killed per year as a result of fish capture necessary to isolate in-water construction areas.

Overall, the effects of work area isolation on the abundance of bull trout in the Columbia River IRU are likely to be small. Almost all of these fish are anticipated to be juveniles, but a small number of adults could possibly be captured. For utility of operation we will not distinguish between take of juveniles and take of adults but will assume that most (95-99%) of the capture would be juveniles.

Post-construction Site Restoration. Most direct and indirect effects of proposed streambank restoration activities are the same as those for general construction discussed above, and these activities will follow the conservation measures for general construction, as applicable.

Fish Passage Restoration (Category 1 Activities). Activities in this category will provide a net long-term beneficial effect to ESA-listed fish. Improved habitat conditions and fish passage will provide greater access to spawning and rearing habitat, less energy expenditure in movement, greater access to diverse habitats that fosters the development and maintenance of locally adapted populations. Negative effects listed fish are related to general construction activities. These effects will be short-term, and will not affect bull trout at the population scale.

River, Stream, Floodplain, and Wetland Restoration (Category 2 Activities). Activities in this category will improve access to off-channel and floodplain habitats, improve the ecological function of streambanks, improve hydrological regimes, improve channel diversity and complexity, and provide resting and rearing areas for fish at a variety of flows. Greater diversity of habitat, and the presence and abundance of large wood is positively related to growth, abundance, and survival of juvenile salmonids (Spalding *et al*. 1995, Fausch and Northcote 1992). Similarly, greater access to rearing habitat and improved rearing conditions through improved habitat complexity will contribute to increased distribution and abundance of juvenile salmonids (Beechie and Sibley 1997, Spalding *et al*. 1995). Instream complexity will provide overhead cover for both adults and rearing juveniles, reducing predation risk. Negative effects related to this activity are primarily related to construction and are discussed above. In addition, there is a potential for negative effects associated with the construction of new channels. Newly-constructed channels may fill during subsequent high flows, and the risk of channel failure, avulsion, or accelerated bank erosion is greatest the first year following construction. Sediment pulses from channel failures or increased erosion may affect migrating adults and rearing juveniles; however, the effect is likely minor and short term. Project design review and adherence to fish work windows will minimize the risk to vulnerable life stages.

The overall effect of this proposed activity category will be beneficial, with improvements expected to productivity, survival, spatial structure, and diversity at the population scale where projects are implemented.

Invasive and Non-native Plant Control (Category 3 Activities). Activities in this category are designed to control or eliminate non-native, invasive plant communities where a benefit to habitat processes and functions are possible. Methods of plant control include both physical control and the use of herbicides. Effects of plant management using physical controls may include effects similar to general construction. Conservation measures such as the restriction to ground-based application methods and spot treatment will minimize the risk of effects. If a catastrophic spill of fuels or chemicals reaches water with listed fish, the potential for mortality to those fish is high. No accidental spill of fuels or chemicals has occurred with HIP I or HIP II, and with continued vigilant implementation of proposed conservation measures, that trend is expected to continue under HIP III.

When used according to the EPA label and the proposed conservation measures, BPA concluded that because of the uncertainty associated with the effectiveness of the conservation measures, it is reasonably likely that chemicals will reach streams with listed fish. BPA asserts that there may be some sub-lethal effects to listed fish as a result of herbicide and adjuvant exposure. It is reasonable to expect that effects will include direct and indirect mortality, an increase or decrease in growth, changes in reproductive behavior, reduction in number of eggs produced, fertilized or hatched, developmental abnormalities, reduction in ability to osmoregulate or adapt to salinity gradients, reduced ability to respond to stressors, increase in susceptibility to disease and predation, and changes in migratory behavior. The consequence of these effects is reasonably likely to result in reduced survival, reproductive success and/or migration.

BPA proposes to fund projects that use 2,4-D and triclopyr as well as many other herbicides that are detected frequently in freshwater habitats within the four western states where listed salmonids are distributed (NMFS 2011b). Stream margins often provide shallow, low-flow conditions, have a slow mixing rate with mainstem waters, and are the site at which subsurface runoff is introduced. Juvenile bull trout use low-flow areas along stream margins. As juveniles grow, they migrate away from stream margins and occupy habitats with progressively higher flow velocities. Nonetheless, stream margins continue to be used by older salmonids for a variety of reasons, including nocturnal resting, summer and winter thermal refuge, predator avoidance, and flow refuge. It is these stream margin habitats that the potential for exposure of the herbicides to fish is the greatest.

Lower exposures are likely when herbicide is applied to smaller areas, when intermittent stream channel or ditches are not completely treated, or when rainfall occurs more than 24 hours after application. Under the proposed action, some formulas of herbicide can be applied within the bankfull elevation of streams, in some cases up to the water's edge. Any juvenile fish in the margins of those streams are reasonably likely to be exposed to herbicides as a result of overspray, inundation of treatment sites, percolation, surface runoff, or a combination of these factors. Overspray and inundation will be minimized through the use of dyes or colorants.

Herbicide toxicity. Herbicides included in this activity were selected due to their low to moderate aquatic toxicity to listed salmonids. The risk of adverse effects from the toxicity of herbicides and other compounds present in formulations to listed aquatic species is mitigated by reducing stream delivery potential by restricting application methods. Only aquatic labeled herbicides are to be applied within wet stream channels. Aquatic glyphosate and aquatic imazapyr can be applied up to the waterline using spot spray or hand selective application methods in both perennial and intermittent channels. Triclopyr TEA and 2,4-D amine can be applied up to the waterline, but only using hand selective techniques. The associated application methods were selected for their low risk of contaminating soils and subsequently introducing herbicides to streams. However, direct and indirect exposure and toxicity risks are inherent in some application scenarios.

Generally, herbicide active ingredients have been tested on only a limited number of species and mostly under laboratory conditions. While laboratory experiments can be used to determine acute toxicity and effects to reproduction, cancer rates, birth defect rates, and other effects to fish and wildlife, laboratory experiments do not typically account for species in their natural environments and little data is available from studies focused specifically on the listed species in this opinion. This leads to uncertainty in risk assessment analyses. Environmental stressors increase the adverse effects of contaminants, but the degree to which these effects are likely to occur for various herbicides is largely unknown.

NMFS (NMFS 2010, NMFS 2012) analyzed the effects of herbicide applications to various representative groups of species for each proposed herbicide. The effects of herbicide applications using spot spray, hand/select, and broadcast spray methods were evaluated under several exposure scenarios: (1) runoff from riparian (above HWM) application along streams, lakes and ponds, (2) runoff from treated ditches and dry intermittent streams, and (3) application within perennial streams (dry areas within channel and emergent plants). The potential for herbicide movement from broadcast drift was also evaluated. Herbicide delivery to surface water is likely to result in mortality to fish during incubation, or lead to altered development of embryos. Stehr *et al*. (2009) found that the low levels of herbicide delivered to surface waters are unlikely to be toxic to the embryos of ESA-listed salmon, steelhead and trout. However, mortality or sub-lethal effects to juveniles are likely to occur; these effects include reduced growth and development, decreased predator avoidance, or other modified behaviors. Herbicides are likely to also negatively impact the food base for listed salmonids and other fish, which includes terrestrial organisms of riparian origin, aquatic macroinvertebrates and forage fish.

Adverse effect threshold values for each species group were defined as either 1/20th of the LC50 value for listed salmonids, 1/10th of the LC50 value for non-listed aquatic species, or the lowest acute or chronic "no observable effect concentration," whichever was lower, found in Syracuse Environmental Research Associates, Inc. risk assessments that were completed for the USFS. Generally, effect threshold values for listed salmonids were lower than values for other fish species groups. In the case of sulfometuron-methyl, threshold values for fathead minnow were lower than salmonid values, so threshold values for minnow were used to evaluate effects to listed fish.

Data on toxicity to wild fish under natural conditions are limited and most studies are conducted on lab specimens. Adverse effects could be observed in stressed populations of fish, and it is less likely that effects would be noted in otherwise healthy populations of fish. Chronic studies or even long-term studies on fish egg-and-fry are seldom conducted. Risk characterizations for both terrestrial and aquatic species are limited by the relatively few animal and plant species on which data are available, compared to the large number of species that could potentially be exposed. This limitation and consequent uncertainty is common to most if not all ecological risk assessments. Additionally, in laboratory studies, test animals are exposed to only a single chemical. In the environment, humans and wildlife may be exposed to multiple toxicants simultaneously, which can lead to additive or synergistic effects.

Given their long residency period and use of freshwater, estuarine, and nearshore areas, juveniles and migrating adults have a high probability of exposure to herbicides that are applied near their habitats. The risk of exposure from herbicides applied under HIP III is low; however, in both HIP I and HIP II, this is the most commonly implemented activity category, and over 23,000 acres were treated with herbicides in the Columbia Basin under HIP II. Therefore, there is a risk of exposure to herbicides as a consequence of HIP III, and negative effects to listed salmonids (including bull trout) would be a consequence of that exposure. Because of the large size of the action area relative to the area treated with herbicides, it is unlikely that the effects would be measureable at the population or DPS scale.

Summary. The proposed conservation measures, including limitations on the herbicides, adjuvants, carriers, handling procedures, application methods, drift minimization measures, and riparian buffers, will greatly reduce the likelihood that significant amounts of herbicide will be transported to aquatic habitats, although some herbicides are still likely to enter streams through aerial drift, in association with eroded sediment in runoff, and dissolved in runoff, including runoff from intermittent streams and ditches. Some individual fish are likely to be negatively impacted as a consequence of that exposure. The indirect effects or long-term consequences of invasive, non-native plant control will depend on the long-term progression of climatic factors and the success of follow-up management actions to exclude undesirable species from the action area, provide early detection and rapid response before such species establish a secure position in the plant community, eradicate incipient populations, and control existing populations.

Piling Removal (Category 4 Activities). Piling removal will re-suspend sediment, and if the piling had been treated creosote or if the adjacent sediments had been contaminated, then there is a reasonable likelihood for exposure to those contaminants. This effect would be short term, and extend for a few days during construction. The long term effect of piling removal is a net beneficial effect for listed fish because it will reduce the number of resting sites for piscivorous birds. It will also reduce cover for aquatic predators such as large and smallmouth bass. It may also reduce the amount of creosote exposure by removing treated pilings.

Road and Trail Erosion Control, Maintenance, and Decommissioning (Category 5 Activities). Effects associated with general construction are discussed above. Individual fish may be exposed to hydrocarbons during small resurfacing activities using asphalt. However, implementation of conservation measures (conducting this activity during dry weather, and limiting the scope to minor repairs) will limit the opportunity for exposure, and this activity will be a net benefit for listed salmonid populations in watersheds that implement these activities.

In-channel Nutrient Enhancement (Category 6 Activities). The goal of this activity is to enhance primary and secondary production in streams, thus enhancing the prey base of listed fish. If successful, the consequence will be increased growth and survival, which contribute to increase productivity for listed fish populations. Potential negative effects include the introduction of piscine diseases into streams as well as the chemicals applied that are used to control those diseases. In-channel nutrient enhancement may also introduce too many nutrients to stream channels causing algal blooms or other eutrophication problems downstream (Compton *et al*. 2006). These adverse effects are not reasonably likely to occur because of the conservation measures that will be implemented with this activity, and the remote likelihood of this activity category being implemented under HIP III.

Irrigation and Water (Category 7 Activities). These activities will maintain or increase the amount of instream flow for fish, and improve riparian complexity and processes. Improved flow, particularly in late summer when flows are typically the lowest, will improve juvenile survival thus enhancing productivity at the reach scale. However, unless conservation measures are adequate to ensure no increase in consumptive use of water, these activities could result in decreases in streamflow downstream of the project site. Construction work will cause minor disturbances to individual fish over the short term, or a short exposure to a sediment pulse.

Fisheries, Hydrologic, and Geomorphologic Surveys (Category 8 Activities). These activities will be implemented to support aquatic restoration, but over the short term, could cause minor disturbances to individual fish, or a short exposure to a sediment pulse. ESA-listed fish would be observed in-water (*e.g*., by snorkel surveys or from the banks). Direct observation is the least disruptive method for determining a species' presence/absence and estimating their relative numbers. Its effects are also generally the shortest-lived and least harmful of the monitoring activities discussed in this section because a cautious observer can effectively obtain data while only slightly disrupting the fishes' behavior. Fry and juveniles frightened by the turbulence and sound created by observers are likely to seek temporary refuge in deeper water or behind or under rocks or vegetation. In extreme cases, some individuals may leave a particular pool or habitat type and then return when observers leave the area. Harassment is the primary effect associated with these observation activities, and few if any injuries (and no deaths) are expected to occur—particularly in cases where monitoring is observed from the stream banks rather than in the water.

Summary of Effects to Bull Trout. The purpose of the proposed action is to fund activities that improve fish and wildlife habitat. These activities will have negative, short-term construction-related effects, but will provide a net benefit to bull trout and other native fishes in the long term. Many environmental conditions can cause incremental differences in feeding, growth, movements, and survival of bull trout during the juvenile life stage. Construction actions that reduce the input of particulate organic matter to streams, add fine sediment to channels, or disturb shallow-water habitats, can adversely affect the ability of fish to obtain food necessary for growth and maintenance. Bull trout are generally able to avoid the adverse conditions created by construction if those conditions are limited to areas that are small or local compared to the total habitat area, and if the system can recover before the next disturbance. This means juvenile and adult bull trout will, to the maximum extent possible, readily move out of a construction area to obtain a more favorable position within their range of tolerance along a complex gradient of temperature, turbidity, flow, noise, contaminants, and other environmental features. The degree and effectiveness of the avoidance response varies with life stage, season, the frequency and duration of exposure to the unfavorable condition, and the ability of the individual to balance other behavioral needs for feeding, growth, migration, and territory.

Chronic or unavoidable exposure heightens physiological stress thus increasing maintenance energy demands (Redding *et al.* 1987, Servizi and Martens 1991). This reduces the feeding and growth rates of juveniles and can interfere with juvenile migrations and growth to maturity. Other threats to bull trout include exposure to herbicides and loss of habitat because of increased consumptive use of water because of irrigation efficiency activities. However, given the full range of mandatory conservation measures in the HIP III program outlined above, the threat is low that the environmental changes caused by events at any single site associated with the proposed action, or even any combination of such sites, could cause chronic or unavoidable exposure over a large habitat area sufficient to cause more than transitory direct affects to individual bull trout.

At the population level, the effects of the environment are understood to be the integrated response of individual organisms to environmental change. Thus, instantaneous measures of population characteristics, such as population abundance, population spatial structure and population diversity, are the sum of individual characteristics within a particular area, while measures of population change, such as population growth rate, are measured as the productivity of individuals over the entire life cycle (McElhany *et al.* 2000). We anticipate on average non-lethal take of five or less bull trout per project (250 total per year) and lethal take of less than 13 bull trout in aggregate annually for all projects implemented under the proposed action. That is too few to influence population abundance at the local population or core area scale. Similarly, small to intermediate reductions in juvenile population density in the action area caused by individuals moving out of project areas to avoid injury or death as a result of exposure to short-term physical and chemical effects of construction are expected to be transitory and are not expected to alter juvenile survival rates. Over the long term, the sum of the HIP III activities may result in measurable improvements to population characteristics, particularly if a project is of large enough scale (provides access to many miles of habitat), or if enough projects are implemented within the Columbia River IRU.

Because adult bull trout are larger and more mobile than juveniles, it is unlikely that any will be killed during work area isolation although adults may move laterally or stop briefly during migration to avoid noise or other construction disturbances. Given the full range of mandatory conservation measures in the HIP III program, it is unlikely that physical and chemical changes caused by construction events at any single site associated with the proposed action, or even any combination of such sites, will cause delays severe enough to reduce spawning success, alter population growth rate, or cause straying that might alter the spatial structure or genetic diversity of populations. Thus, it is unlikely that the biological effects of implementing the activities within the HIP III program will negatively affect the characteristics of local populations or core areas of bull trout. We anticipate the proposed action will have long-term beneficial effects on population abundance, productivity, and spatial structure.

6.2.1 Effects to Bull Trout Critical Habitat

Construction projects have the greatest potential to affect critical habitat. Most projects that alter stream channel, or provide fish passage will adversely affect PCEs 1, 2, 3, 6, 7 and 8 by contributing sediment to the system and increasing cobble embeddedness during the short term. Depending on the category and specific design of the project these effects could last from a few days or weeks to several months (possibly years or decades where stream channels are reconstructed). While these PCEs will be adversely affected for some period of time by these projects, all of the projects described in this BO will eventually contribute to the improvement of fish habitat with long-term benefits resulting from passage enhancement. Thus they will result in benefits over time to these PCEs of critical habitat.

Instream projects will result in insignificant negative effects to PCEs 2, 3 and 6. These are ephemeral effects of low intensity and short duration.

Vegetation management activities will have adverse effects on PCEs 1, 2, 3, 4, 6, 7 and 8. These effects are likely to be a combination of short-term (weeks to months) and long-term (one to 20 years depending on the individual project) effects that will contribute increased sediment to the system. These effects should diminish and eventually halt as native vegetation becomes reestablished. These projects will ultimately result in improved infiltration rates, reduced overland flows and sediment yields and a more natural hydrograph.

A more detailed description of how the proposed action will affect individual PCEs of bull trout critical habitat follows:

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

Channel Condition, dynamics and floodplain connectivity will be greatly affected by construction projects. Inwater or near-water construction will cause short-term adverse effects to stream channels at the site specific scale. Changes in flow resulting from many construction projects will also cause short-term adverse effects to the dynamics of the stream system. In most cases these effects will be short-term (weeks to months), but could be long term, lasting years. Ultimately these projects are designed to improve conditions (passage, channel dynamics, correct anthropogenic conditions), and therefore will benefit the ability of critical habitat to provide high quality water and connectivity. Because short-term impacts will reduce the ability of critical habitat to supply these functions for weeks, months, or even years in some cases, these projects will adversely affect PCE 1.

Instream projects such as the placement of gravel, or LW may have slight negative effects to PCE 1 by contributing to turbidity and donation of some amounts of sediment to the system thus affecting water quality. Channel conditions will show some effects from many of these projects. These effects will be of low intensity, short duration (more likely hours than days), and are considered insignificant to PCE 1.

Flow and Hydrology (change in peak/base flows) will be affected by construction projects. Flow will be interrupted, and redirected in some cases. Most of the adverse effects resulting from these types of projects would be short-term (weeks or months). However, larger projects such as stream reconstruction could have adverse effects on flow for many years before beneficial effects to the system are recognized. In general, construction projects described within this BO will adversely affect PCE 1.

Vegetation management projects will have short-term adverse effects on PCE 1 through this indicator. The use of herbicides to treat invasive plants could add chemicals to the system that may affect aquatic flora and thus aquatic fauna as well. Any adverse effect to this PCE will be short-term and would be expected to lesson and then terminate once native vegetation becomes reestablished on the project sites. Restoration activities that improve conditions for streamside and upland vegetation will ultimately benefit the aquatic system in the long-term (1-20 years) through the reduction of sediment delivery over time, improved infiltration rates, and a more natural hydrograph over time.

PCE 2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

Habitat Access (barriers) may be disrupted during implementation of some construction projects. In many cases this disruption may only be ephemeral, but in other cases short-term adverse effects will occur to PCE 2. With long-term benefits resulting from passage enhancement. Thus they will result in benefits over time to PCE 2 of critical habitat eventually.

Instream projects such as the addition of LW, or the placement of gravel or boulders will have a neutral effect on this indicator. Also vegetation projects will have a neutral effect to this PCE.

Water quality (chemical contaminants/nutrients) will be adversely affected by instream and near stream construction projects. These projects will contribute sediment to the system and increase cobble embeddedness during the short term. Depending on the category and specific design of the project these effects could last from a few days or weeks to several months (possibly years where stream channels are reconstructed). The presence of equipment instream adds some degree of risk of contamination from lubricants, antifreeze, and hydraulic fluids. These risks are greatly reduced by the general and specific conservation measures proposed by BPA. While PCE 2 will be adversely affected for some period of time by these projects, all of the projects described in the proposed action will eventually contribute to the improvement of fish habitat.

Instream projects will have a slightly negative effect on water quality. The addition of LW, or placement of gravel or boulders may contribute minor amounts of sediment to the system. These effects should be of short duration and low intensity and are considered insignificant.

Vegetation treatments considered within this BO will adversely affect water quality in the short-term. The use of herbicides to treat invasive plants could add chemicals to the system that may affect aquatic flora and thus aquatic fauna as well. Further, the removal of vegetation can change overland flows and infiltration rates. Increased run off from rainfall or snow melt will result in increased sediment delivery to the system. Any adverse effects to this PCE will be short-term and would be expected to lesson and then terminate once native vegetation becomes reestablished on the project sites. Restoration activities that improve conditions for streamside and upland vegetation will ultimately benefit the aquatic system in the long-term (1-20 years) through the reduction of sediment delivery over time, improved infiltration rates, and a more natural hydrograph.

Flow and Hydrology **(**change in peak/base flows) will be affected by construction projects. Flow will be interrupted, and redirected in some cases. Most of the adverse effects resulting from these types of projects would be short-term (weeks or months). However, larger projects such as stream reconstruction could have adverse effects on flow for many years before beneficial effects to the system are recognized. In general, construction projects described within this BO will adversely affect PCE 2.

Vegetation management projects will have short-term adverse effects on PCE 2 through this indicator. The use of herbicides to treat invasive plants could add chemicals to the system that may affect aquatic flora and thus aquatic fauna as well. Any adverse effect to this PCE will be short-term and would be expected to lesson and then terminate once native vegetation becomes reestablished on the project sites. Restoration activities that improve conditions for streamside and upland vegetation will ultimately benefit the aquatic system in the long-term (1-20 years) through the reduction of sediment delivery over time, improved infiltration rates, and a more natural hydrograph.

Instream projects such as the addition of LW, or the placement of gravel or boulders will have a neutral effect on this PCE.

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

Water quality, channel condition and dynamics, and habitat access will be adversely affected by construction projects. These effects will limit the availability of prey species within critical habitat in the short-term. Increased sediment and reduced water quality will reduce the ability of critical habitat to provide foraging opportunities to bull trout through reduced visibility, and reduced presence of prey fish.

Instream projects may have a slightly negative effect on this PCE. These projects may increase, or disturb fine sediment at a small, localized scale. These effects are likely to be ephemeral, of short duration and of low intensity. Thus, these effects are considered insignificant to PCE 3 through these pathways.

Vegetation management projects will adversely affect the ability of critical habitat to provide both aquatic and terrestrial prey species needed by bull trout during the short term. Increased donations of sediment with increase turbidity and reduce both the availability of prey and the ability of bull trout to pursue such prey. Changes to streamside vegetation will result in some reduction of terrestrial macroinvertebrates available in bull trout critical habitat. This condition should ease over-time as native vegetation becomes reestablished on the affected sites. Because of these factors, vegetation management projects will adversely affect PCE 3.

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

Habitat Elements such as large wood, pool frequency and quality, large pools, off channel habitat, and refugia, will not be affected by construction projects when applied to PCE 4. Instream projects such as additions of large wood, or placement of gravel or boulders would have entirely beneficial effects. Vegetation management projects would generally have a neutral effect as applied to PCE 4, however they may well have a short-term (months) adverse effect on refugia. Therefore they must be considered as an adverse effect on PCE 4 through this pathway.

PCE 5. Water temperatures ranging from 36 °F to 59 °F (2 °C to 15 °C), 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.

Water quality (Temperature) will not be affected by construction projects. Vegetation projects will have a slightly negative effect on this PCE. The removal of vegetation could allow increased solar radiation which could affect temperatures to some degree. These effects will be extremely localized and of low intensity, and are considered insignificant to PCE 5.

PCE 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.
Water Quality (sediment*)* will be adversely affected by construction projects. These projects will contribute sediment to the system and increase cobble embeddedness during the short term.

Depending on the category and specific design of the project these effects could last from a few days or weeks to several months (possibly years where stream channels are reconstructed).

Instream projects such as the placement of gravel, or LW may have slight negative effects to PCEs 1 by contributing to turbidity and donation of some amounts sediment to the system thus affecting water quality. Channels conditions will show some effects from many of these projects. These effects will be of low intensity, short duration (more likely hours than days), and are considered insignificant to PCE 6

Vegetation treatments considered within this BO will adversely affect water quality in the short-term. The removal of vegetation can change overland flows and infiltration rates. Increased run off from rainfall or snow melt will result in increased sediment delivery to the system. Most adverse effects to PCE 6 will be relatively short-term and would be expected to lesson and then terminate once native vegetation becomes reestablished on the project sites. However larger scale projects may increase sediment loads for long periods (up to five years). Restoration activities that improve conditions for streamside and upland vegetation will ultimately benefit the aquatic system in the long-term (1-20 years depending on the exact project) through the reduction of sediment delivery over time, improved infiltration rates, and a more natural hydrograph over time.

Habitat Elements such as substrate embeddedness will be adversely affected by instream or near-stream construction projects. The addition of sediment described above will result in some portion of substrate embeddedness. While it is expected that most of this would subside the year following the project when high flows would purge the system of most of the residual sediment on the substrate, these projects will still result in short-term adverse effects for most projects. Obviously in larger scale projects such as stream reconstruction these adverse conditions could persist longer, possibly up to years in time.

Instream projects such as the placement of gravel, or LW may have slight negative effects to PCE 6 by contributing to turbidity and donation of some amounts sediment to the system thus affecting water quality. These effects will be of low intensity, short duration (more likely hours than days), and are considered insignificant to this indicator.

Vegetation management projects will have an adverse effect on substrate embeddedness because they will result in increased sediment donations to the system short-term. If projects are located within bull trout spawning and rearing habitat this could adversely affect the ability of critical habitat to provide high quality substrates needed for spawning. As mentioned above most of these effects would not last more than one season, but are considered an adverse effect on PCE 6.

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

Flow and Hydrology (change in peak/base flows) will be adversely affected by construction projects. Flow will be interrupted, and redirected in some cases. Most of the adverse effects resulting from these types of projects would be short-term (weeks or months). However, larger projects such as stream reconstruction could have adverse effects on flow for many years before beneficial effects to the system are recognized. In general, construction projects described within this BO will adversely affect PCE 7 during the short-term, but will ultimately benefit critical habitat over the long term (1-20 years) by aiding in the restoration of a more natural hydrograph.

Vegetation management projects will have short-term adverse effects on PCE 7 through this indicator. The removal of vegetation can change overland flows and infiltration rates. Increased run off from rainfall or snow melt will result in increased water delivery to the system. Any adverse effect to this PCE will be short-term and would be expected to lesson and then terminate once native vegetation becomes reestablished on the project sites. Restoration activities that improve conditions for streamside and upland vegetation will ultimately benefit the aquatic system in the long-term (1-20 years) through improved infiltration rates, and a more natural hydrograph over time.

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

Water quality (chemical contaminants/nutrients) will be adversely affected by instream and near stream construction projects. These projects will contribute sediment to the system and increase cobble embeddedness during the short term. Depending on the category and specific design of the project these effects could last from a few days or weeks to several months (possibly years where stream channels are reconstructed). The presence of equipment instream or near lakeshore adds some degree of risk of contamination from lubricants, antifreeze, and hydraulic fluids. These risks are greatly reduced by general and specific conservation measures proposed by BPA. While PCE 2 will be adversely affected for some period of time by these projects, all of the projects described in this BO will eventually contribute to the improvement of fish habitat.

Instream projects will have a slightly negative effect on water quality. The addition of LW, or placement of gravel or boulders may contribute minor amounts of sediment to the system. These effects should be of short duration and low intensity and are considered insignificant to this PCE.

Vegetation treatments considered within this BO will adversely affect water quality in the short-term. The use of herbicides to treat invasive plants could add chemicals to the system that may affect aquatic flora and thus aquatic fauna as well. Further, the removal of vegetation can change overland flows and infiltration rates. Increased run off from rainfall or snow melt will result in increased sediment delivery to the system. Any adverse effects to this PCE will be short-term and would be expected to lesson and then terminate once native vegetation becomes reestablished on the project sites. Restoration activities that improve conditions for streamside and upland vegetation will ultimately benefit the aquatic system in the long-term (1-20 years) through the reduction of sediment delivery over time, improved infiltration rates, and a more natural hydrograph over time.

PCE 9. Sufficiently low levels of occurrence of non-native 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.

Subpopulation characteristics such as life history diversity and isolation, persistence and genetic integrity*)* will be benefitted by construction projects that improve fish passage. Providing improved passage, or reconnecting isolated local populations where safe to do so, will improve genetic diversity.

Summary of effects to bull trout CHUs, Columbia River IRU and critical habitat at the rangewide scale

While the proposed action will have adverse effects to bull trout critical habitat at the local, site specific scale, these adverse effects will not be significant when evaluated at larger scales. The projects involved are too small and too distant and too infrequent to adversely affect the PCEs across an entire CHU. Because of this the effects of these projects cannot rise to a level to adversely affect the Columbia River IRU.

6.3 Effects to Oregon Chub

Potential effects on Oregon chub may occur as the result of multiple activities described in the proposed action; these effects are described below by categories of activities.

Each project will be reviewed by BPA staff to determine whether the proposed work is covered under the HIP III consultation. This will include a review of whether the proposed work incorporates the appropriate general and species-specific conservation measures and project design standards that have been designed to reduce or avoid impacts to listed species. Projects which cannot meet these standards or that have the likelihood of causing effects beyond the scope of the analysis within this Biological Opinion will require a separate ESA Section 7 consultation.

Effects from Construction-Related Activities

The following effects to Oregon chub may occur as a result of construction-related activities proposed in the action, which include:

1. Fish Passage Restoration
2. River, Stream, Floodplain, and Wetland Restoration
3. Piling Removal
4. Road and Trail Erosion Control, Maintenance and Decommissioning

Effects on Water Quality

Turbidity

Construction-related activities may temporarily increase suspended sediment and turbidity during in-water work for minutes to hours following cessation of construction activities at each location. Although turbidity has been linked to a number of behavioral and physiological stress responses in salmonids, available data documenting the effects of turbidity on Oregon chub are limited. Localized turbidity increases are likely to cause some juveniles and adults to seek alternative habitat, which could contain suboptimal cover and forage and cause increases in behavioral stress (*e.g.,* avoidance and displacement), and sub-lethal responses (*e.g.,* increased respiration, reduced feeding success, and reduced growth rates). Turbidity and sediment can also reduce embryo survival and juvenile rearing densities. Excessive sediment can clog the gills of juvenile fish, reduce prey availability, and reduce juvenile success in catching prey. Similar responses, to a lesser magnitude, are expected in chub. Effects of turbidity on fish are influenced by several factors: the duration of turbidity (the quantity of suspended materials, size of sediment particles, and current velocities), and the proximity of fish to the turbid area (Bisson and Bilby 1982).

The effects of turbidity on Oregon chub will be minimized by the limited, temporary nature of disturbance, by conducting fish salvage, by installing turbidity controls (turbidity curtains), and by monitoring turbidity levels downstream during in-water work (BA p. 2-17). Additionally, work will be conducted only during approved in-water work periods prescribed by ODFW when Oregon chub are least vulnerable (i.e., not spawning). Temporary erosion controls will be installed down slope of restoration activities within the riparian buffer to prevent soil movement into aquatic habitats.

The use of access roads may cause erosion resulting in sediments entering chub habitats. However, the proposed action includes several conservation measures to prevent effects to Oregon chub from use of access roads (BA, p. 2-16). Existing access roads will be used whenever possible and temporary access roads will not be built on slopes greater than 30% or where soil erosion is likely to occur as a result. The implementation of these and other conservation measures described in the proposed action will reduce the likelihood of effects to Oregon chub from the use of access roads.

Chemical Contamination

Chemical contamination is possible when activities involving hazardous materials occur in areas having direct or indirect hydrologic connections to these drainages. These activities are primarily limited to fluid leaks from construction equipment and vehicles during project construction. The proposed action includes conservation measures designed to prevent equipment leaks into aquatic habitats (BA, p. 2-16).

Accidental spills of construction materials or petroleum products could result in adverse effects to water quality. The timing of such an effect would be instantaneous and unpredictable. The duration of effects from a spill would depend on the severity of the spill and whether the spill occurred inside an isolation/containment area or resulted in releases away from in-water work areas (e.g., a hydraulic fluid leak under pressure). The worst-case scenario could entail the failure of a large piece of equipment and the release of several gallons of petroleum product near or into a waterway. This could result in the death of local aquatic organisms such as fish, waterfowl, macroinvertebrates, and vegetation. There were no documented accidental spills of hazardous materials under HIP I and II; thus, we anticipate a very low likelihood of spills under HIP III.

Emergency spill control materials will be provided on-site at all times and ready for immediate deployment in the event of an accident. Development of pollution control plans that include preventive and containment measures for construction-related chemical hazards will significantly reduce the likelihood for chemical releases in the project area, as well as the severity and spatial extent of contamination, should they occur.

Effects on Habitat Function

Changes in flows, temperature, and habitat connectivity

In-water restoration activities under the categories of 1) Fish Passage Restoration, and 2) River, Stream, Floodplain, and Wetland Restoration may alter the physical features that make downstream habitat suitable for Oregon chub, including flow rates, connectivity, and temperatures. Although restoration activities under this category are intended to restore natural floodplain functions, they may also have the unintended consequence of affecting Oregon chub downstream. Construction projects may also cause long-term changes in sediment deposition patterns downstream. Sedimentation could affect Oregon chub habitat downstream of restoration projects by blocking the entrance to off-channel habitat and causing site isolation from the main channel. This isolation would eliminate the potential for dispersal between habitats and could lead to a reduction in genetic diversity in the affected population. Sedimentation could also reduce the area of affected habitat or the amount of emergent vegetation available for spawning. This reduction in habitat could cause a decline in survival, growth, or reproductive success in an affected population. For instance, removal of dikes could alter flow patterns downstream (e.g. shifting flows to secondary channels) and result in reductions in the volume of water reaching downstream off-channel habitat occupied by Oregon chub. Decreased water volumes and the resulting increased water temperatures could result in physiological stress and injury or death of individual chub due to decreased dissolved oxygen. Additionally, reproductive losses may occur as vegetated areas where spawning occurs are desiccated. Reduced flows could also reduce habitat connectivity that allows for chub dispersal and reduce genetic diversity due to isolation.

Projects could also result in increased flows into Oregon chub habitat reducing the habitat suitability for Oregon chub. For instance, flows may be redirected as a result of restoration projects into historic secondary channels that are now off-channel habitat with no or low velocity. Increased flows could significantly change the habitat conditions, including temperature, vegetation, and substrate deposition which are key elements in Oregon chub habitat.

Effects on Riparian Vegetation

Riparian reserves directly influence Oregon chub habitat structure and function, as well as indirectly affect a multitude of hydrologic and biochemical processes. Intact riparian areas are responsible for water quality treatment, stormwater infiltration, groundwater storage, and other biochemical and hydrologic processes vital to properly functioning habitat. Riparian vegetation influences shading, organic inputs, stream bank stabilization, channel complexity, and soil properties. Removal of riparian vegetation and trees may result in a reduction of these benefits to Oregon chub. Reduced shade over streams and off-channel habitats due to construction activities or after weeds are removed and before native vegetation becomes established could slightly increase water temperatures over the short-term. Consequently, it is possible that the optimal temperature range for Oregon chub could be exceeded or result in reduced oxygen levels that could cause stress to Oregon chub or their prey in the short-term. However, shade loss that significantly affects water temperature is likely to be rare, occurring primarily from treating large-scale streamside monocultures (e.g., knotweed and blackberry), and possibly from cutting streamside woody species (e.g., tree of heaven, scotch broom, etc.).

Effects from Work-Site Isolation

Fish removed from the isolated work area may be caught in nets, electrofished, and handled, resulting in an elevated risk of harm and harassment, and possible mortality. Oregon chub may also be injured or killed during containment system construction. However, work area isolation and fish salvage will be conducted by experienced biologists using methods approved by the ODFW and NMFS to minimize the potential for these effects.

Containment measures will minimize the potential for direct harm to fish from project construction activities. Work area isolation at each location will result in a minor localized habitat modification in the short term (until containment/isolation measures are removed) that could impair or disrupt behavioral patterns of fish, including feeding and sheltering. However, accomplishing the proposed work within the isolation/containment areas will reduce potential adverse effects to downstream habitat and reduce the probability of direct adverse effects to fish in the project area.

Fish Screens

Fish screens must be used on pump intakes to avoid juvenile fish entrainment; screens must meet NOAA Fisheries' fish screen criteria, be self-cleaning or regularly maintained (by removing debris buildup), and a responsible party must be designated to ensure proper operation (*i.e.*, regular inspection and as-needed maintenance to ensure pumps and screens are properly functioning).

The larvae of the Oregon chub are assumed to be more susceptible to entrainment due to their small size and differences in swimming performance compared to salmonids. While some entrainment or impingement of Oregon chub is possible, the screens will greatly reduce the risk of potential losses. Adults will be large enough to be kept out by the screens. The larval stage is the primary stage that will be vulnerable because larvae are small enough that they could potentially move through the screens. However, conservation measures that were designed to avoid work in areas occupied by Oregon chub will minimize the potential for these effects to occur.

Effects from Irrigation Improvements

Irrigation improvements will reduce the number of diversions on streams, conserve water, and improve habitat for fish. Projects with a medium to high risk (i.e. the removal of irrigation diversion structures greater than 3 feet in height) will be reviewed by the RRT prior to approval and will be designed to minimize or avoid any downstream effects to Oregon chub. Adverse effects of both low and medium to high risk activities in this category may include turbidity and reduced flows to existing Oregon chub habitats. See the above discussion for effects on Oregon chub from turbidity. Decreased water volumes and increased water temperatures could result in physiological stress and injury or death of individual chub due to decreased dissolved oxygen. Additionally, reproductive losses may occur as vegetated areas where spawning occurs are desiccated. Reduced flows could also reduce habitat connectivity that allows for chub dispersal and reduce genetic diversity due to isolation. However, given that only 9 projects in this category were funded under HIP II, we anticipate few of these projects are likely to occur within the range of Oregon chub.

Effects from Invasive and Nonnative Plant Control

Manual and Mechanical Control

Manual and mechanical control of invasive and nonnative plant control activities will follow conservation measures designed to prevent erosion of sediments into aquatic habitats. However, these activities may still result in small amounts of sediment entering the water. Any effects to Oregon chub from the resulting turbidity are likely to be short-term as sediment is expected to settle into the substrate or quickly diffuse in areas with higher flows.

Herbicide Applications

Herbicide delivery to surface water can result in mortality to fish during incubation, or lead to altered development of embryos. Mortality or sub-lethal effects such as reduced growth and development, decreased predator avoidance, or modified behavior could occur. Herbicides can also impact the food base for Oregon chub and other fish, which includes aquatic macroinvertebrates. Data are not available on the direct or indirect effects of herbicides to Oregon chub. However, in general, effects of chemical applications can be considered detrimental to aquatic ecosystems if the physical, chemical, or biological processes that support those ecosystems are adversely impacted (Preston 2002).

The risk of herbicides directly entering the water would be relatively low, as herbicides will be applied according to the guidelines in the BA. These guidelines include buffers, weather restrictions, application techniques, and quantity. The risks of Oregon chub being directly exposed to herbicides, and the risks of significant loss of submergent and emergent aquatic vegetation, are therefore minimized.

Herbicide use is limited to chemicals and measures that are expected to result in exposures that are below threshold risk levels (HQ values less than 1 or NOAC levels) for fish as well as aquatic invertebrates, algae and aquatic macrophytes. The conservation measures as proposed in the BA limit the specific herbicides, application rates, and distances from aquatic resources to only those that were found in the analyses to be below the threshold risk levels for all evaluated species groups. Therefore, as proposed with the conservation measures for herbicide use, the risk of adverse effects from herbicide use on BPA HIP projects has been greatly reduced and potentially avoided for Oregon chub.

Effects from Fisheries, Hydrologic, and Geomorphologic Surveys

Survey activities could result in accidental injury or mortality to a small percentage of Oregon chub as a result of capture stress or handling during trapping and species verification. Chub captured during surveys will be identified as quickly as possible and returned to the water immediately. Traps will be set for short duration (1 to 8 hours) to minimize impacts. The timing of surveys will occur outside the spawning window in order to avoid adverse impacts to chub reproduction. Oregon chub may spawn from April to August, with the bulk of spawning activity occurring May-late July. Surveys will be conducted outside this time frame. Additionally, BPA or their project proponent will consult the most recent location data available for Oregon chub and will avoid surveys in those habitats. This data is currently available from ODFW's Corvallis Research Lab, (541)757-4263 ext. 224.

Effects from Irrigation and Water Delivery/Management Actions

Restoration projects under this category are unlikely to occur in areas where Oregon chub are known to occur; therefore, we anticipate no effects to Oregon chub from irrigation and water delivery/management actions.

Benefits of Proposed Action

BPA HIP projects will benefit Oregon chub over the long-term. It is anticipated that floodplains will become more complex and natural function will be restored. If projects affect stream hydrographs, they are likely to more closely resemble natural conditions due to improved wetland, riparian and floodplain functions. Wetland restoration such as breaking tile drainage lines and restoring native plant communities increases water storage in wetlands and floodplains, creating additional fish habitat and enhancing subsurface flow into streams during the summer.

Establishment of native trees, shrubs, grasses and forbs along streams will increase shade, increase dissolved oxygen levels, and promote instream habitat complexity. Increased riparian vegetation and instream cover should increase aquatic insect populations, enhancing food availability for fish.

Summary of Effects to Oregon Chub

In summary, adverse effects may result from increases in turbidity and fine-sediment deposition; disturbance of individuals during instream work; changes in flows, temperature, and habitat connectivity; exposure to herbicides; and adverse effects to algae, aquatic macrophytes and aquatic macroinvertebrates from herbicides and sedimentation. Most of these adverse impacts will be of short duration, and over the long term we expect habitat conditions and status of Oregon chub populations to improve.

6.3.1 Effects to Oregon Chub Critical Habitat

Although projects will not occur in habitats that have been designated as critical habitat for Oregon chub, effects to critical habitat located downstream of restoration projects may occur. A variety of restoration activities are included in the proposed action. Only those activities likely to have adverse effects on Oregon chub critical habitat are analyzed below; the remaining activities are not likely to have adverse effects.

The primary constituent elements (PCEs) for Oregon chub critical habitat are:

1. Off-channel water bodies such as beaver ponds, oxbows, side-channels, stable backwater sloughs, low-gradient tributaries, and flooded marshes, including at least 500 continuous square meters (0.12 ac) of aquatic surface area at depths between approximately 0.5 and 2.0 m (1.6 and 6.6 ft).

2. Aquatic vegetation covering a minimum of 250 square meters (0.06 ac) (or between approximately 25 and 100 percent) of the total surface area of the habitat. This vegetation is primarily submergent for purposes of spawning, but also includes emergent and floating vegetation and algae, which are important for cover throughout the year. Areas with sufficient vegetation are likely to also have the following characteristics:

   • Gradient less than 2.5 percent;
   • No or very low water velocity in late spring and summer;
   • Silty, organic substrate; and
   • Abundant minute organisms such as rotifers, copepods, cladocerans, and chironomid larvae.

3. Late spring and summer subsurface water temperatures between 15 and 25 °C (59 and 78 °F), with natural diurnal and seasonal variation.
4. No or negligible levels of nonnative aquatic predatory or competitive species. Negligible is defined for the purpose of this rule as a minimal level of nonnative species that will still allow the Oregon chub to continue to survive and recover.

Effects from Construction-Related Activities

The following effects to Oregon chub critical habitat may occur as a result of construction-related activities proposed in the action, which include:

1. Fish Passage Restoration
2. River, Stream, Floodplain, and Wetland Restoration
3. Piling Removal

Effects on Water Quality

Chemical Contamination

Accidental spills of construction materials or petroleum products could result in adverse effects to water quality. The worst-case scenario could entail the failure of a large piece of equipment and the release of several gallons of petroleum product near or into a waterway. This could result in the death of local aquatic organisms such as macroinvertebrates and vegetation, both components of PCE 2. However, there were no documented accidental spills of hazardous materials under HIP I and II; thus, we anticipate a very low likelihood of spills under HIP III.

Effects on Critical Habitat Function

Changes in flows, temperature, habitat area, and vegetation

In-water restoration activities under the categories of 1) Fish Passage Restoration, and 2) River, Stream, Floodplain, and Wetland Restoration may alter the physical features of Oregon chub critical habitat, including flow rates (PCE 2) and temperatures (PCE 3). Construction projects may also cause long-term changes in sediment deposition patterns downstream. Sedimentation could reduce the area of affected habitat (PCE1) or the amount of emergent vegetation (PCE2) available for spawning. Projects could also result in increased flows into Oregon chub critical habitat. For instance, flows may be redirected as a result of restoration projects into historic secondary channels that are now off-channel habitat with no or low velocity (PCE 3). Increased flows could significantly change the habitat conditions, including temperature, vegetation, and substrate deposition (PCE 2) which are key elements in Oregon chub critical habitat.

Effects from Irrigation Improvements

Irrigation improvements will reduce the number of diversions on streams, conserve water, and improve habitat for fish. Projects with a medium to high risk (i.e. the removal of irrigation diversion structures greater than 3 feet in height) will be reviewed by the RRT prior to approval and will be designed to minimize or avoid any downstream effects to Oregon chub. An adverse effect of both low and medium to high risk activities in this category may include reduced flows to existing Oregon chub habitats. Decreased water volumes would affect the area of critical habitat (PCE 1) and may result in increased water temperatures (PCE 3) and decreased dissolved oxygen. Additionally, reproductive losses may occur as vegetated areas where spawning occurs are desiccated. Reduced flows could also reduce habitat connectivity that allows for chub dispersal and reduce genetic diversity due to isolation. However, given that only 9 projects in this category were funded under HIP II, we anticipate few of these projects are likely to occur within the range of Oregon chub.

Effects from Invasive and NonNative Plant Constrol

Herbicide Applications

Herbicides can impact the food base for Oregon chub, which includes aquatic macroinvertebrates (PCE 2). However, herbicide use is limited to chemicals and measures that are expected to result in exposures that are below threshold risk levels (HQ values less than 1 or NOAC levels) for fish as well as aquatic invertebrates, algae and aquatic macrophytes. The conservation measures as proposed in the BA limit the specific herbicides, application rates, and distances from aquatic resources to only those that were found in the analyses to be below the threshold risk levels for all evaluated species groups. Therefore, as proposed with the conservation measures for herbicide use, the risk of adverse effects from herbicide use on BPA HIP projects has been greatly reduced and potentially avoided for Oregon chub critical habitat.

Summary of Effects to Oregon Chub Critical Habitat

In summary, adverse effects to Oregon chub critical habitat include sediment deposition; changes in flows, temperature, and habitat area; reduced water quality due to chemical contamination and herbicides; and adverse effects to aquatic macroinvertebrates from herbicides and sedimentation. However, most of these adverse impacts will be of short duration and over the long term we expect habitat conditions for Oregon chub to improve under the HIP III Program.

6.4 Effects to Marbled Murrelet

The USFWS analyzed whether effects related to habitat changes (i.e., habitat effects) and effects related to increased noise (i.e., disturbance/disruption effects) are likely to cause murrelet injury or mortality. The primary focus is disturbance effects, since this consultation does not cover projects that may adversely affect murrelets via habitat changes, or that adversely affect their critical habitat.

a. Habitat Effects

We describe below how habitat modifications may negatively impact murrelets and why actions covered under this consultation are not likely to adversely affect murrelets through habitat changes. Considerable evidence links the declining numbers of murrelets to the removal and degradation of available suitable nesting habitat (Ralph et al. 1995). The removal of habitat can potentially adversely affect the murrelet population in several ways including the following: 1) immediate displacement of birds from traditional nesting areas; 2) concentration of displaced birds into smaller, fragmented areas of suitable nesting habitat that may already be occupied; 3) increased competition for suitable nest sites; 4) decreased potential for survival of remaining murrelets and offspring due to increased predation; 5) diminished reproductive success for nesting pairs; 6) diminished population due to declines in productivity and recruitment; and 7) reduction of future nesting opportunities.

For the purposes of this programmatic consultation, we assume suitable habitat is likely to be occupied by murrelets. As part of the proposed action, activities that remove or reduce the capability of suitable, potential, or critical murrelet habitat will not be covered under this consultation. This includes suitable habitat and potential nest structures, which are defined in Appendix D of this document. Also, for actions to avoid adverse effects to murrelet critical habitat, BPA must ensure that site-specific actions would not remove or eliminate the availability of primary constituent elements. In other words, adverse effects to primary constituent elements [i.e., "individual trees with potential nesting platforms and forested areas within 0.8 km (0.5 miles) of individual trees with nesting platforms, and with a canopy height of at least one-half the site-potential tree height (USFWS 1996)."] will not be covered by this programmatic BO.

Therefore activities will not harm (i.e., significantly change habitat such that it results in death or injury) murrelets by habitat loss.

b. Disturbance/Disruption Effects

There is an increased likelihood of injury to murrelet young from disturbance/disruption effects related to the proposed action. This likelihood is created because some projects will occur within disruption distances of occupied or suitable-unsurveyed murrelet areas during the murrelet breeding season. BPA has proposed to implement restoration projects within disruption distances during their breeding season. While most projects will avoid disturbing murrelets, we assume for the purposes of this effects analysis that some projects will occur near nesting murrelets that can only be implemented during the murrelet breeding period.

Likelihood of injury is greatly reduced because only a limited number of actions will adversely affect murrelets via disturbance/disruption effects. Restoration projects may disturb or disrupt murrelets only after the following steps have been taken to attempt to fully avoid or minimize adverse effects to murrelets: 1) a wildlife biologist has determined murrelets may occur in the project area; 2) a site survey by wildlife biologist indicates an active nest is within the species-specific disturbance distance of the project (or if protocol survey (Evans et al. 2003) is not completed then BPA will assume suitable habitat is occupied); and 3) the action cannot be scheduled outside of the murrelet nesting period, or moved to a location outside of the murrelet disturbance/disruption distance.

When the potential for injury exists, the USFWS needs to determine if the projects and nesting murrelets will occur within proximity (disruption distances) of each other (both spatially and temporally), but the actual project locations and nest locations are unknown for these proposed actions. Even when a murrelet survey is completed, the amount of site-specific adverse effects are not necessarily easier to quantify (i.e., since active nests are difficult to locate). Also, some projects may occur in suitable, unsurveyed murrelet habitat, which further complicates quantification of adverse effects.

Since murrelets can be very difficult to locate, we have developed a method to analyze expected adverse effects in unsurveyed, suitable habitat. This requires some site-specific or estimated knowledge of the likelihood of encountering a nest (i.e., density or home range size) within the project area. The size and shape of action areas is not specified for all actions, and it is possible for some projects to overlap into more than one potential active nest location. Consequently, we quantified the amount of action area (including disturbance buffers) where we might reasonably expect to locate one murrelet nest in unsurveyed, suitable habitat.

Our methodology is to be used as a guide, to help determine a project size where we anticipate finding one nest in continuous suitable murrelet habitat. This does not replace site-specific analysis, but is a tool to determine the probable extent of effects. A wildlife biologist during project design will determine whether there is suitable murrelet habitat or potential nest trees within the project area, which is part of the nest analysis required for pre-project planning (Appendix D – Specific Conservation Measures for Birds). This type of information would be provided by BPA to the Service via a Project Notification/Completion form. The USFWS assumes that project areas containing suitable habitat are likely to have a nesting murrelet, until an effects analysis from BPA or their project proponents (based on nest analysis and/or protocol survey) determine otherwise.

c. Methodology to predict effects in unsurveyed and occupied, suitable habitat

In cases of uncertainty such as unsurveyed habitat, it is USFWS policy to give the benefit of the doubt to the listed species. On that basis, the USFWS considers occupied and unsurveyed stands with murrelet nesting structure to be occupied. The USFWS determined the number of acres of occupied or unsurveyed habitat where we would anticipate finding a pair of nesting murrelets. A nest density study for the Washington and Oregon does not exist. Accordingly, we are unable to estimate the actual number of murrelets that would be exposed to noise and visual disturbance during the proposed action. Instead, our analysis uses an estimation of individuals exposed based on acres and stands disturbed as a surrogate for the actual number of individual murrelets disturbed.

The latest estimate comparing the murrelet population to the amount of inland suitable habitat results in an average of 186 acres of habitat per murrelet (Huff et al. 2006, page 141). The sex ratio is believed to be equal for murrelets in all Recovery Zones and juvenile murrelets are estimated to be eight percent of the population (McShane et al. 2004, p 3-45). Efforts to determine the proportion of adults breeding have resulted in estimates of 31 to 95 percent, potentially varying based on food availability (McShane et al. 2004, pp. 3-39 and 40). Therefore, the assumption that murrelets occur inland at a density of 372 acres (2 x 186) per pair would be a conservative assessment for the species as this number does not factor out the non-breeding murrelets. It also must be noted that although the USFWS is estimating the potential for murrelets, they are not territorial nor are they documented as colonial (seeking out nest sites based on the location of others nest site – an attracting factor[30]). Therefore, the USFWS estimates that one to zero murrelet pair is nesting at each site/stand smaller than 372 acres of habitat.

Therefore, one project in up to 372 acres of potential, unsurveyed murrelet habitat is expected to impact one young from one murrelet nest. Because the probability of encountering one nest differs between one continuous area of habitat compared to multiple fragments of habitat distributed across the landscape (since actual murrelet densities vary throughout the landscape), two spatially separated projects in unsurveyed suitable habitat (even if their total acreage amounts to 372 acres) is expected to affect two young from two separate nests. Project length impacts the likelihood of encountering multiple nests (i.e., 15 miles of channel work versus 5 miles of channel and associated riparian to upland area). Multiplying number of nests likely to be disturbed by acres of potential habitat where we expect to find one nest (i.e., 372), we can expect to find one nest in 0.01-372 acres, two nests in 373-744 acres, three in 745-1,116 acres, four in 1,117-1,488 acres, and five in 1,489-1,860 acres of unsurveyed potential habitat. Results are displayed in Table 14 below.

To quantify the project length for linear restoration projects in which we would expect to encounter a murrelet nest, we considered or assume the following: 1) for simplicity we assume a linear project area (e.g., linear stream); 2) the range-wide density estimate of one

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[30] It is to be noted that Nelson and Wilson (2002, page 107) calculated murrelet nesting densities of 0.1 to 3.0 nests per hectare (or 1 nest per 24.21 to 0.83 acres). Murrelets in the study were nesting in patches of suitable habitat, and the density of nests at the stand scale is likely lower (Nelson and Wilson 2002, page 107). In general nests are spaced far apart (Nelson and Wilson 2002, page 107).

nest per 372 acres; 3) murrelets occur at range-wide density levels within a project area; 4) murrelets are relatively evenly distributed across the range in suitable habitat (since we do not have site-specific information and cannot predict distribution at the local-level/within a stand); and 5) a project area will generally occur within 300 feet of the stream on either side of the bank. The USFWS also uses the buffer for noise and smoke, 0.25 miles, in our estimates since this is the maximum level of potential effect.

Based on these assumptions, a project's zone of influence (with noise buffers) may extend 0.25 miles + 300 feet from a stream. The USFWS multiplies this by two (to account for work along both sides of the stream bank), and divide this into 372 acres to obtain project length. This length is the maximum project length, for projects that do not exceed 372 acres, where we anticipate disturbance to only one murrelet young. However, the projected project length where we expect to encounter one nest is 0.95 miles in marbled murrelet habitat (i.e., for every 0.95 miles of linear project ~ 600 feet wide the USFWS expects to encounter one marbled murrelet nest). Multiplying this by number of nests, we generally anticipate projects will encounter one nest within 0.01-0.95 miles, two in 0.96-1.92 miles, three in 1.93-2.85 miles, four in 2.86-3.81miles, and five in 3.82-4.77 miles of stream within suitable, unsurveyed habitat. Results are displayed in Table 14.

Table 14. Acreage and project length of action areas where activities are likely to encounter active marbled murrelet nests in unsurveyed, suitable murrelet habitat.

Estimated number of active murrelet nests	Project Area (acres)	Maximum Project Length (in miles)
1	0.01-372	0.01-0.95
2	373-744	0.96-1.92
3	745-1,116	1.93-2.85
4	1,117-1,488	2.86-3.81
5	1,489-1,860	3.82-4.77

Determining the number of likely projects with potential annual disruption impacts to MAMU under BPA's HIP III proposed action is difficult for several reasons: 1) BPA's previous proposed action under HIP II was limited to the Columbia Basin proper, thus only a small portion of the total action area occurred within the range of MAMU (Coast range of NW Oregon and SW Oregon along the lower Columbia River). As a result, few projects occurred in this portion of the action area; and, 2) the expanded HIP III action area now includes, in addition to the Columbia Basin, Oregon coastal basins from the Columbia River south to Cape Blanco. This expanded area is fully encompassed by three of the six MAMU recovery zones. Because this is a new area for BPA's HIP program, there's not a baseline established that would help predict the frequency of future BPA funded restoration projects in this area.

As discussed in Section 4.3.2 above, there are six MAMU recovery zones in the U.S. These recovery zones are the functional equivalent of recovery units as defined by FWS policy

(USFWS 1997, p. 115). BPA's HIP III action area overlaps with three of the six recovery zones: a small portion of Zone 2 in SW Washington; the entire Zone 3 along the Oregon coast; and a small portion of Zone 4 along the southern Oregon coast. Given the small amount of overlap between the action area and Recovery Zones 2 and 4, we expect no more than 2 BPA funded projects under HIP III will occur in each of these zones on an annual basis within disruption distances of marbled murrelets during the marble murrelet critical breeding season. Given the large area of overlap between the HIP III action area and Zone 3, we anticipate up to 5 projects per year may be implemented within disruption distances of marbled murrelets during the marble murrelet critical breeding season. To allow for flexibility in funding levels and variation in high priority restoration projects, project impacts will be averaged over a five-year period such that Recovery Zones 2 and 4 cannot exceed disruption to 10 nest in each zone, and 25 nest in Zone 3, during any five-year period.

Based on our above quantification, we anticipate that in total, BPA could fund and implement 45 restoration projects within the disruption distances of murrelets during their breeding season during any five-year period. This assumes that project size (area and length) in unsurveyed, suitable habitat does not exceed values listed in Table 14, or, if they do, that the project notification/completion form provided to the Service includes information on the site-specific analysis that documents otherwise.

d. Description of anticipated effects

The remainder of our effects analysis relates to disturbance/disruption effects that may occur to the murrelets in recovery zones 2, 3 and 4 on an annual basis.

Noise and human intrusion are one of many threats to this species (McShane et al. 2004). Effects to murrelets from noise and human intrusion are not well known, but effects (e.g., energetic expenditure, stress levels, and susceptibility to predation) have been documented in other species (Knight and Gutzwiller 1995). While studies have not directly linked murrelet nest failure, abandonment, or chick mortality to disturbance, they have documented flushes from the nest and missed or delayed feedings at the nest (Singer et al. 1995, Hamer and Nelson 1998, Golightly et al. 2002). Murrelet breeding biology may preclude easy detection of sub-lethal disturbance effects (i.e., flushes from the nest and missed feedings) at the population level. Therefore, potential effects of disturbance on murrelet fitness and reproductive success should not be completely discounted (McShane et al. 2004).

Based on available information for the murrelets (Nelson and Hamer 1995, Long and Ralph 1998, Hamer and Nelson 1998, Nelson and Wilson 2002) and other bird species (Kitaysky et al. 2001, Delaney et al. 1999a), the USFWS has concluded that significant noise, helicopter rotor wash and human presence in the canopy may significantly disrupt murrelet breeding, feeding, or sheltering behavior such that it creates the potential of injury to the species (i.e., adverse effects in the form of harassment; USFWS 2003e). Additionally, groups of people are known to attract corvids, which temporarily increase the likelihood of young or eggs being preyed on by corvids in the action area.

An effect to murrelet behavior may occur when activities covered under this BO occur within the disturbance/disruption distance of active murrelet nests. The disturbance and disruption distances were developed utilizing the best available scientific information (Table 15 below). Loud noises at distances greater than identified in Table 15 are expected to either have no or negligible effects on murrelet behavior. In Washington the Service considers the murrelet nesting season to span from April 1 – September 23, while in Oregon the Service considers the murrelet nesting season to span from April 1 – September 15. The differences in applied nesting seasons are due to internal evaluations of murrelet biology and nesting season data, which are on-going.

Although the USFWS has assumed disruption distances based on interpretation of the best available information, distances are likely conservative because they consider the reasonable worst-case scenario for murrelets. While the most severe impacts of noise likely occur within a narrower zone, the exact distance where disturbances disrupt murrelets is difficult to predict and can be influenced by a multitude of factors. Site-specific information (e.g., topographic features, project length or frequency of disturbance to an area) could influence effects. Activities that are short duration (i.e., 1-3 days) that do not cause physical injury to marbled murrelets, and include both daily timing restrictions and garbage pick-up may have limited exposure to nesting murrelets to an extent that renders the effects insignificant or discountable. The potential for noise or human intrusion-producing activities to create the likelihood of injury to murrelets also depends on background (baseline) environmental levels. In areas that are continually exposed to higher ambient noise or human presence levels (e.g., areas near well- traveled roads, camp grounds), murrelets are probably less susceptible to small increases in disturbances because they are accustomed to such activities. Murrelets do occur in areas near human activities and may habituate to certain levels of noise.

Human presence (including increase in corvids) or excessive noise levels within close proximity to individuals may cause nesting adults to flush and leave their eggs exposed to predation or increase the risk of predation to a chick. These disturbances can also cause delayed feeding attempts by adults which may reduce the fitness of the young. They may also cause premature juvenile fledging, potentially reducing their fitness due to having sub-optimal energy reserves before leaving the nest. A murrelet that may be disturbed when it flies into the stands for other reasons than nest exchange or feeding young is presumably capable of moving away from disturbance without a significant disruption of its own behavior. As stated in the Status of the Species section, murrelets feed at sea and only rely on forest habitat for nesting.

Table 15. Disturbance and disruption distance thresholds for marbled murrelet during the nesting season (April 1 - Sept 15 for OR; and, April 1 - Sept 23 for WA). Distances are to a known occupied murrelet nest tree or suitable nest trees in unsurveyed habitat.

Action	Action Not Likely Detected Above Ambient Levels	Disturbance Distances	Disruption Distances	Increased Risk of Physical Injury and/or Mortality
Light maintenance (e.g., road brushing and grading), and heavily-used roads	> 0.25 mile	≤ 0.25 mile	NA[1]	NA
Log hauling on heavily-used roads (FS maintenance levels 3, 4, 5)	>0.25 mile	≤ 0.25 mile	NA[1]	NA
Chainsaws (includes felling hazard/danger trees)	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards[2]	Potential for mortality if trees felled contain platforms
Heavy equipment for road construction, road repairs, bridge construction, culvert replacements, piling removal, etc.	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards[2]	NA
Helicopter: Chinook 47d	>0.5 mile	266 yards to 0.5 mile	≤ 265 yards[5]	100 yards[6] (injury/mortality)
Helicopter: Boeing Vertol 107, Sikorsky S-64 (SkyCrane)	>0.25 mile	151 yards to 0.25 mile	≤ 150 yards[7]	50 yards[6] (injury/mortality)
Helicopters: K-MAX, Bell 206 L4, Hughes 500	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards[8]	50 yards[6] (injury/mortality)

1. NA = not applicable. We anticipate that marbled murrelets that select nest sites in close proximity to heavily used roads are either undisturbed by or habituate to the sounds and activities associated with these roads (Hamer and Nelson 1998, p. 21).
2. Based on recommendations from murrelet researchers that advised buffers of greater than 100 meters to reduce potential noise and visual disturbance to murrelets (Hamer and Nelson 1998, p. 13, USFWS 2012c, pp. 6-9).
3. Based on an estimated 92 dBA sound-contour (approximately 265 yards) for the Chinook 47d (Newman et al. 1984, Table D.1).
4. Because murrelet chicks are present at the nest until they fledge, they are vulnerable to direct injury or mortality from flying debris caused by intense rotor wash directly under a hovering helicopter. Hovering distance is based on a 300-ft radius rotor-wash zone for large helicopters hovering at < 500 above ground level (from WCB 2005, p. 2 – logging safety guidelines). We reduced the hovering helicopter rotor-wash zone to a 50-yard radius for all other helicopters based on the smaller rotor-span for all other ships.
5. Based on an estimated 92 dBA sound contour from sound data for the Boeing Vertol 107 the presented in the San Dimas Helicopter Logging Noise Report (USFS 2008, chapters 5, 6).
6. The estimated 92 dBA sound contours for these helicopters is less than 110 yards (e.g., K-MAX (100 feet) (USFS 2008, chapters 5, 6), and Bell 206 (85-89 dbA at 100 m)(Grubb et al. 2010, p. 1277).

Disturbance from proposed actions that are conducted: 1) outside of the breeding period (between September 24 and March 31 for WA and between September 16 and March 31 for Oregon); 2) greater than 0.25 mile from occupied or unsurveyed suitable habitat during the breeding season; or 3) within 0.25 mile of surveyed unoccupied habitat during any time of the year, *is not expected to affect* murrelets because these activities are not likely to result in any exposure to nesting murrelets. Murrelets that are not nesting are expected to be able to move away from disturbance with no increased risk of death or injury. Additionally, in these situations corvid attraction will not cause an increased risk of predation because we believe corvid predation is only likely to affect murrelet chicks and eggs, not adults.

Within the murrelet nesting period in Oregon, the USFWS considers two distinct periods: the critical nesting season between April 1 – August 5, and the late nesting season between August 6 and September 15. In Washington, the USFWS does not incorporate a late nesting period into its management evaluations. During the late nesting season in Oregon, activities other than helicopters are *not likely to adversely affect* murrelets *provided that they don't begin until two hours after sunrise and cease prior to two hours before sunset.*

In the late breeding period, we believe the likelihood that disturbance will cause injury declines because most murrelets are finished incubating and either have completed nesting (about half of the chicks have fledged) (Hamer et al. 2003) or adult murrelets are still tending the nest. Adults still tending their young in the late breeding period are heavily invested in chick-rearing making it unlikely adults will abandon their young due to noise from the proposed activities. In addition, the proposed action limits disturbance activities for the two hours after sunrise and two hours before sunset (between Aug 6-Sept 15) when most food deliveries to young are made. This restriction thus reduces the likelihood of nest abandonment or significant alteration of breeding success, therefore the likelihood of injury by annoying it to such an extent as to significantly disrupt normal behavior patterns, which includes but are not limited to, breeding feeding or sheltering has been minimized. However, some data indicate that murrelets are making more food deliveries during the day than previously assumed and that predation pressures on eggs and chicks is throughout the entire breeding period. Two-hour daily timing restrictions are still recommended minimization measures.

Due to disturbance, the proposed action could cause a chick to fall off a nest branch, prematurely fledge, or have an injury due to excessive noise. These activities may potentially cause the likelihood of injury to fledglings throughout the entire breeding period (April 1 – September 15 for Oregon and April 1-September 23 for Washington).

As the breeding season progresses there are fewer nesting murrelets as nests either fledge or fail. Therefore, projects that start during the end of the nesting season reach a point where the likelihood of a nearby nest site still being active is discountable. For Washington, after September 4^{th} 97.72 percent of all nests are estimated to have fledged (B. Tuerler, *in litt.*). Therefore, in Washington, projects conducted September 5 – September 23 are not likely to adversely affect murrelets, as the likelihood of exposure to a nest site that is still active is considered discountable.

Table 16. Summary of disturbance effects from the proposed action when active marbled murrelet nests are within the disruption distances of actions within Washington State.

Disturbance Type	Time Period[1]	Effects	Rationale for Effect Determination
Noise other than helicopters (*i.e., all actions except surveys*)	Apr 1 - Sept 4	LAA	Effects vary and may cause from little to significant disruption depending on site- and activity-specific factors and the individual murrelet's noise tolerance. Worst-case scenario, adults move from noise, causing increased predation to young, missed feedings, or premature fledging. Based on anecdotal observations and limited studies, murrelets appear generally undisturbed by sharp or prolonged loud noise, and nesting attempts are not easily disrupted by human disturbance except when confronted very near the nest itself (Long and Ralph 1998, USFWS 2003). Most actions will not occur within 100 yards of active nests or likely occupied, unsurveyed habitat from Apr 1-Aug 5. For those that do, likelihood of injury to young will mostly occur through the potential increase of predation of abandoned young. However, predation likelihood is reduced by PDCs that are part of the proposed action (e.g., removal of project generated garbage to prevent attraction of corvids). Since this likelihood cannot be eliminated this type of disturbance is considered likely to adversely affect murrelets. Actions will seldom occur during crepuscular time periods, thereby significantly reducing the probability of missed feeding attempts.
	September 5 – Sept 23	NLAA	This is the tail end of the nesting season when approximately 98 percent of all nests are estimated to have fledged. Therefore in WA, projects conducted September 5 – September 23 are not likely to adversely affect murrelets as the likelihood of exposure to a nest site that is still active is considered discountable.
	Sept 24-March 31	NE	This time period is outside of the murrelet breeding season.

Disturbance Type	Time Period[1]	Effects	Rationale for Effect Determination
Noise and rotor wash associated with helicopters (*i.e., some culvert/bridge, nutrient enhancement, LW placement actions*).	Apr 1 - Sept 4	LAA	Noise effects vary and may cause little to significant disruption depending on site- and activity-specific factors and an individual's noise tolerance. Worst-case scenario, adults move from noise, causing increased predation to young, missed feedings, or premature fledging. Young, which are not capable of moving away from noise, may have injury form excessive noise levels. Most activities do not use helicopters, and most helicopter use will not occur within 0.25 miles of active nests or likely occupied, unsurveyed habitat from Apr 1-Sept 15. Helicopters will generally hover no closer than 300 feet from the ground and ferry logs at 500 feet altitude for safety purposes. Activities will seldom occur during crepuscular time periods, thereby significantly reducing the probability of delayed feeding attempts. Helicopter passes over nests are less likely to cause injury than hovering in close proximity to nests. There is some indication that murrelets do not respond to airplanes and helicopters flying overhead unless they pass over at low altitude (Long and Ralph 1998). Prior murrelet studies involved circling/hovering over 125 nests for 3-min intervals within 100-300 m (328-984 feet), which did not flush any of the incubating adults (USFWS 2003).
	September 5 – Sept 23	NLAA	This is the tail end of the nesting season when approximately 98 percent of all nests are estimated to have fledged. Therefore in WA, projects conducted September 5 – September 23 are not likely to adversely affect murrelets as the likelihood of exposure to a nest site that is still active is considered discountable.
	Sept 24-March 31	NE	This time period is outside of the murrelet breeding season.
	September 5 – Sept 23	NLAA	This is the tail end of the nesting season when approximately 98 percent of all nests are estimated to have fledged. Therefore in WA, projects conducted September 5 – September 23 are not likely to adversely affect murrelets as the likelihood of exposure to a nest site that is still active is considered discountable.
	Sept 24-March 31	NE	This time period is outside of the murrelets breeding season.
On-the-ground human	Apr 1 - Sept 4	LAA	Murrelets are susceptible to an increase in predation levels within an action area when groups of humans attract corvids.

Disturbance Type	Time Period[1]	Effects	Rationale for Effect Determination
presence (*i.e., all actions*)	September 5 – Sept 23	NLAA	This is the tail end of the nesting season when approximately 98 percent of all nests are estimated to have fledged. Therefore in WA, projects conducted September 5 – September 23 are not likely to adversely affect murrelets as the likelihood of exposure to a nest site that is still active is considered discountable.
	Sept 24-March 31	NLAA	This time period is outside of the murrelet breeding season.
In canopy human presence (*i.e., if needed to monitor adverse effects surveys*)	Apr 1 - Sept 4	LAA	Murrelets have been known to flush from a nest due to human presence in the tree canopy.
	September 5 – Sept 23	NLAA	This is the tail end of the nesting season when approximately 98 percent of all nests are estimated to have fledged. Therefore in WA, projects conducted September 5 – September 23 are not likely to adversely affect murrelets as the likelihood of exposure to a nest site that is still active is considered discountable.
	Sept 24-March 31	NE	This time period is outside of the murrelet breeding season.

[1] - All activities in the breeding season affecting murrelet habitat will have 2-hour timing restrictions applied.

Table 17. Summary of disturbance effects from the proposed action when active marbled murrelet nests are within the disruption distances of actions with the state of Oregon.

Disturbance Type	Time Period	Effects	Rationale for Effect Determination
Noise other than helicopters (*i.e., all actions except surveys*)	Apr 1 - Aug 5	LAA	Effects vary and may cause little to significant disruption depending on site- and activity-specific factors and the individual's noise tolerance. Worst-case scenario, adults move from noise, causing increased predation to young, missed feedings, or premature fledging. Most actions will not occur within 100 yards of active nests or likely occupied, unsurveyed habitat from Apr 1-Aug 5. For those that do, likelihood of injury to young will mostly occur through the potential increase of predation of abandoned young. However, predation likelihood is reduced by PDCs that are part of the proposed action (e.g., removal of project generated garbage to prevent attraction of corvids). Actions will seldom occur during crepuscular time periods, thereby significantly reducing the probability of missed feeding attempts. Based on anecdotal observations and limited studies, murrelets appear generally undisturbed by sharp or prolonged loud noise, and nesting attempts are not easily disrupted by human disturbance except when confronted very near the nest itself (Long and Ralph 1998, USFWS 2003e).
	Aug 6 – Sept 15	NLAA[1]	In this period nests have been established, most of incubation is complete and many young have fledged. Project design criteria in the proposed action require 2-hour timing restrictions, which will allow feedings of murrelet young to occur during crepuscular periods.
	Sept 16-March 31	NE	Based on nest fledging data this time period is past when most murrelets fledge.

Disturbance Type	Time Period	Effects	Rationale for Effect Determination
Noise and rotor wash associated with helicopters (*i.e., some culvert/bridge, nutrient enhancement, LW placement actions*).	Apr 1 – Aug 5	LAA	Noise effects vary and may cause little to significant disruption depending on site- and activity-specific factors and an individual's noise tolerance. Worst-case scenario, adults move from noise, causing increased predation to young, missed feedings, or premature fledging. Young, which are not capable of moving away from noise, may have injury form excessive noise levels. Most activities do not use helicopters, and most helicopter use will not occur within 0.25 miles of active nests or likely occupied, unsurveyed habitat from Apr 1-Sept 15. Helicopters will generally hover no closer than 300 feet from the ground and ferries logs at 500 feet for safety purposes. Also, helicopters will not hover within 500 feet of active nests. Activities will seldom occur during crepuscular time periods, thereby significantly reducing the probability of delayed feeding attempts. Helicopters passes over nests are less likely to cause injury than hovering in close proximity to nests. There is some indication that murrelets do not respond to airplanes and helicopters flying overhead unless they pass over at low altitude (Long and Ralph 1998). Prior murrelet studies involved circling/hovering over 125 nests for 3-min intervals within 100-300 m (328-984 feet), which did not flush any of the incubating adults (USFWS 2003e).
	Aug 6 – Sept 15	LAA	For young that have not fledged, the action could cause a chick to fall off a nest branch, prematurely fledge or may cause the chick injury form excessive noise levels or from being hit by flying debris.
	Sept 16-March 31	NE	Based on nest fledging data this time period is past when most murrelets fledge.
	Aug 6 – Sept 15	NLAA[1]	In this period nests have been established, most incubation is complete and many young have fledged. Project design criteria in the proposed action require 2-hour timing restrictions, which will allow feedings of murrelet young to occur during crepuscular periods.
	Sept 16-March 31	NE	Based on nest fledging data this time period is past when most murrelets fledge.
On-ground human	Apr 1–Aug5	LAA	Murrelets are susceptible to an increase in predation levels within an action area when groups of humans attract corvids.

Disturbance Type	Time Period	Effects	Rationale for Effect Determination
presence (*i.e., all actions*)	Aug 6-Sept 15	NLAA[1]	In this period nests have been established, most incubation is complete and many young have fledged. Project design criteria in the proposed action require 2-hour timing restrictions, which will allow feedings of murrelet young to occur during crepuscular periods.
	Sept 16-30	NLAA	Based on two hour daily timing restrictions, and that more marbled murrelets have finished nesting and have fledged as the season goes on, the risk of corvid predation is decreasing in this time period.
In canopy human presence (*i.e., if needed to monitor adverse effects surveys*)	Apr 1-Aug 5	LAA	Murrelets have been known to flush from a nest due to human presence in the tree canopy.
	Aug 6 – Sept 15	NLAA[1]	In this period nests have been established, most of incubation is completed and many young have fledged. Project design criteria in the proposed action require 2-hour timing restrictions, which will allow feedings of murrelet young to occur during crepuscular periods.
	Sept 16-March 31	NE	Based on nest fledging data this time period is past when most murrelets fledge.

NLAA[1] - The activity is NLAA because 2-hour timing restrictions will be applied.

The potential for large-scale disturbance is greatly reduced by the species specific conservation measures associated with the proposed action and as outlined in Appendix D of this document. The BPA and their project proponents will use disturbance and disruption guidelines listed in Tables 16 and 17 to determine whether projects are likely to adversely affect murrelets. Many activities will result in NE determinations for disturbance since agencies will implement most actions outside of nesting period windows and/or outside of disturbance distances from murrelet nests and unsurveyed suitable habitat. Additional activities will result in NLAA determinations for disturbance since BPA and their project proponents will implement some actions in the late nesting period with daily timing restrictions and outside of the disruption distance from murrelet nests and unsurveyed suitable habitat. The conservation measures for marbled murrelets proposed by BPA will ensure that most projects will not rise to the level of an LAA determination.

d. Effects at the Conservation Zone and Range-wide

It is likely that some nesting murrelets exposed to these disturbances will still nest successfully. We anticipate marbled murrelet nesting habitat in the action area will be subjected to noise and visual disturbance during implementation of the proposed action, and that all murrelets associated with occupied or unsurveyed nesting habitat would have a significant behavioral response to noise and visual disturbance that results in an increased likelihood of injury. Potential murrelet responses to disturbance include delay in or avoidance of nest establishment, flushing from a nest or branch within nesting habitat, aborted or delayed feeding of juveniles, or increased vigilance/alert behaviors at nest sites with implications for reduced individual fitness and reduced nesting success. These behavioral disruptions create a likelihood of injury by increasing the risk of predation, reduced fitness of nestlings as a result of missed feedings, and/or increased energetic costs to adults that must make additional foraging trips. We do not expect that noise and visual disturbance will result in actual nest failure, but acknowledge that disturbance creates a likelihood of injury that can indirectly result in nest failure due to predation or reduced fitness of some individuals. The proposed action incorporates a daily operating restriction that will avoid project activities during the murrelet's daily peak activity periods during dawn and dusk hours. This daily restriction reduces but does not eliminate the potential for adverse disturbance effects or disrupted feeding attempts during mid-day hours.

We anticipate marbled murrelet nesting habitat in the action area (recovery zones 2, 3 and 4) will be subjected to the mechanical disruption from rotor wash (excessive wind) during implementation of the proposed action, and that all murrelets associated with occupied or unsurveyed nesting habitat subjected to rotor wash would have a significant behavioral response to these disturbances that results in an increased likelihood of injury. Potential murrelet responses to this disturbance includes being blown or shaken from the nest, which would result in death, or being injured from debris (i.e., a branch) being blown onto the chick at nest sites with implications for reduced individual fitness and reduced nesting success. Rotor wash has a small footprint and tree canopy cover may reduce actual impacts at a nest site. These behavioral disruptions create a likelihood of injury by increasing the risk of reduced fitness of nestlings as a result of physical injury from flying debris or being blown from the nest. We do expect that rotor wash disturbance will result in a likelihood of injury that can result in a reduced fitness of individuals.

The anticipated disruption of normal nesting behaviors will result in an increased likelihood of injury to murrelets nesting within those affected acres but is not reasonably certain to result in direct nest failures. The anticipated increased likelihood of injury is not anticipated to appreciably reduce murrelet numbers or reproduction at the scale of the action area or any larger scale because 1) most nests exposed to disturbance are not expected to fail given the variability of responses to noise, rotor wash and visual disturbance; and 2) no direct mortality of adult murrelets is anticipated, so there would be no reduction in the current population of breeding adults. Therefore, the Service believes the proposed project will not result in jeopardy for the marbled murrelet at the Conservation Zone or Range Wide scales.

6.4.1 Effects to Marbled Murrelet Critical Habitat

As the proposed projects are not likely to adversely affect marbled murrelet habitat or their critical habitat, the proposed projects will not affect the marbled murrelet critical habitat at the NWFP, Conservation Zones or range-wide scales.

7.0 Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions on listed species or critical habitat that are reasonably certain to occur in the action area considered in this BO. 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 ESA.

The contribution of non-Federal activities to the current condition of ESA-listed species and designated critical habitats within BPA's HIP III action area was described in the Status of the Species and sections, above. Among those activities were agriculture, forest management, mining, road construction, urbanization, water development, and river restoration. Those actions were driven by a combination of economic conditions that characterized traditional natural resource-based industries, general resource demands associated with settlement of local and regional population centers, and the efforts of social groups dedicated to the river restoration and use of natural amenities, such as cultural inspiration and recreational experiences.

Resource-based industries caused many long-lasting environmental changes that harmed ESA-listed species and their critical habitats, such as state-wide loss or degradation of stream channel morphology, spawning substrates, instream roughness and cover, estuarine rearing habitats, wetlands, riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants), fish passage, and habitat refugia. Those changes reduced the ability of populations of ESA-listed species to sustain themselves in the natural environment by altering or interfering with their behavior in ways that reduce their survival throughout their life cycle. The environmental changes also reduced the quality and function of critical habitat PCEs. Without those features, species cannot successfully produce offspring. As noted above, however, the declining level of resource-based industrial activity and rapidly rising industry standards for resource protection are likely to reduce the intensity and severity of those impacts in the future.

The economic and environmental significance of natural resource-based economy is currently declining in absolute terms and relative to a newer economy based on mixed manufacturing and marketing with an emphasis on high technology (Brown 2011). Nonetheless, resource-based industries are likely to continue to have an influence on environmental conditions within the program-action area for the indefinite future. However, over time those industries have adopted management practices that avoid or reduce many of their most harmful impacts, as is evidenced by the extensive conservation measures included with the proposed action, but which were unknown or in uncommon use until even a few years ago.

While natural resource extraction within Oregon may be declining, general resource demands are increasing with growth in the size and standard of living of the local and regional human population. The percentage increase in population growth may provide the best estimate of general resource demands because as local human populations grow, so does the overall consumption of local and regional natural resources. Between April 2010 and July 2011, the population of Oregon and Idaho both grew by 1.1% and the population of Washington State grew by 1.6%.[31] The population is expected to continue to grow at a similar rate. We assume that private and state actions that have routinely occurred in the past will continue within the action area, increasing as population rises.

Similarly, demand for cultural and aesthetic amenities continues to grow with human population, and is reflected in decades of concentrated effort by Tribes, states, and local communities to restore an environment that supports flourishing wildlife populations, including populations of species that are now ESA-listed (CRITFC 1995; NWPCC 2012). Reduced economic dependence on traditional resource-based industries has been associated with growing public appreciation for the economic benefits of habitat restoration, and growing demand for the cultural amenities that restoration provides. Thus, many non-Federal actions have become responsive to the recovery needs of ESA-listed species. Those actions included efforts to ensure that resource-based industries adopt improved practices to avoid, minimize, or offset their adverse impacts. Similarly, many actions focused on completion of river restoration projects specifically designed to broadly reverse the major factors now limiting the survival of ESA-listed species at all stages of their life cycle. For aquatic species, those actions have improved the availability and quality of estuarine and nearshore habitats, floodplain connectivity, channel structure and complexity, riparian areas and large wood recruitment, stream substrates, stream flow, water quality, and fish passage. In this way, the goal of ESA-species recovery has become institutionalized as a common and accepted part of the State's economic and environmental culture. We expect this

[31] http://quickfacts.census.gov/qfd/states/16000.html, accessed December 18, 2012.

trend to continue into the future as awareness of environmental and at-risk species issues increases among the general public.

It is not possible to predict the future intensity of specific non-Federal actions related to resource-based industries at this program scale due to uncertainties about the economy, funding levels for restoration actions, and individual investment decisions. However, the adverse effects of resource-based industries in the action area are likely to continue in the future, although their net adverse effect is likely to decline slowly as beneficial effects spread from the adoption of industry-wide standards for more protective management practices. These effects, both negative and positive, will be expressed most strongly in rural areas where these industries occur, and therefore somewhat in contrast to human population density. The future effects of habitat restoration are also unpredictable for the same reasons, but their net beneficial effects may grow with the increased sophistication and size of projects completed and the additive effects of completing multiple projects in some watersheds.

In summary, resource-based activities such as timber harvest, agriculture, mining, shipping, and energy development are likely to continue to exert an influence on the quality of freshwater and estuarine habitat in the action area. The intensity of this influence is difficult to predict and is dependent on many social and economic factors. However, the adoption of industry-wide standards to reduce environmental impacts and the shift away from resource extraction to a mixed manufacturing and technology based economy should result in a gradual decrease in influence over time. In contrast, the populations of Oregon, Washington and Idaho are expected to increase in the next several decades with a corresponding increase in natural resource consumption. Additional residential and commercial development and a general increase in human activities are expected to cause localized degradation of habitat valuable for native fish and wildlife. Interest in restoration activities is also increasing as is environmental awareness among the public. This will lead to localized improvements to fish and wildlife habitat. When these influences are considered collectively, we expect trends in habitat quality to remain flat or improve gradually over time. This will, at best, have positive influence on population abundance and productivity for the species affected by this consultation. In a worst cases scenario, we expect cumulative effects would have a relatively neutral effect on population abundance trends. Similarly, we expect the quality and function of critical habitat PCEs or physical and biological features to express a slightly positive to neutral trend over time as a result of the cumulative effects.

8.0 Conclusions

After reviewing the status of the listed species addressed by this BO**,** the status of their designated critical habitats, the environmental baseline for the action areas, the effects of the proposed actions, and cumulative effects, we determine that the proposed program of restoration actions is not likely to jeopardize the continued existence of bull trout, Oregon chub or marbled murrelet and is not likely to adversely modify or destroy critical habitat for any of these three species.

The no jeopardy, no adverse modification or destruction finding for bull trout, Oregon chub, and marbled murrelet is supported by the following:

Bull Trout:

1. The primary objective of the proposed action is restoration of habitat for aquatic and terrestrial species. The majority of work that will occur under the proposed action will have immediate and long term benefits for aquatic and terrestrial species. A limited number of projects may cause short-term adverse effects to individuals but not at the local population, core area or interim recovery unit scale.

2. Bull trout specific conservation measures such as working within inwater work windows and coordination with FWS personnel when working in bull trout spawning and juvenile rearing areas will significantly limit the likelihood of harm to individuals.

Oregon Chub:

1. The primary objective of the proposed action is restoration of habitat for aquatic and terrestrial species. The majority of work that will occur under the proposed action will have immediate and long term benefits for aquatic and terrestrial species. A limited number of projects may cause short-term adverse effects to individuals but not at population, subbasin or range-wide scale.

2. Conservation measures have been designed to minimize or avoid adverse effects to Oregon chub and its critical habitat.

3. Harm and/or mortality of Oregon chub individuals associated with survey, capture, and habitat restoration projects is expected to be very low.

4. Habitat restoration projects in the vicinity of Oregon chub will occur outside of the spawning window for Oregon chub.

5. Given the history of projects funded under BPA's HIP I and II programs, we anticipate very few projects will occur in the vicinity of Oregon chub habitats.

Marbled Murrelet:

1. Adverse affects to murrelets will be limited to disturbance only; no adverse affects to habitat will be permitted under this programmatic BO.

2. Only a limited number of disturbance impacts are permitted annually during the nesting season within marbled murrelet recovery zones 2, 3 and 4.

3. Most nests exposed to disturbance are not expected to fail given the variability of responses to noise, rotor wash and visual disturbance.

4. No direct mortality of adult murrelets is anticipated, so there would be no reduction in the current population of breeding adults.

5. The HIP III action area only encompasses a very small geographic area of recovery zone 2 and zone 4, thus adverse affects will generally be limited to only one of the six recovery zones (zone 3 – Oregon coast).

9.0 Incidental Take Statement

Section 9(a) (1) of the ESA prohibits the taking of endangered species without a specific permit or exemption. Protective regulations adopted pursuant to section 4(d) extend the prohibition to threatened species. 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 is further defined by the Service as an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3). Harass is further defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3).

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 (ITS). Among other things, an action that harasses, wounds, or kills an individual of a listed species or harms a species by altering habitat in a way that significantly impairs its essential behavioral patterns is a taking (50 CFR 222.102). Incidental take refers to takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(o) (2) exempts any taking that meets the terms and conditions of a written ITS from the taking prohibition.

9.1 Amount or Extent of Take

9.1.1 Bull Trout

Any of the nine proposed restoration categories may result in short-term adverse impacts to bull trout, mainly from water quality changes (suspended sediment, temperature, dissolved oxygen, contaminants and chemical herbicides) and effects from in-stream construction, worksite isolation and associated fish handling. Depending on the species, project location, and timing, there is a varying likelihood of species presence, and thus exposure.

Take caused by the habitat-related effects of this action cannot be accurately quantified as a number of fish because the distribution and abundance of fish that occur within the action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional and operate across far broader temporal and spatial scales than will be affected by the proposed action. Thus, the distribution and abundance of fish within the action area cannot be predicted precisely based on existing habitat conditions, nor can we precisely predict the number of fish that are reasonably certain to be harmed or harassed if their habitat is modified or degraded by the proposed action. In such circumstances we use the causal link established between the activity and the likely changes in habitat conditions affecting the listed species to describe the extent of take as a numerical level of habitat disturbance.

Short-term impacts to water quality (suspended sediment, temperature, etc.) and physical habitat features. Here, the best available indicators for the extent of incidental take associated with short-term impacts to water quality and physical habitat features are as follows:

1. The total length of stream reach that will be modified by construction each year.
2. The visible increase in suspended sediment associated with construction activities.

These variables are proportional to the amounts of harm and harassment that the proposed action is likely to cause through degradation of water quality or physical habitat. Suspended sediment is proportional to the water quality impairment that the proposed action will cause, including increased sediment, temperature, and contaminants, and reduced dissolved oxygen. Stream length is proportional to the amount of habitat that will be physically altered, including natural cover, floodplain connectivity, riparian vegetation, forage and safe passage conditions.

NMFS' HIP III BO (NMFS 2013) assumed up to 150 projects per year may be funded or carried out under BPA's HIP III programmatic per year based on the BA and information from the HIP I and II consultations between BPA and NMFS. For the purposes of our analysis, and for consistency between our HIP III BO and NMFS', we will assume the same. Based on previous implementation of BPA's HIP, at most half of these projects (n=75) will involve near or in-water work. The proposed action may be much localized (e.g., culvert replacement) or much larger in scope (e.g., channel reconstruction). Because we do not want to limit the scope of large, beneficial restoration projects, the extent of take is best identified by the maximum number of projects requiring near and in-water construction in any given year. Therefore, implementation of more than 90 projects per year (i.e., 15 projects more than the expected 75 projects per year with in-water work) that include near or in-water construction is a threshold for reinitiating consultation.

In addition, we assume that an increase in sediment will be visible in the immediate vicinity of construction associated with the proposed action as well as a distance downstream, and the distance that sediment will be visible is proportionate both to the size of the disturbance and to the width of the wetted stream as follows (see Rosetta 2005), and whether the area is subject to tidal or coastal scour. Therefore, a further threshold for reinitiating consultation is a visible increase in suspended sediment:

1. up to 50 feet from the project area in streams that are 30 feet wide or less;
2. up to 100 feet from the discharge point or nonpoint source of runoff for streams between 30 and 100 feet wide;
3. up to 200 feet from the discharge point or nonpoint source for streams greater than 100 feet wide; and
4. up to 300 feet from the discharge point or nonpoint source for areas subject to tidal or coastal scour.

If an exceedance of either the total linear stream feet limit or suspended sediment limits occurs, the project sponsor must modify the activity and continue to monitor every two hours. If an exceedance over the background level continues after the second monitoring interval, the activity must stop until the turbidity levels return to background.

Short-term water quality impacts from chemical herbicide application. Application of chemical herbicides will result in short-term degradation of water quality which will cause injury to fish in the form of sublethal adverse physiological effects. This is particularly true for herbicide applications in riparian areas or in ditches that may deliver herbicides to stream occupied by listed salmonids. These sublethal effects, described fully in the effects analysis for this opinion, will include increased respiration, reduced feeding success, and subtle behavioral changes that can result in increased susceptibility to predation. The future abundance and distribution of listed fish in relation to the effects of herbicide applications within HIP III is indeterminate and so a specific number of individuals taken cannot be predicted. For herbicide application, the extent of take is best identified by the total number of riparian acres treated each year. The BPA shall reinitiate consultation if more than 1,000 total riparian acres are treated in a calendar year under this programmatic consultation.

Fish Capture

Given the general locations of projects implemented under BPA's HIP program from 2003 to 2012, we estimate that 50 of the estimated 75 near or in-stream projects implemented annually under HIP III could occur within the range of the bull trout (SR or FMO habitat). While we expect the majority of ESA-listed fish captured as part of these projects would be salmon and steelhead, a portion of these fish are likely to be bull trout.

In the absence of empirical data, and for programmatic assessments where there is uncertainty as to where projects will be implemented across the action area, we often rely on professional judgment to develop formulas that help predict the likelihood of a listed species occurrence and rate of occurrence within a project area. Given that bull trout are an apex predator and generally persist in much lower abundance than other sympatric salmonids such as salmon, steelhead and other species of trout, we believe bull trout would comprise a relatively low percentage of the overall catch of salmonids within a given project area; probably somewhere between three and four percent for migratory populations, although there will be wide variation between project locations. Areas where resident bull trout populations exist may comprise a slightly higher proportion of the overall number of salmonids, somewhere near ten percent or possibly higher in some cases. While the overall percentage of bull trout to other salmonids may increase in SR habitat during summer and fall, the converse is true for FMO habitats during this time period because of warmer water temperatures and generally poorer water quality. Because the ratio of bull trout to other salmonids varies considerably across their range, and to err conservatively, we will estimate a ratio of bull trout to salmon and steelhead of .05 to 1 (i.e., bull trout are estimated to comprise on average five percent of all salmonids captured during isolation and capture efforts). Therefore based on NMFS' anticipated capture of 100 salmon and steelhead per in-stream project as described previously, we anticipate an average capture of five bull trout for each project within the range of bull trout where isolation and dewatering could be required. Based on information presented in the Effects section, we anticipate injury or mortality to five percent of the fish that are captured and released, with the remainder (95 percent) likely to survive with no long-term adverse effects. Data presented in the Effects section suggests that the injury/mortality number is more likely around two percent for fish captured and handled. Nonetheless, we are choosing to err on the side of caution and use the more conservative five percent figure. Thus, we anticipate up to 250 individual bull trout will be captured on average per year (estimated 50 in-stream projects within the range of bull trout x 5 bull trout per project on average) of which an estimated 13 individuals (.05 percent x 250 fish) will be injured or killed per year as a result of fish capture necessary to isolate in-water construction areas.

Overall, the effects of work area isolation on the abundance of bull trout in the Columbia River IRU are likely to be small. Almost all of these fish are anticipated to be juveniles, but a small number of adults could possibly be captured. For utility of operation we will not distinguish between take of juveniles and take of adults but will assume that most (95-99%) of the capture would be juveniles. Adult equivalents are discussed to show the likely effect to the overall Columbia River IRU population. These adult equivalents represent the effect the number of fish killed or injured (assuming these were all juveniles) would have on the adult population. As noted previously, we anticipate that few if any adult bull trout will be captured thus the threshold for reinitiating consultation is 250 bull trout juveniles captured and 13 injured or killed per calendar year under the HIP III proposed action.

9.1.2 Oregon Chub

Take Incidental to In-Water Work-Site Isolation

Oregon chub, in previously unknown populations, may be captured during in-water work-site isolation. Due to the wide variation in population abundance, we are unable to estimate the number of Oregon chub that could potentially be encountered. However, pre-project sampling efforts should reduce the potential that chub will be found unexpectedly during in-water work-site isolation. Therefore, we anticipate incidental take, due to capture, of no more than 150 Oregon chub. We anticipate that fewer than 5 percent (maximum of 8 individuals) of captured

Oregon chub may be injured or killed on an annual basis during capture or handling. We anticipate that all captured Oregon chub may be harassed.

Take Incidental to In-Water Construction Projects

The Service anticipates incidental take of Oregon chub due to effects downstream of in-water construction projects will be difficult to detect due to their small body size and because finding a dead or impaired specimen is unlikely. Instead we will use habitat area as a surrogate for Oregon chub. We estimate that up to a 30 percent reduction in one habitat (e.g. reduced water volume causing desiccation of vegetation used for spawning habitat, sedimentation reducing habitat area, increased flows resulting in habitat becoming unsuitable for chub) may occur annually as a result of these activities. Depending on the size of the remaining area of habitat, this may cause a decrease in the affected Oregon chub population.

9.1.3 Marbled Murrelet

Take of marbled murrelets will occur from disruption related to HIP III project activities within the action area. In the Columbia River Basin portion of the marbled murrelet's recovery Zone 2 (Washington Coast Range Zone) and the Oregon portion of Zone 4 (Siskiyou Coast Range Zone) between Cape Blanco to the south and the northern boundary of Zone 4 (North Bend, Coos County), we anticipate up to 2 nest may be disrupted per year in each zone with no five-year period exceeding disruption of more than 10 nest per zone. In zone 3 (Oregon Coast Range zone) we anticipate up to 5 nest may be disrupted per year, with no five-year period exceeding disruption of more than 25 nest.

This will result in the harassment (reduced fitness or greater risk of predation through disrupting normal behavioral patterns) of up to 45 marbled murrelets per five-year period in recovery zones 2, 3, and 4 under this programmatic BO.

9.2 Effect of Take

In the accompanying BO, we determined that this level of anticipated take is not likely to result in jeopardy to bull trout, Oregon chub or marbled murrelet, or result in the destruction or adverse modification of critical habitat for these species.

9.3 Reasonable and Prudent Measures and Terms and Conditions

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). "Terms and conditions" implement the reasonable and prudent measures (50 CFR 402.14). These terms and conditions must be implemented for the exemption in section 7(o)(2) to apply.
The BPA shall:

1. Ensure completion of a comprehensive monitoring and reporting program regarding all actions funded or carried out by BPA under this programmatic biological opinion.

The measures described below are non-discretionary, and must be undertaken by BPA or, if an applicant is involved, must become binding conditions of any funding provided to the applicant, for the exemption in section 7(o)(2) to apply. BPA has a continuing duty to regulate the activity covered by this incidental take statement. If BPA (1) fails to assume and implement the terms and conditions or (2) fails to require an applicant to adhere to the terms and conditions of the incidental take statement through funding conditions, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, BPA must report the progress of the action and its impact on the species considered in this BO to USFWS as specified in the incidental take statement.

1. To implement reasonable and prudent measure #1 (monitoring and reporting), BPA shall:
    a. Submit a monitoring report to USFWS by April 15 each year that describes BPA's efforts to carry out this opinion. The report will include an assessment of overall program activity, a map showing the location and type of each action funded or carried out under this opinion, compliance with the biological opinion, and any other data or analyses BPA deems necessary or helpful to assess habitat trends as a result of actions completed under this opinion.
    b. BPA will host an annual coordination meeting with USFWS and NMFS by April 15 each year to discuss the annual monitoring report, compliance with the Service's biological opinion, and any actions that will improve conservation under this opinion, or make the program more efficient or accountable.

10.0 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02). The following conservation recommendations are discretionary measures that USFWS believes is consistent with this obligation and therefore should be carried out by the Federal action agency:

The USFWS recommends that BPA and their project sponsors consider biological needs of lamprey spp. whenever they plan or conduct any instream or near-stream projects. An effort to follow all recommendations found in Best Management Practices to minimize adverse effect to Pacific Lamprey http://www.fws.gov/columbiariver/publications/BMP_Lamprey_2010.pdf will improve habitat conditions for all native fish, and may aid in the recovery of ESA-listed fish within the action area.

11.0 Reinitiation of Consultation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal action agency involvement or control over the action has been retained, or is authorized by law, and if: (1) The amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action on listed species or designated 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 on the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

If monitoring and reporting are not done in accordance with the description of the proposed action, the BPA needs to reinitiate formal consultation in accordance with the requirements of 402.16(c). Failure to adequately monitor and report constitutes a change in the proposed action that may facilitate effects to listed species or critical habitat that were not considered in the BO. To reinitiate consultation, contact the Oregon Fish and Wildlife Office of the USFWS and refer to Reference Number 01EOFW00-2013-F-0199.

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Appendix A – HIP III Reporting Process

Bonneville Power Administration's (BPA) habitat improvement program requires project notifications via email for each set of contract actions implemented under the terms and conditions of the Services HIP III BOs. This appendix contains BPA's internal standard operating procedures for submission of those email notifications. These procedures are subject to change based on annual review by BPA, FWS and NMFS.

For each project, environmental leads on the contract will submit a completed Project Notification/Completion form to a BPA HIP_Reporting mailbox for QA/QC**.** The HIP_Reporting mailbox manager will check the form before forwarding to FWS (hip3@fws.gov) and/or NMFS (hip.nwr@noaa.gov) for approval. Incomplete or incorrect forms will be returned and corrected forms must be re-submitted to the HIP_Reporting mailbox. The Project Notification/Completion (PNC) form (included within Appendix A) can be used to request approval of a minor variance when necessary. The "project completion" section of the form is for reporting success in meeting project requirement and fish capture/mortality.

The PNC form shall be submitted exclusively to the HIP_Reporting mailbox manager (currently Israel Duran) for BPA Environmental Compliance staff.

- Each email shall have only one PNC form attached.
- Each form will be for a single project. Please Note: If a contract has several phases that will be submitted at different times, please number each phase with the contract number and then the letter A, B, and so on (i.e. 47997A, 47997B, 47997C, etc.). This helps the HIP III email monitor to attach all the appropriate paperwork for each work element submission and prevents confusion.
- Follow the detailed instructions on the PNC form and enter information accurately. Inspect to ensure that all the appropriate boxes are checked in each section and that a signature is applied (typewritten name) and dated at the end of the form. It will be returned if this is not filled in.
- Forms will be forwarded to the FWS and NMFS email box in Adobe pdf format. If sent in any other format they will be returned.
- BPA will ensure that only a single PNC is submitted for the final project to prevent multiple submittals for a single project.
- The FWS and NMFS email box will be used only for submissions of standard forms as described herein. Do not send any other email correspondence to this address.

When addressing HUC Number and HUC Name:

- If the project is completely located within 1 HUC
  - provide 6th field level HUC number and name
- If the project covers less than or equal to 3 HUCs
  - determine a primary HUC and list it first as NMFS will enter only this HUC into the database
  - list all of the HUCs and Names in the following format –

6th field level HUC/Name; 6th field level HUC/Name; 6th field level HUC/Name

- If the project covers greater than or equal to 4 HUCs
  - List the 5th field level HUC number and name which envelopes all 6th field level HUCs
  - Include a note on the Project Notification form stating why the HUCs are listed at the 5th field level

Please pay particular attention to the email subject line conventions. Deviation from subject line conventions will obstruct notification processing, and constitutes noncompliance with terms and conditions. The common format for all HIP III email subject lines is:

FWS Field Office/NMFS branch office, notification type, project contact, water body, county, state.

The FWS Field Office or NMFS branch office with responsibility for the geographic area of a project is determined from the FWS field office jurisdiction maps in this BO (Appendix B) and NMFS branch office maps provided to BPA.

Notification type is one of four: notification, variance, completion, or withdrawal. **Project contact** is the first and last name of a single person that will be most familiar with and in control of the ongoing project and need not necessarily be a BPA employee. **Water body** is the name of the stream or river mostly affected by the project. **County** and **state** describe the project's location and if working in a water body dividing two counties/states list the county/state most affected by the project. Use two-letter state code.

The following are examples of subject line format:
1. **Eastern Oregon**, **notification,** John Doe, Rock Creek, Gilliam, OR.
2. **North Idaho**, **completion,** Dave Black, Lolo Creek, Clearwater, ID.
3. **Eastern Washington**, **withdrawal,** Bill Smith, Toppenish Creek, Yakima, WA.
4. **South Idaho**, **variance,** Jane Jones, Pahsimeroi River, Custer, ID.

Project Notification (without a minor variance request): Shall be submitted prior to commencement of any project activities that may affect listed species covered under the Services BOs. Follow the detailed instructions on the standard PNC form. All engineering design review must be completed prior to submission. Use the term "notification" in the email subject line. You will not receive a return-reply from FWS or NMFS. Should the need for a minor variance request and approval arise after this form is submitted, follow the instructions below for *Variance Request After Notification.*

Project Notification (with a minor variance request): If it is known that the project will require a minor variance request review at the notification stage, include the request on the standard PNC form. The form shall be submitted at least 30 days before commencement of any project activities that may affect listed species covered under the Services BOs. All engineering design review must be completed prior to project notification form submission. Follow he detailed instructions on the standard notification form. The “variance explanation” should explain why a minor variance is needed, and should provide persuasive rationale why the variance will not result in effects beyond those considered in the HIP III BO and incidental take authorization. Variances will not be granted for proposed changes that cause effects beyond those considered in the HIP III. Variance approval or disapproval will be provided by reply email from the FWS Field Office supervisor and/or NMFS branch chief responsible for the geographic area of the proposed project, to the “from” address of the BPA Environmental Compliance Lead submitting the request, with CC to: **nwr.hip@noaa.gov**, and FWS HIP mailbox hip3@fws.gov generally within two weeks of the request date. There will be no further opportunity for discussion of the variance request after a decision is made. BPA must have the variance approval in hand before commencement of any project activities that may affect listed salmon. FWS Field Office supervisors and NMFS Branch chiefs will reply only to variance requests. Use the term "variance" in the email subject line.

Variance Request After Notification: If a minor variance request was not foreseen and thus not requested on the original PNC form, fill in the minor variance request section of the original PNC form following closely the detailed instructions. Email the form to HIP_Reporting for review. Upon review it will be forwarded to the FWS hip mailbox hip3@fws.gov and **hip.nwr@noaa.gov** and then to the appropriate FWS Field Office supervisor or NMFS branch chief. The form should be submitted at least 30 days before commencement of any project activities that may affect federally listed species. Use the term "variance" in the email subject line. The “variance explanation” should explain why a minor variance is needed, and should provide persuasive rationale why the variance will not result in effects beyond those considered in the HIP III BO and incidental take authorization. Variances will not be granted for proposed changes that cause effects beyond those considered in the HIP III. Variance approval or disapproval will be provided by reply email from the FWS Field Office supervisor and/or NMFS branch chief responsible for the geographic area of the proposed project, to the “from” address of the BPA Environmental Compliance Lead submitting the request with CC to: FWS hip mailbox hip3@fws.gov and NMFS hip mailbox **hip.nwr@noaa.gov**, generally within two weeks of the request date. There will be no further opportunity for discussion of the variance request after a decision is made. BPA must have the variance approval in hand before commencement of any project activities that may affect listed species. Field Office supervisors and Branch chiefs will reply only to variance requests.

Project Completion: Shall be submitted within 120-days after project completion. Follow closely the detailed instructions on the standard PNC form. The 120-day countdown begins based on the "proposed project end date" provided on the PNC form. Use the term “completion" in the email subject line. Make sure that all sections are filled in prior to submitting the form. Submit the PNC form to HIP_Reporting for review. Upon review it will be forwarded to FWS hip mailbox hip3@fws.gov and/or NMFS h**ip.nwr@noaa.gov** and then to the appropriate FWS Field Supervisor and/or NMFS branch chief.

Withdrawal: There is no standard form to request the withdrawal of a submitted PNC form. Send a withdrawal request to the HIP _Reporting mailbox using the term "withdrawal" in the email subject line, and provide the reason for the withdrawal in the body of the email or as an attachment. Upon review it will be forwarded to FWS hip3@fws.gov and/or NMFS **hip.nwr@noaa.gov** and then to the appropriate FWS Field Office supervisor and/or NMFS branch chief. If a previously submitted project is rejected by the branch chief, then the HIP III mailbox manager will go into PCTS and show the project as “withdrawn” to take away the “active” status of the project. If a previously withdrawn project must be resubmitted, submit it as a new PNC form. Should the scope of a project expand after the PNC form has been submitted to FWS and/or NMFS (as could occur in a Fish Accord “expansion” project when additional work elements are added to a current contract), the BPA Staff would proceed through the Withdrawal Process and Re-submit a new PNC form with the additional activities included. BPA staff will contact BPA’s KEC HIP III FWS and NMFS liaison who will call FWS and/or NMFS and inform them of the change.

Special Note to BPA Staff: Correct and consistent operation of this email reporting system is crucial to the required implementation tracking of the HIP III biological opinions. The forms are entered into FWS and NMFS tracking systems when sent to the email address, therefore:

- Please do not send any email submission prematurely or carelessly.
- Be certain that all form fields are filled-in accurately, instructions are followed correctly, and form sections are complete.
- Wait until a project design and schedule are complete and final before submitting a PNC form.
- Avoid the need for a withdrawal by considering the project in its entirety before submitting a PNC form.
- Design projects to comply with the specific HIP III BO terms and conditions and mitigation measures for the project's actions.
- Avoid variance requests by thoroughly considering all actions and timing and possible difficulties with the proposed project implementation, and design the project around these issues as it is preferred that the project remains in compliance with the HIP III BOs terms and conditions and mitigation measures. Variance requests can be denied.
- It is **BPA’s responsibility to ensure that proposed projects are consistent with all HIP III criteria.** The HIP_Reporting mailbox manager will check forms before forwarding to FWS and NMFS for approval. Incomplete or incorrect forms will be returned and must be resubmitted to HIP_Reporting with corrections. FWS and NMFS will not routinely review PNC forms for compliance with the HIP III BO; however, the FWS and NMFS mailbox managers will consistently check whether the forms are filled in correctly before forwarding to the field for approval. If they are missing items or are incorrectly filled in, they will be returned to the HIP_Reporting mailbox manager and must be re-submitted once the corrections are made.
- Always submit a PNC form within 120 days after the project is complete. The 120-day countdown begins based on the "proposed project end date" provided on the PNC form.

NMFS Internal Administration: The mailbox manager will check the mailbox daily and forward each email to the chief of the branch office indicated at the start of the subject line. At that time, or at least weekly, the mailbox manager will make a PCTS entry for each submission and save the email and attachment electronically to "S:\Doc_Rec_Mngt\Read File\Programmatic Implementation Records\HIP 3" electronic docket file in Portland. Branch chiefs will reply only to variance requests. Chiefs will reply to the "from" address of the BPA Environmental Compliance Lead, with CC to NMFS, generally within two weeks of the request date. Branch offices will not maintain administrative record ("docket file") of HIP III implementation.

HIP III Programmatic - Consultation
Project Notification/Completion Form (Revised 7/17/13)

Bonneville Power Administration environmental staff will review and submit this completed action notification form with the following information to the project sponsor and to the appropriate consulting agency (NMFS/USFWS).

Lead Action Agency: BPA		
NMFS Tracking #: 2013/9724	**Statutory Authority:** ☐ ESA & EFH ☐ ESA	**USFWS Tracking #: 01EOFW00-2013-F-0199**

Date of Request: ______________________

Project Title: ______________________

BPA Project #: ____________ **BPA Contract #:** ____________

BPA EC Contact: ____________ **Phone:** ____________

Project Sponsor Contact: ____________ **Phone:** ____________

Project Design Contact: ____________ **Phone:** ____________

NMFS Branch Office: ______________________

USFWS Field Office: ______________________

Lat/Long: (in decimal degrees) ____________ **Datum:** ____________

6th Field HUC: ____________ **HUC Name:** ____________

Project Start Date: ____________ **Project End Date:** ____________

(Project Completion Form due ≤60-days after this date)

Is the Project Herbicide Application only?	Yes ☐ No ☐
Does the project require near- and/or in-water construction?	Yes ☐ No ☐
Does the project require near- and/or in-water work (no construction)?	Yes ☐ No ☐
Does the project require work area isolation?	Yes ☐ No ☐
Does the project require fish salvage?	Yes ☐ No ☐
Will the project increase the amount of impervious surfaces?*	Yes ☐ No ☐
Does the project require a variance?	Yes ☐ No ☐

**** A stormwater management plan will be required.***

Project Description (include O&M Plan if required)

List the project activities and describe the intended result(s); tell when the project is to occur; describe how the activities will be implemented; provide any other pertinent information. Please include Work Element for each activity.

Minor Variance Request

Describe how the effects of the requested variance fall within the range of effects described for the proposed activities in the HIP III Opinion, by addressing the following:

1) Define the requested variance and the relevant criterion by page number.
2) Environmental conditions anticipated at the time of the proposed work (flow and weather conditions).
3) Biological justification as to why a variance is necessary and a brief rationale why the variance will either provide a conservation benefit or, at a minimum, not cause additional adverse effects beyond the scope of the Opinion.
4) Include as attachments any necessary approvals from state agencies.

NMFS Species/Critical Habitat Present in Action Area:

Anadromous Fish:

- ☐ Lower Columbia River Chinook
- ☐ Lower Columbia River coho
- ☐ Lower Columbia River steelhead
- ☐ Middle Columbia River steelhead
- ☐ Upper Columbia River spring-run Chinook
- ☐ Upper Columbia River steelhead
- ☐ Columbia River chum
- ☐ Green sturgeon
- ☐ Upper Willamette River Chinook
- ☐ Upper Willamette River steelhead
- ☐ Snake River spring/summer-run Chinook
- ☐ Snake River fall-run Chinook
- ☐ Snake River Basin steelhead
- ☐ Snake River sockeye
- ☐ Pacific eulachon

Marine Mammals:

- ☐ Steller sea lion

Essential Fish Habitat Species:

- ☐ Salmon (West Coast Salmon FMP)
- ☐ Estuarine Composite (Ground fish, pelagics)

USFWS Species/Critical Habitat Present in Action Area:

Freshwater Fish Species:

- ☐ Bull Trout
- ☐ Oregon Chub

Mammalian Species:

- ☐ Canada lynx
- ☐ Gray wolf
- ☐ North American wolverine
- ☐ Pygmy rabbit
- ☐ Columbian White-tailed Deer
- ☐ Grizzly Bear
- ☐ Northern Idaho ground squirrel
- ☐ Woodland caribou

Avian Species:

- ☐ Marbled murrelet
- ☐ Streaked horned lark
- ☐ Northern spotted owl
- ☐ Western snowy plover

Invertebrate Species:

- ☐ Banbury Springs limpet
- ☐ Bruneau Hot springsnail
- ☐ Fender's blue butterfly
- ☐ Taylor's checkerspot butterfly
- ☐ Bliss Rapids snail
- ☐ Snake River Physa snail
- ☐ Oregon silverspot butterfly

Plant Species:

- ☐ Bradshaw's lomatium
- ☐ Gentner's fritillary
- ☐ Howell's spectacular thelypody
- ☐ Large-flowered wooly meadowfoam
- ☐ McFarlane's four o'clock
- ☐ Rough popcorn flower
- ☐ Slickspot peppergrass
- ☐ Umtanum Desert buckwheat
- ☐ Western lily
- ☐ White Bluffs bladderpod
- ☐ Cook's lomatium
- ☐ Golden paintbrush
- ☐ Kincaid's lupine
- ☐ Malheur wire-lettuce
- ☐ Nelson's checkermallow
- ☐ Showy stickseed
- ☐ Spalding's catchfly
- ☐ Wenatchee Mountain checkermallow
- ☐ Willamette daisy

Types of Action:

Identify the types of action(s) proposed.

1. Fish Passage Restoration (Profile Discontinuities)

- ☐ a. Dams, Water Control or Legacy Structure Removal
- ☐ b. Consolidate, or Replace Existing Irrigation Diversions
- ☐ c. Headcut and Grade Stabilization
- ☐ d. Low Flow Consolidation
- ☐ e. Providing Fish Passage at an Existing Facility

Fish Passage Restoration (Transportation Infrastructure)

- ☐ f. Bridge and Culvert Removal or Replacement
- ☐ g. Bridge and Culvert Maintenance
- ☐ h. Installation of Fords

2. River, Stream, Floodplain, and Wetland Restoration

- ☐ a. Improve Secondary Channel and Wetland Habitats
- ☐ b. Set-back or Removal of Existing, Berms, Dikes, and Levees
- ☐ c. Protect Streambanks Using Bioengineering Methods
- ☐ d. Install Habitat-Forming Natural Material Instream Structures (Large Wood, Boulders, and Spawning Gravel)
- ☐ e. Riparian Vegetation Planting
- ☐ f. Channel Reconstruction

3. Invasive and Non-Native Plant Control

- ☐ a. Manage Vegetation using Physical Controls
- ☐ b. Manage Vegetation using Herbicides

4. Piling Removal.

- ☐ Piling Removal

5. Road and Trail Erosion Control, Maintenance, and Decommissioning

- ☐ a. Maintain Roads
- ☐ b. Decommission Roads

6. In-channel Nutrient Enhancement

- ☐ In-channel Nutrient Enhancement

7. Irrigation and Water Delivery/Management Actions

- ☐ a. Convert Delivery System to Drip or Sprinkler Irrigation
- ☐ b. Convert Water Conveyance from Open Ditch to Pipeline or Line Leaking Ditches or Canals
- ☐ c. Convert from Instream Diversions to Groundwater Wells for Primary Water Sources
- ☐ d. Install or Replace Return Flow Cooling Systems
- ☐ e. Install Irrigation Water Siphon Beneath Waterway
- ☐ f. Livestock Watering Facilities
- ☐ g. Install New or Upgrade/Maintain Existing Fish Screens

8. Fisheries, Hydrologic, and Geomorphologic Surveys

- ☐ Fisheries, Hydrologic, and Geomorphologic Surveys

9. Special Actions (Terrestrial Species)

- ☐ a. Install/develop Wildlife Structures

- ☐ b. Fencing Construction for Livestock Control
- ☐ c. Implement Erosion Control Practices
- ☐ d. Plant Vegetation
- ☐ e. Tree Removal for LW Projects

NMFS Hydro Division Review

Does the project require approval from NMFS Hydro Division for:

Fish Passage Restoration Yes ☐ Date of NMFS approval:
No ☐

Bridge and Culvert Removal and Replacement Yes ☐ Date of NMFS approval:
No ☐

Install New or Upgrade/Maintain Existing Fish Screens Yes ☐ Date of NMFS approval:
No ☐

RRT REVIEW

Does the project contain any Medium or High Risk WEs that require RRT review? Yes ☐ No ☐

Date of RRT submittal: Date of RRT Approval: RRT Reviewer:

BPA Determination of Consistency with all Requirements of the HIP III Consultation

The BPA must certify that the proposed project is consistent with all requirements and applicable terms and conditions of the HIP III Consultation.

BPA EC Contact (constitutes your electronic signature): Date of Certification:

Project Completion reporting

Within 60 days of completing a project covered under the HIP III programmatic biological opinion, Bonneville Power Administration staff will review and submit this completed form with the following information to the project sponsor and-to NMFS at hip.nwr@noaa.gov and USFWS at hip@fws.gov.

	Project Activity Start and End Dates:	**Start**:12/31/31	**End**:12/31/31
Work Element	**In-water Activities**	**Start Date**	**End Date**
G	LWD	12/31/31	12/31/31

☐ **Check Box if project included instream work, but not in-water or near-water construction.**
☐ **Check Box if project included work area isolation.**

Fish Capture Reporting

The BPA will report the following information for all projects that involve work area isolation with associated fish capture and relocation. When available, provide a tally of ESA-listed salmonids by species and life stage.

Supervisory Natural Resource Specialist (name, contact info, address)		
Type of take	**Interior Columbia Basin**	**Lower Columbia (Hood River downstream) and Willamette**
Number of salmonids Captured		
Number of salmonids Injured		
Number of salmonids Killed		

Turbidity Reporting

The Project Sponsor shall complete and record the following water quality observations to ensure that any increase in suspended sediment is not exceeding the limit for HIP III compliance.

Work Element	**Upstream**			**Downstream**				
					0 hrs	**+4 hrs**	**+8 hrs**	**+12 hrs**
	Distance from turbidity source (ft)	Time	Measured Turbidity (NTUs)	Distance from turbidity source (ft)	Measured Turbidity (NTUs)	Measured Turbidity (NTUs)	Measured Turbidity (NTUs)	Measured Turbidity (NTUs)
G	100 ft	10:45	100	-50 ft	300	200	150	110

Linear extent of observed turbidity downstream	

Narrative Assessment

Provide a narrative assessment of the project sponsor's success in meeting all requirements including the terms and conditions of the HIP III BO consultation. Please include:

- For any action involving RRT review, a copy of information used to satisfy the data requirements and analysis as described below in the design criteria for the proposed activity.
- Photos of habitat conditions before, during, and after action completion.
- Any dates work ceased due to high flows.
- Evidence of compliance with fish screen criteria, for any pump used in fish-bearing waters.
- A summary of the results of pollution and erosion control inspections, including any erosion control failure, turbidity in exceedance of HIP III standards, contaminant release, and correction effort.
- The number, type, and diameter of any pilings removed or broken during removal.
- A description of the post-project condition of any riparian area cleared within 150 feet of Ordinary High Water.
- A description of site restoration completed and future site restoration plans.

Appendix B – Maps and Contacts for FWS Field Offices

The following list provides points of contact for this programmatic consultation for each FWS State office and associated Field Office's within the range of HIP III action area. The contacts below will likely direct species-specific inquiries to a local biologist or the species lead. Review and approval of variances and RRT reviews will require the signature of the following contacts for their respective areas of jurisdiction. The maps which follow (WA, OR, ID), provide information relative to areas of jurisdiction by each State and Field Office.

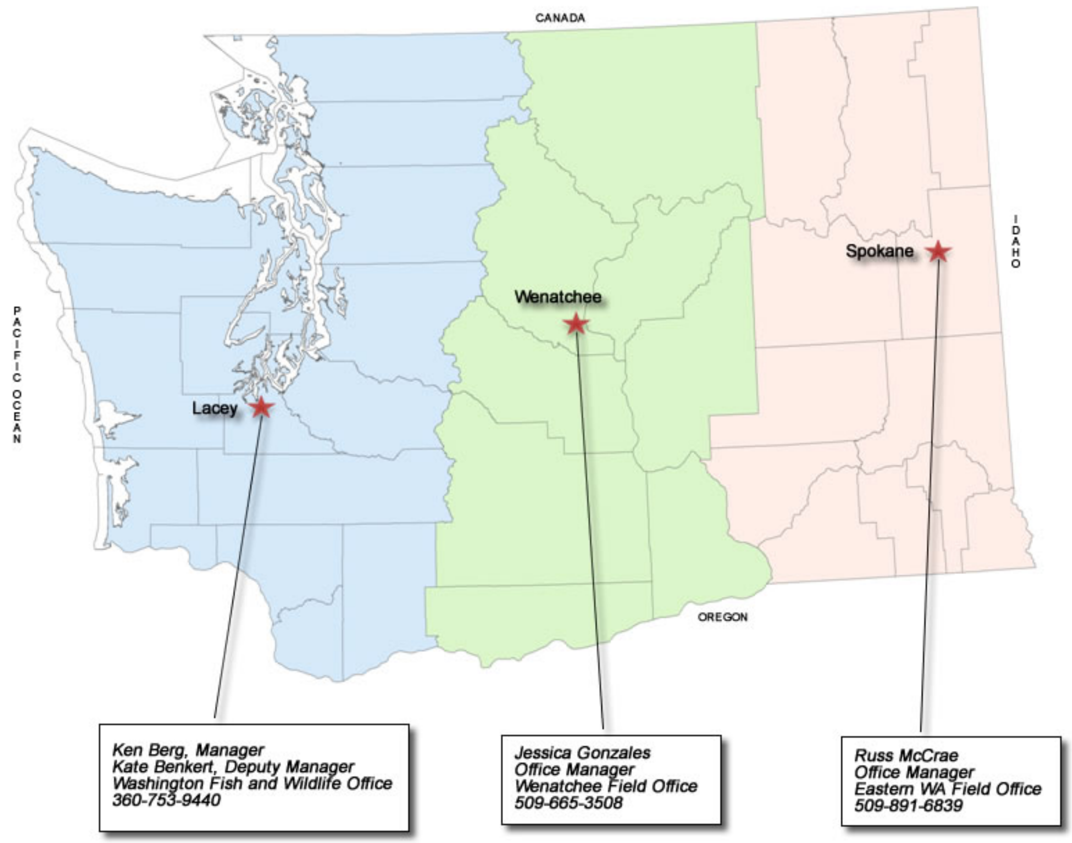
Washington Fish and Wildlife Office (WFWO)
Lacey (State Office) – Bridget Moran, Division Manager
Central Washington – Jessica Gonzales, FO Supervisor
Eastern Washington – Russ MacRae, FO Supervisor
**Michelle Eames – biologist and technical POC for WFWO for HIP III consultation

Oregon Fish and Wildlife Office (OFWO)
Portland (State Office) – ES Division Manager (Jeff Dillon)
Bend FO – Nancy Gilbert, FO Supervisor
La Grande FO – Gary Miller, FO Supervisor
Roseburg FO – Jim Thrailkill, FO Supervisor
Newport FO – Laura Todd, FO Supervisor
** Chris Allen – biologist in the Portland office and technical POC for OFWO for HIP III consultation

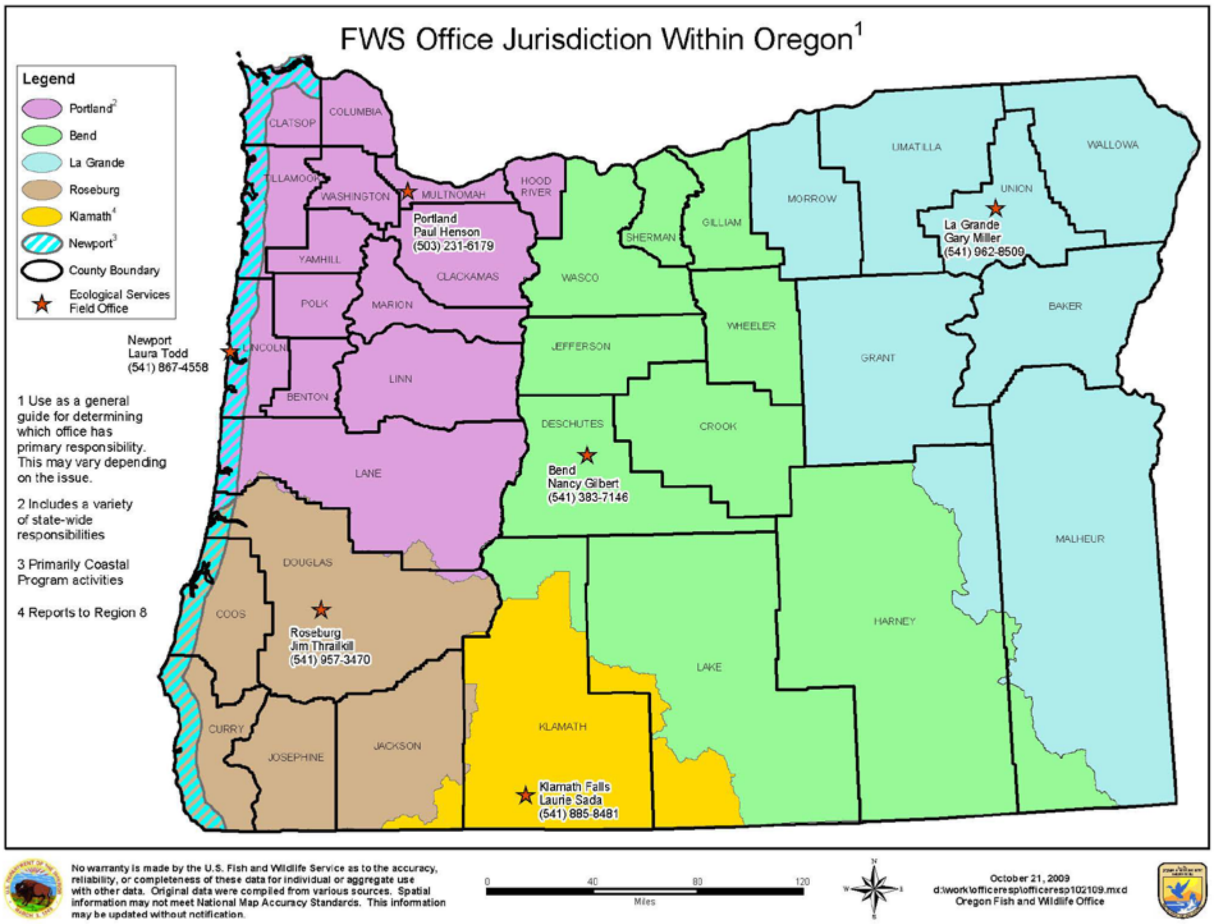
Idaho Fish and Wildlife Office (IFWO)
Boise (State Office) – Russ Holder, Assistant State Supervisor
Eastern Idaho FO – David Kampwerth, Field Office Supervisor
Northern Idaho FO – Ben Conard, Field Office Supervisor
**Pam Druliner – biologist & technical POC for IFWO for HIP III consultation

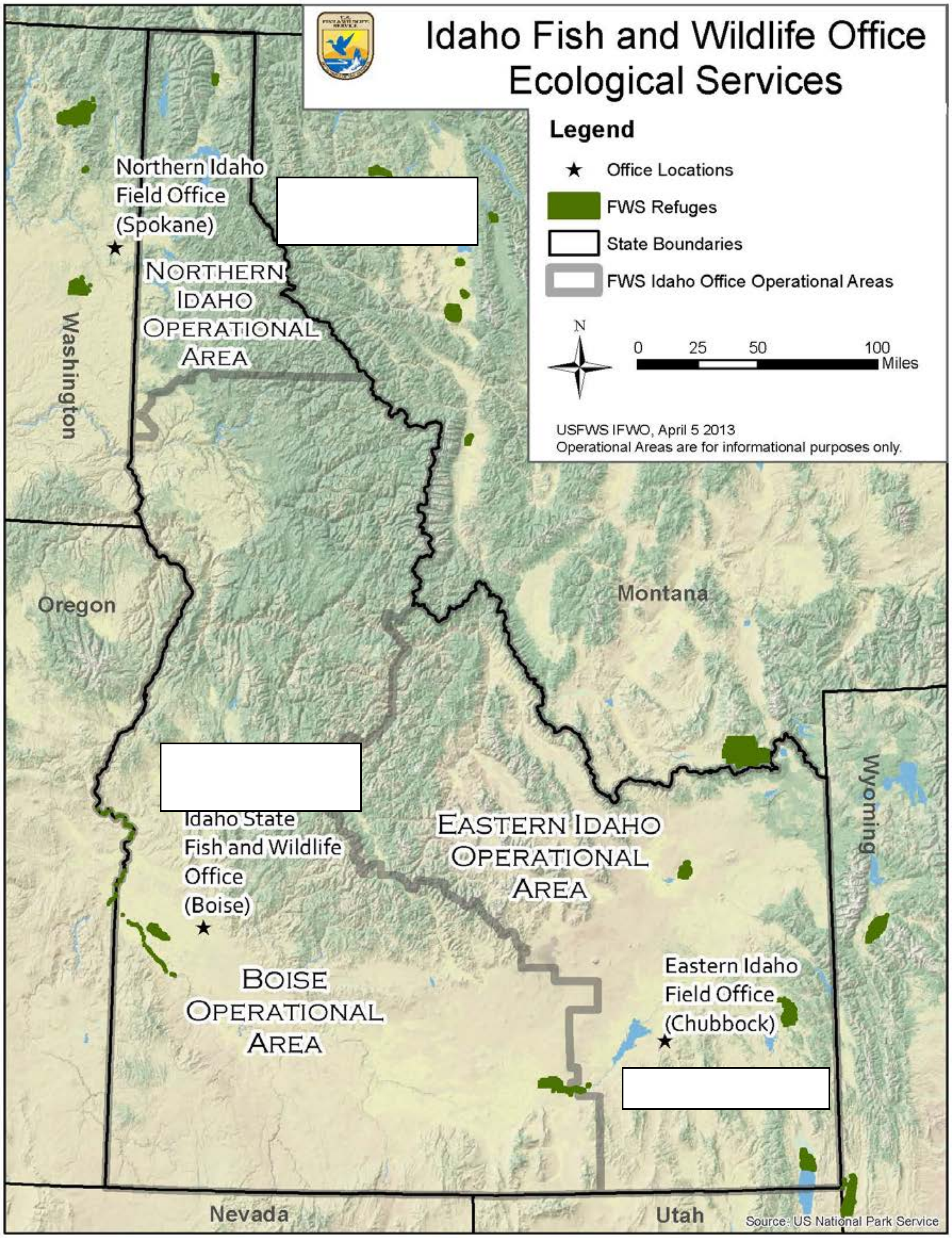
Montana Fish and Wildlife Office (MFWO)
Helena (State Office) – Jodi Bush, State Supervisor; Brent Esmoil, Assistant State Supervisor
Kalispel – Tim Bodurtha, Field Office Supervisor
**Shannon Downey – biologist & technical POC for MFWO for HIP III consultation

Washington


CANADA
IDAHO
PACIFIC OCEAN
OREGON
Spokane
Wenatchee
Lacey
Ken Berg, Manager
Kate Benkert, Deputy Manager
Washington Fish and Wildlife Office
360-753-9440
Jessica Gonzales
Office Manager
Wenatchee Field Office
509-665-3508
Russ McCrae
Office Manager
Eastern WA Field Office
509-891-6839

Oregon


FWS Office Jurisdiction Within Oregon1
Legend
Portland2
Bend
La Grande
Roseburg
Klamath4
Newport3
County Boundary
Ecological Services Field Office
Newport
Laura Todd
(541) 867-4558
1 Use as a general guide for determining which office has primary responsibility. This may vary depending on the issue.
2 Includes a variety of state-wide responsibilities
3 Primarily Coastal Program activities
4 Reports to Region 8
CLATSOP
COLUMBIA
TILLAMOOK
WASHINGTON
MULTNOMAH
HOOD RIVER
Portland
Paul Henson
(503) 231-6179
YAMHILL
CLACKAMAS
POLK
MARION
LINCOLN
BENTON
LINN
LANE
DOUGLAS
COOS
Roseburg
Jim Thrailkill
(541) 957-3470
CURRY
JOSEPHINE
JACKSON
KLAMATH
Klamath Falls
Laurie Sada
(541) 885-8481
WASCO
SHERMAN
GILLIAM
WHEELER
JEFFERSON
DESCHUTES
CROOK
Bend
Nancy Gilbert
(541) 383-7146
LAKE
HARNEY
MORROW
UMATILLA
UNION
WALLOWA
La Grande
Gary Miller
(541) 962-8509
BAKER
GRANT
MALHEUR
No warranty is made by the U.S. Fish and Wildlife Service as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.
0
40
80
120
Miles
October 21, 2009
Oregon Fish and Wildlife Office


Idaho Fish and Wildlife Office
Ecological Services
Legend
Office Locations
FWS Refuges
State Boundaries
FWS Idaho Office Operational Areas
N
0 25 50 100 Miles
USFWS IFWO, April 5 2013
Operational Areas are for informational purposes only.
Northern Idaho Field Office (Spokane)
NORTHERN IDAHO OPERATIONAL AREA
Washington
Oregon
Montana
Wyoming
Idaho State Fish and Wildlife Office (Boise)
EASTERN IDAHO OPERATIONAL AREA
BOISE OPERATIONAL AREA
Eastern Idaho Field Office (Chubbock)
Nevada
Utah
Source: US National Park Service


CANADA
NORTH DAKOTA
Kalispell
Glacier Nat'l. Pk.
Havre
Clark Fork
Flathead Lk.
Missouri
Ft. Peck Lake
ROCKY MTS.
Great Falls
Yellowstone
MONTANA
Missoula
HELENA
Anaconda
Butte
Billings
Bozeman
Jefferson
Yellowstone Nat'l. Pk.
SOUTH DAKOTA
IDAHO
WYOMING

Appendix C – Restoration Review Team Process

Restoration Review Team (RRT)
A BPA led QA/QC process will be utilized on complex, medium to high-risk projects in the Fish Passage Restoration activity category and the River, Stream, Floodplain and Wetland Restoration activity category to (a) meet the obligations set forth in the FWS and NMFS BOs within the action area, (b) ensure consistency between projects, (c) maximize ecological benefits of restoration and recovery projects, and (d) ensure consistent use and implementation throughout the geographic area covered by the FWS and NMFS BOs.

A primary purpose of a RRT is to define high, medium, and low risk project types, and then provide additional review on medium to higher risk projects as needed. Project managers and environmental compliance staff, using guidance developed by the RRT, will screen projects and then forward only the medium and high risk projects to the RRT for review.

Risk for the purposes of the RRT is defined primarily as risk to species and their habitats, but is also applied more broadly to social, economic, and institutional risks, which may include, but are not limited to: (a) Precedent and/or policy setting actions, such as the application of new technology, (b) Project types that are not necessarily new, but are new to a geographic area or stakeholder group, and (c) Project types for which the project manager is unfamiliar, regardless of the relative risk.

Another primary purpose of the RRT is to provide updates and clarifications regarding the FWS and NMFS BOs to all users to ensure consistent use, and to resolve inconsistencies and obtain clarification from the Services when needed. A BO Addendum that tracks all clarifications, changes, and interpretations will serve as the administrative record of the RRT.

Restoration Review Team Structure:
The following members are all internal BPA team members. The Team Leader, Core Team Members, and Technical Team members are not necessarily mutually exclusive roles. Service to the RRT in any capacity is not intended to compromise staff work or relieve staff of other responsibilities or obligations.

- Restoration Review Team Leader
- Core Team Members
  -KEC
  -KEW

- Technical Team: (KEC, KEW Subject Matter Experts, as needed)
  -Biology
  -Aquatics
  -Terrestrial
  -Contaminants
  -Engineering

-Environmental

The following external members have an open invitation to attend:

- NMFS assigned team member
- USFWS assigned team member (if applicable)

For all projects reviewed by the RRT that may impact bull trout or Oregon chub, Janine Castro from the Service's Oregon Fish and Wildlife Office, will serve as lead representative on RRT for the FWS, along with an FWS biologist from the field office most proximate to the project being reviewed. Brigette Tuerler from the Oregon Fish and Wildlife Office, and Emily Teachout from the Washington Fish and Wildlife Office, should be involved in any RRT discussions for projects that may adversely impact marbled murrelets

The RRT Team Lead from BPA will provide overall leadership to the RRT review process and will coordinate with Contracting Officers and Contracting Officer's Technical Representatives (COTRs) to identify Medium – High risk contracts that will require RRT review. Twice a year the RRT Team Lead will generate a project list that will require RRT review. This list could be generated from PISCES, or based on COTR requests or requests from KEC or KEW managers. This list will be used to track and assign project review tasks to Core Team members, who will then review and rate projects. Meetings will be held as necessary to review and discuss projects. On occasions when members need to be replaced or re-assigned, the RRT will be convened to review and discuss the RRT charter. Meetings will be convened to best coincide with funding cycles. Meetings will be used to develop a project list, coordinate and prioritize reviews, and assign projects to core team members.

The RRT Team Lead will coordinate and respond to input from KEC and KEW managers. This position directs Core Team members for assistance in the process. Core Team members provide program, policy, and technical review, and solicit additional technical input when necessary. If subject matter experts are solicited for project review or input, the RRT will either identify the additional expertise and experience needed or rely on the technical expertise provided by the project manager or sponsor. The function of the RRT shall not replace existing review processes. The RRT review process should not slow project permitting and/or implementation unless significant technical, policy, and/or program concerns with a particular restoration approach are identified.

General Project and Data Summary Requirements

Planning and design documentation of conservation practices should effectively communicate that appropriate planning, analysis, design and resulting construction documentation are met. The project documentation should provide other persons the means of quickly following the rationale used in determining all features of a design including the design objective(s), data, criteria, assumptions, procedures, and decisions used in design and resulting construction plans, specifications and details. The General Project and Data Summary Requirement (GPDSR) serves as the design submittal framework that is needed to assess and evaluate the adequacy of the proposed project.

The BPA RRT will review submitted GPDSR documents to determine if the technical deliverables provided are adequate for functionality (adherence to HIP 3 Conservation Measures) and technical quality (competent execution of design and project plans – contract documents).

The GPDSR criteria were developed using the River Restoration Analysis Tool and address the 16 overarching questions proposed within the RiverRAT Framework.

For the Channel Reconstruction activity category a project specific Monitoring and Adaptive Management Plan must be included.

Project Background

1. Name and titles of sponsor, firms and individuals responsible for design.
2. List of project elements that have been designed by a licensed Professional Engineer.
3. Identification and description of risk to infrastructure or existing resources.
4. Explanation and background on fisheries use (by life stage - period) and limiting factors addressed by project.
5. List of primary project features including constructed or natural elements.
6. Description of performance / sustainability criteria for project elements and assessment of risk of failure to perform, potential consequences and compensating analysis to reduce uncertainty.
7. Description of disturbance including timing and areal extent and potential impacts associated with implementation of each element.

Resource Inventory and Evaluation

8. Description of past and present impacts on channel, riparian and floodplain conditions.
9. Instream flow management and constraints in the project reach.
10. Description of existing geomorphic conditions and constraints on physical processes.
11. Description of existing riparian condition and historical riparian impacts.
12. Description of lateral connectivity to floodplain and historical floodplain impacts.
13. Tidal influence in project reach and influence of structural controls (dikes or gates).

Technical Data

14. Incorporation of HIP 3 specific Activity Conservation Measures for all included project elements.
15. Summary of site information and measurements (survey, bed material, etc.) used to support assessment and design.
16. Summary of hydrologic analyses conducted, including data sources and period of record including a list of design discharge (Q) and return interval (RI) for each design element.

17. Summary of sediment supply and transport analyses conducted, including data sources including sediment size gradation used in streambed design.
18. Summary of hydraulic modeling or analyses conducted and outcomes – implications relative to proposed design.
19. Stability analyses and computations for project elements, and comprehensive project plan.
20. Description of how preceding technical analysis has been incorporated into and integrated with the construction – contract documentation.

Construction – Contract Documentation

21. Incorporation of HIP 3 General and Construction Conservation Measures
22. Design – construction plan set including but not limited to plan, profile, section and detail sheets that identify all project elements and construction activities of sufficient detail to govern competent execution of project bidding and implementation.
23. List of all proposed project materials and quantities.
24. Description of best management practices that will be implemented and implementation resource plans including:
    a) Site Access Staging and Sequencing Plan with description
    b) Work Area Isolation and Dewatering Plan with description of how aquatic organisms within the action area will be treated / protected.
    c) Erosion and Pollution Control Plan.
    d) Site Reclamation and Restoration Plan
    e) List proposed equipment and fuels management plan.
25. Calendar schedule for construction/implementation procedures.
26. Site or project specific monitoring to support pollution prevention and/or abatement.

The Monitoring and Adaptive Management Plan (Channel Reconstruction)

1. Introduction
2. Existing Monitoring Protocols
3. Project Effectiveness Monitoring Plan
    a. Objective 1
    b. Objective 2
    c. Objective 3
4. Project Review Team Triggers
5. Monitoring Frequency, Timing, and Duration
    a. Baseline Survey
    b. As-built Survey
    c. Monitoring Site Layout
    d. Post-Bankfull Event Survey
    e. Future Survey (related to flow event)
6. Monitoring Technique Protocols
    a. Photo Documentation and Visual Inspection
    b. Longitudinal Profile

c. Habitat Survey
d. Survival Plots
e. Channel and Floodplain Cross-sections
f. Fish Passage
g. Other

7. Data Storage and Analysis
8. Monitoring Quality Assurance Plan
9. Literature Cited

Recommendation and Approval Template for RRT Email Correspondence

RRT TEMPLATE RECOMMENDATION

To: NMFS Branch Chief / USFWS Field Office Supervisor

Subject: RRT Project Recommendation: <PROJECT NAME>

The <PROGRAMMATIC> RRT has completed a technical and program review of <PROJECT NAME>, which is scheduled for implementation during the <YEAR> construction season.

Our review was based on the following documents:

- <Document 1>
- <Document 2>
- <Document 3>
- <Document 4>

The RRT fully supports this project and recommends covering the project under <PROGRAMMATIC>.

Sincerely,

<NAME>
<PROGRAMMATIC> Restoration Review Team Lead

NMFS or FWS TEMPLATE APPROVAL

Subject: <NMFS or FWS> Project Approval: <PROJECT NAME>

Thank you for submitting plans for the <PROJECT NAME>, which is scheduled for implementation during the <YEAR> construction season. Endangered Species Act compliance for <USFWS or NMFS> species will be provided through the <PROGRAMMATIC NAME> <DATE>.

This project was formally presented to the <PROGRAMMATIC> Restoration Review Team (RRT) on <DATE>, and received a thorough technical and program review. <ADD MORE HISTORY HERE, OR REVIEWER NAMES IF APPLICABLE>. Further, in order to address both implementation and effectiveness monitoring of this project, a detailed Monitoring and Adaptive Management Plan was developed, which was submitted to the full RRT for review on <DATE>. This Monitoring and Adaptive Management Plan is an additional requirement to the biological opinions.

Based on the project design plans and specifications, a summary of review comments and project modifications, and the thoroughness of the Monitoring and Adaptive Management Plan, the RRT fully supports this project and recommends covering the project under the biological opinion(s) referenced above.

Based on project design, Monitoring and Maintenance Plan, review comments, and that the project:

- Will take place where ESA-listed species occur and designated critical habitat occur,
- Was reviewed and approved by a NMFS fish passage engineer <NAME> on <DATE>,
- Was reviewed and approved by the <Programmatic> Restoration Review Team on <DATE>, and
- All other relevant project design criteria for construction practices will be used.

the <USFWS or NMFS> hereby approves inclusion of this project for coverage under the biological opinion(s) referenced above.

Sincerely,

<USFWS Field Office Supervisor>
<NMFS Branch Chief>

FISH PASSAGE TEMPLATE APPROVAL

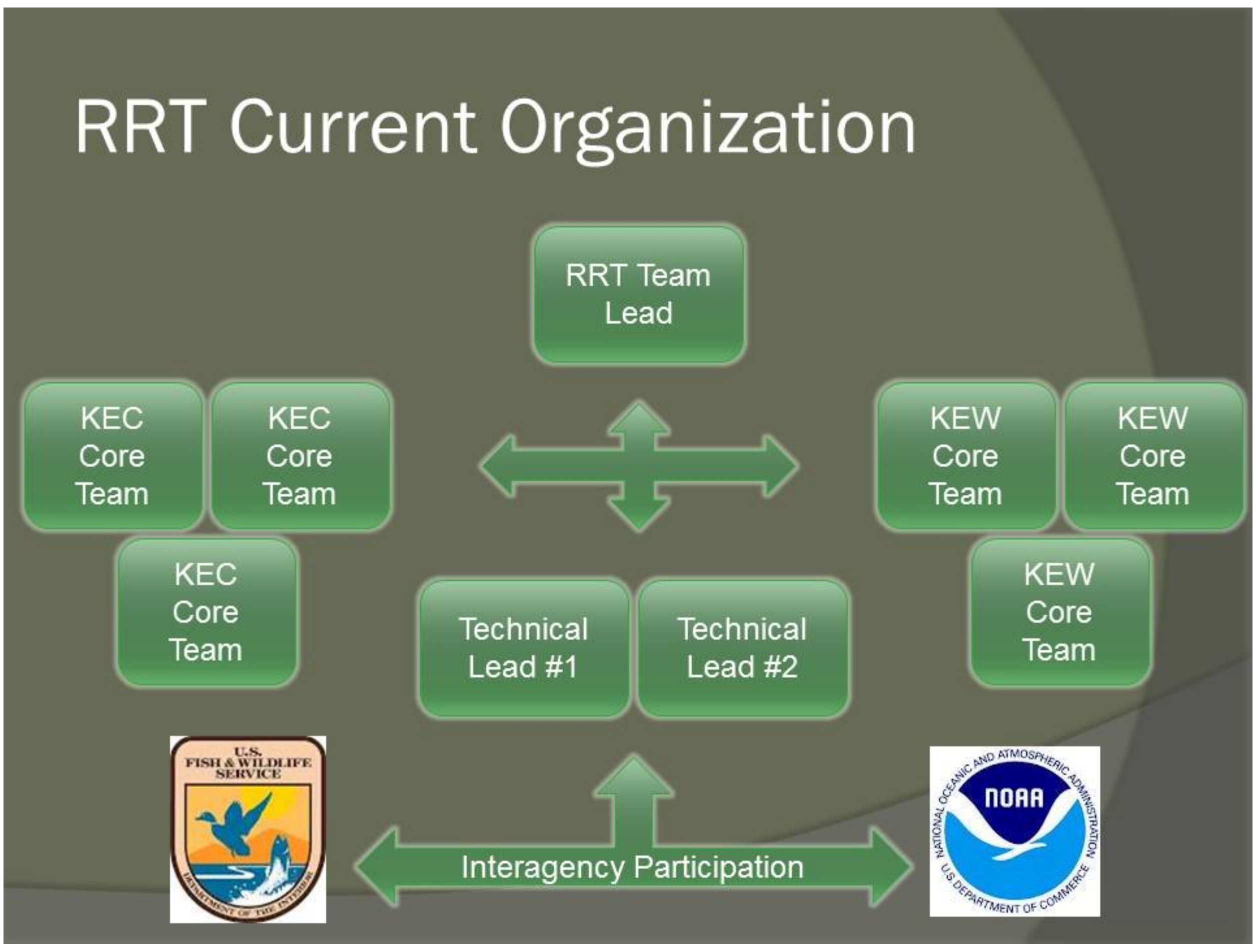
Subject: NMFS Fish Passage Approval: <PROJECT NAME>

Upon review of the provided plans and other documentation for the <PROJECT NAME>, I find that the project meets NMFS fish passage criteria and is appropriate for the site. Please forward this approval as necessary for programmatic or individual biological opinion documentation.

NMFS appreciates the opportunity to review this project and to provide comments. If you have any questions or concerns, feel free to contact me at your convenience.

Sincerely,

<NMFS Fish Passage Engineer>



Appendix D – General and Species-Specific Conservation Measures for Terrestrial Plants, Wildlife and Aquatic Invertebrates

This appendix describes general and species-specific conservation measures (CMs) and practices included in the proposed action to minimize or avoid the exposure of certain endangered, threatened, and proposed species managed by USFWS to effects of the underlying restoration activities. These conservation measures were developed by the Service, in cooperation with BPA, during the consultation process in order to support BPA's "not likely to adversely affect" calls for a suite of federally listed and proposed species (and associated proposed and designated critical habitat) within the HIP III action area. These CMs were submitted by BPA as part of the proposed action via a BA Amendment received by the Service on August 26, 2013.

HIP III restoration projects are unlikely to occur within the range of some of the listed species included herein, but due to the programmatic approach to this consultation, and the fact that specific project locations are unknown at this time, we are providing the benefit of the doubt to the species and have included project design measures for all species that occur within the proposed action area.

Although we are formally consultating on adverse effects to marbled murrelets, we are including CMs for this species in the section because based on the timing of project implementation, and the type of activity category, some actions may be either "no effect" or "not likely to adversely affect" to marbled murrelet.

The CMs below that are specific to marbled murrelet were developed to provide clarification on the types of projects and associated timing that fall under an "likely to adversely affect" (LAA) determination versus a "no effect" (NE) or "not likely to adversely affect" (NLAA) determination. As outlined in the incidental take statement of this biological opinion, there is only a limited number of "likely to adversely affect" projects covered under this programmatic consultation for marbled murrelet. All other projects within the range of marbled murrelet must meet the CMs resulting in NE or NLAA determinations.

Identifying Species Locations:

1. When proposed project locations have been identified, the action agency or project proponent will obtain the current species list for the county in which the proposed project is located. The species lists can be accessed at the following websites:

    - **Idaho**: http://www.fws.gov/idaho/species/IdahoSpeciesList.pdf
    - **Oregon**: http://www.fws.gov/oregonfwo/Species/Lists/default.asp
    - **Montana**: http://www.fws.gov/montanafieldoffice/Endangered_Species/Listed_Species/countylist.pdf

- **Washington, Western**: http://www.fws.gov/wafwo/speciesmap.html
- **Washington, Eastern**: http://www.fws.gov/wafwo/species_EW.html

2. If species are located within the county where the proposed project is located, refer to the habitat descriptions for each species below for each species or critical habitat to determine whether that listed species may occur in the vicinity of the proposed project. Maps for some species have also been provided at the end of this Appendix to assist in identifying suitable habitat that may be occupied by listed species. For additional assistance, contact the appropriate state FWS office for more information:

   - Idaho Fish and Wildlife Office, (208) 378-5243
   - Oregon Fish and Wildlife Office, (503) 231-6179
   - Montana Ecological Services, (406) 459-5225
   - Washington Fish and Wildlife Office, (360) 753-9440
   - Eastern Washington Field Office, (509) 891-6839
   - Central Washington Field Office, (509) 665-3508

   Site-specific information of listed species occurrences in Washington State may be obtained from the Washington Department of Fish and Wildlife Priority Habitat and Species Program http://www.wdfw.wa.gov/hab/phspage.htm and from the Washington Department of Natural Resources Natural Heritage Program at http://wdfw.wa.gov/mapping/phs/.

   Site-specific information of listed species occurrences in Oregon may also be available from the Oregon Biodiversity Information Center at http://orbic.pdx.edu/index.html.

3. If it is determined that listed species, critical habitat, or unsurveyed suitable habitat for listed species are located within the vicinity (generally within 1 mile) of the proposed project, the action agency will implement the following project design standards for each species.

General Conservation Measures for Terrestrial Species and Critical Habitats

1) Project Access. Existing roads or travel paths will be used to access project sites whenever possible; vehicular access ways to project sites will be planned ahead of time and will provide for minimizing impacts on riparian corridors and areas where listed species or their critical habitats may occur.

2) Vehicle use and human activities. Including walking in areas occupied by listed species, will be minimized to reduce damage or mortality to listed species.

3) Flight patterns. Helicopter flight patterns will be established in advance and located to avoid seasonally important wildlife habitat

4) Herbicide Use. On sites where ESA-listed **terrestrial wildlife** occur, herbicide applications will be avoided or minimized to the extent practicable while still achieving project goals. Staff will avoid any potential for direct spraying of wildlife or immediate habitat in use by wildlife for breeding, feeding, or sheltering. Herbicide use in or within 1 mile of habitat where listed terrestrial wildlife occur will be limited to the chemicals and application rates as shown in **Table 1**. Additional species-specific herbicide limitations are also defined below in each species CMs section.

TABLE 1: Maximum Herbicide Application Rates in or Within 1 Mile of Habitat Where ESA-listed Terrestrial Species Occur[32]

	2,4-D	Aminopyralid	Chlorsulfuron	Clethodim	Clopyralid	Dicamba	Glyphosate 1	Glyphosate 2	Imazapic	Imazapyr	Metsulfuron	Picloram	Sethoxydim	Sulfometuron	Triclopyr (TEA)
Listed Species	Maximum Rate of Herbicide Appliction (lb/ac)														
Mammals	NA	0.22	0.083	NA	0.375	NA	2.0	2.0	0.189	1.0	0.125	NA	0.3	NA	NA
Birds*	NA	0.11	0.083	NA	0.375	NA	2.0	2.0	0.189	1.0	0.125	NA	0.3	NA	NA
Invertebrates*	NA	NA	NA	NA	0.375	NA	2.0	2.0	NA	1.0	NA	NA	0.3	NA	NA

NA = Not Authorized for use
** See required buffers and methods restrictions within each species-specific PDS*

Species Specific Conservation Measures for Mammals

Within the Columbia River Basin, BPA funded activities may occur in areas that are near or occupied by the following mammalian ESA-listed species; (a) North American Wolverine (*Gulo gulo luscus*) (b) Northern Idaho ground squirrel (Spermophilus brunneus brunneus) (c) Columbian white-tailed deer (*Odocoileus virginianus leucurus*) (Columbia River DPS) (d) Gray wolf (*Canis lupus*) (e) Pygmy rabbit (*Brachylagus idahoensis*) (Columbia Basin DPS) (f) Woodland caribou (*Rangifer tarandus caribou*) and critical habitat (Southern Selkirk Mountains DPS) (g) Canada lynx (*Lynx canadensis*) and critical habitat and (h) Grizzly bear (*Ursus arctos horribilis*).

[32] This list of chemicals is based on the analyses in the Syracuse Environmental Research Associates (SERA) risk assessments maintained by the U.S. Forest Service and available at http://www.fs.fed.us/foresthealth/pesticide/risk.shtml. The herbicides and application rates listed in this table include only those that were found in the SERA assessments to be below both the acute and chronic NOAELs for terrestrial wildlife.

a. North American Wolverine (*Gulo gulo luscus*)

Description. Mean seasonal elevations used by wolverines in the northern Rocky Mountains and North Cascades vary between 1,400 and 2,600 m (4,592 and 8,528 ft) depending on location, but are always relatively high on mountain slopes. Wolverines do not appear to specialize on specific vegetation or geological habitat aspects, but instead select areas that are cold and receive enough winter precipitation to reliably maintain deep persistent snow late into the warm season. Wolverines prefer to move across suitable habitat (as defined by persistent spring snow cover) rather than to cross unsuitable habitats during dispersal movements. In the contiguous United States, valley bottom habitat appears to be used only for dispersal movements and not for foraging or reproduction. Litters are born in mid-February thru March. Natal birthing dens are used thru late April or early May and are located in snow deeper than 1.5 meters (5 feet). Depending on weather or disturbance, wolverines may move to maternal dens during the month of May. Rendezvous sites may be used through early July.

Conservation Measures.

1) Restoration activities at locations at or above the elevation of 4,000 ft that generate noise above ambient levels (the typical level of background noise within an environment) within 0.25 mile (1 mile for blasting and pile driving) of any known wolverine den, will not occur from February 1 to May 15.
2) Within suitable or occupied habitat use only herbicides listed under **General Conservation Measures for Terrestrial Species and Critical Habitats #4**.

b. Northern Idaho ground squirrel (*Spermophilus brunneus brunneus*)

Description. The Northern Idaho ground squirrel (NIDGS) needs large quantities of grass seed, stems and other green leafy vegetation to store fat reserves for its eight-month hibernation period (August/early September through late April/May). Adult males are first to emerge from burrows in the spring followed by females and their young. Populations of the northern Idaho ground squirrel have been found in Adams and Valley Counties of western Idaho, though the species historic range extends into neighboring Washington County.

It occurs in dry meadows surrounded by ponderosa pine and Douglas-fir forests, including lands managed by the U.S. Forest Service's Payette National Forest (1,500 to 7,500-foot elevations). This species is not likely to be found in riparian areas of streams. Areas where the northern Idaho ground squirrel may occur are shown in **Appendix B-1.**

Conservation Measures.

1) If a project occurs within NIDGS suitable habitat a qualified wildlife biologist must conduct onsite surveys during the appropriate time of year at least three times during a 7-day period in potential NIDGS habitat to determine their presence.
2) If upland projects will occur in within 0.25 miles of a known occurrence or potential habitat of northern Idaho ground squirrel, contact the appropriate USFWS field office to confirm the project will have *no effect* or is *not likely to adversely affect* northern Idaho ground squirrel.
3) Avoid blasting and pile driving within 1 mile of occupied NIDGS habitat, unless it is confirmed the activity is not likely to adversely affect NIDGS.
4) Avoid ground disturbing activities within occupied NIDGS between April 1 and August 15 to avoid the NIDGS above ground activity period.
5) Do not locate parking, vehicle turnout, staging or fueling areas, or any type of temporary sites associated with a project, within occupied or potential habitat.
6) No off-road travel in occupied habitat.
7) Avoid conducting weed treatments during the squirrels' above ground activity period (April 1 through August 15). Within suitable or occupied habitat use only herbicides listed under **General Conservation Measures for Terrestrial Species and Critical Habitats #4**.

c. Columbian white-tailed deer (*Odocoileus virginianus leucurus*) (Columbia River DPS)

Description. Within the action area, Columbian white-tailed deer are closely associated with riparian habitats in the Lower Columbia River **Appendix B-2.** The deer found on islands in the Columbia River use "tidal spruce" habitats characterized by densely forested swamps covered with tall shrubs and scattered spruce, alder, cottonwood and willows; in the summer Columbian white-tailed deer preferentially inhabit mixed forests of western red cedar, red alder, and parkland habitat with a grassy understory. Breeding activity begins the first week of November and lasts a month or more. The gestational period is approximately 210 days, with the peak of fawning occurring in mid-to-late June. Fawns stay with their mother until just prior to the next fawning season.

Conservation Measures.

1) To avoid and minimize impacts to Columbian white-tailed deer during the fawning period, restoration activities will not occur from June 1 to July 15 within the following region: The Columbia River, including all islands and extending 2 miles inland from both sides of the river, from Svensen Island, Clatsop County, to the confluence with the Willamette River. The Columbia River includes the outlet of Vancouver Lake from the Lake, north to its confluence with the Columbia River just south of the confluence of the Lewis River and Columbia Rivers.

2) To avoid and minimize impacts to Columbian white-tailed deer and their movements, fencing projects on Puget Island; the Hunting Islands; Price Island; and 2 miles inland from the Columbia River between 2 miles east of Cathlamet and 2 miles west of the community of Ridgefield, will use only three-strand barbed wire and have a maximum fence height of 42 inches, with lower strands 18 or more inches above the ground.
3) Project personnel will be instructed to not approach Columbian white-tailed adults or fawns at any time and reduce vehicle speeds around project sites where deer occur to avoid vehicle-deer collisions.
4) Herbicides will not be used in known or suitable Columbian white-tailed deer fawning areas from June 1 to July 15. Within suitable or occupied habitat use only herbicides listed under **General Conservation Measures for Terrestrial Species and Critical Habitats #4**.
5) Restoration projects proposed within the areas identified in CM 1 & 2 above, which include activities under **Categories 1a (Fish Passage Restoration: Dams, Water Control or Legacy Structure Removal) and 2b (River, Stream, Floodplain, and Wetland Restoration: Set-back or Removal of Existing Berms, Dikes, and Levees)** will be reviewed by the appropriate USFWS field office to confirm the project will have *no effect* or *is not likely to adversely affect* Columbian white-tailed deer habitat. Those projects that cannot avoid adverse effects to Columbian white-tailed deer or their habitat are not covered under this Biological Opinion and will require a separate section 7 consultation.

d. Gray wolf (*Canis lupus*)

The Rocky Mountain Distinct Population Segment of the grey wolf was delisted on February 27, 2008. Within the action area, the wolf remains listed in portions of Oregon and Washington as follows:

> **Oregon:** that portion of OR west of the centerline of Highway 395 and Highway 78 north of Burns Junction and that portion of OR west of the centerline of Highway 95 south of Burns Junction. To date, no wolf packs have been identified in these areas.
>
> **Washington:** that portion of WA west of the centerline of Highway 97 and Highway 17 north of Mesa and that portion of WA west of the centerline of Highway 395 south of Mesa). Within this area, wolf packs have recently been identified in Okanogan and Kittitas Counties (http://wdfw.wa.gov/conservation/gray_wolf/).

Description. Habitat for wolves is diverse and generally encompasses areas with adequate supply of prey. Wolves prey primarily on ungulates but may also prey on smaller mammals, including beaver. Wolves breed in mid to late February and pups are usually born two months later. Dens are often in underground burrows, but can occur in abandoned beaver lodges, hollow trees, and shallow rock caves. Dens are commonly located on southerly aspects of moderately steep slopes in well-drained soils (or rock caves/abandoned beaver lodges), usually within 400 yards of surface water and at an elevation overlooking surrounding low-lying areas. As pups grow older, they are taken from the den to a rendezvous site. One or more rendezvous sites are used over the summer until the pups are large enough to travel and hunt with the pack. Rendezvous sites are usually complexes of meadows and adjacent hillside timber, with surface water nearby.

Conservation Measures.

1) Restoration activities generating noise above ambient levels within 1 mile of any known gray wolf den or rendezvous site (based on current information from state wildlife agencies and the USFWS), will not occur from Dec 1 to June 30, unless the project is reviewed by the appropriate USFWS field office to confirm the project will have *no effect* or is *not likely to adversely affect* the gray wolf.
2) Restoration activities will not increase trail or road densities within gray wolf habitat.
3) Within suitable or occupied habitat use only herbicides listed under **General Conservation Measures for Terrestrial Species and Critical Habitats #4**.

e. Pygmy rabbit (*Brachylagus idahoensis*) (Columbia Basin DPS)

Description. Pygmy rabbits are typically found in areas that include tall, dense stands of sagebrush (*Artemisia spp.*), and are highly dependent on sagebrush to provide both food and shelter throughout the year. During winter months the rabbits' diet consists of up to 99 percent sagebrush. In the summer and spring months, their diet becomes more varied, including more grass and forbs. The pygmy rabbit digs its own burrows, which are typically found in deep, loose soils. However, pygmy rabbits occasionally make use of burrows abandoned by other species and, as a result, may occur in areas of shallower or more compact soils that support sufficient shrub cover.

Pygmy rabbits breed in early spring, having up to three litters per year and averaging six young per litter. Recent information on captive and wild pygmy rabbits indicates that pregnant females dig secret, relatively shallow burrows, known as natal burrows. These natal burrows, which are found in the vicinity of the pygmy rabbit's regular burrows, are used to give birth in and for nursing and early rearing of their litters.

Conservation Measures.

1) Prior to initiating restoration activities in the central Columbia Plateau (Douglas, Lincoln, Adams and Grant counties) in dense, tall stands of sagebrush, or if any evidence of pygmy rabbit presence is detected on a project outside of these counties, but within the historic range of the pygmy rabbit, contact the appropriate USFWS field office to confirm the project will have *no effect* or is *not likely to adversely affect* the pygmy rabbit.
2) Within suitable or occupied habitat use only herbicides listed under **General Conservation Measures for Terrestrial Species and Critical Habitats #4**.

f. Woodland caribou (*Rangifer tarandus caribou*) and critical habitat (Southern Selkirk Mountains DPS)

Description. The Selkirk caribou occurs in the Selkirk mountains at elevations of 4,000 feet or above in Bonner or Boundary counties in Idaho or east of the Pend Oreille River, Pend Oreille County, Washington. A general description of seasonal habitats used by Selkirk caribou follows (**Table 2**); a more detailed description is available in the Recovery Plan for Selkirk caribou at: http://ecos.fws.gov/docs/recovery_plan/940304.pdf.

Table 2: Seasonal Habitats Used by Selkirt Caribou

Season	**Habitat Description**
Early Winter	Mature to old-growth cedar-hemlock and spruce-fir stands, 70 percent canopy closure, high windthrow and lichen densities.
Late Winter	High elevation, open canopied spruce-fir stands, high lichen density.
Spring	Mature timber with canopy openings.
Calving	Secluded, high elevation, mature old-growth forest.
Summer	Relatively flat terrain, abundant understory cover, variable overstories.
Fall	Mature old-growth stands with dense understories.

Conservation Measures.

1) Prior to initiating restoration activities at elevations of 4,000 feet or above in Bonner or Boundary counties in Idaho or east of the Pend Oreille River, Pend Oreille County, Washington, within recovery zones (as defined in the Woodland Caribou Recovery Plan, USFWS 1993), contact the appropriate USFWS field office to confirm the project will have *no effect* or is *not likely to adversely affect* woodland caribou.
2) Projects that are scheduled during early winter in the caribou recovery area (Michael Borysewicz pers. com. 2003) and generate noise above ambient levels will be evaluated by the local USFWS wildlife biologist to determine if there will be disturbance effects to woodland caribou.
3) Any vegetation management in woodland caribou habitat will not affect more than 1.0 acre of native forest per year.
4) Projects will not result in increased access for snowmobiles or other off-road vehicles and will not result in new roads in woodland caribou habitat.

5) Within suitable or occupied habitat use only herbicides listed under **General Conservation Measures for Terrestrial Species and Critical Habitats #4**.

g. Canada lynx (*Lynx canadensis*) and critical habitat

Description. Canada lynx inhabit lodgepole pine, cedar/hemlock and sub-alpine forest habitats at or above 3000 ft. elevation in Idaho, Montana, Oregon and Washington. Canada lynx are specialized predators that are highly dependent on the snowshoe hare (*Lepus americanus*) for food, but also eat alternate prey such as squirrels and grouse. The range of the snowshoe hare coincides with Canada lynx. The snowshoe hare prefer diverse, early successional forests with dense stands of conifers and shrubby understories that provide food, cover to escape from predators, and protection during extreme weather. Lynx usually concentrate their winter foraging activities in areas where hare activity is high.

Canada lynx den in forests with large woody debris, such as downed logs and windfalls, to provide denning sites with security and thermal cover for kittens. In Washington, lynx used lodgepole pine (*Pinus contorta*), spruce (*Picea spp.*), and subalpine fir (*Abies lasiocarpa*) forests older than 200 years for denning. Based on information from the western United States, sites selected for denning also must provide for minimal disturbance by humans and proximity to foraging habitat (early successional forests), with denning stands at least one hectare (2.5 acres) in size. Intermediate-age forests allow for lynx access between den sites and foraging areas, movement within home ranges, and random foraging opportunities.

Conservation Measures.

1) Prior to initiating restoration activities in lodgepole pine, cedar/hemlock and sub-alpine forest habitats at or above 3000 ft. in elevation in Idaho, Montana, Oregon and Washington, contact the appropriate USFWS field office to confirm the project will have *no effect* or is *not likely to adversely affect* Canada lynx.
2) Activities within or near potential denning sites will be reviewed by the appropriate USFWS field office to confirm the project will have *no effect* or is *not likely to adversely affect* the lynx.
3) The project will meet the standards and guidelines identified in the Northern Rockies Lynx Management Direction (NRLMD) and/or in the current and upcoming revised (2013) LCAS (Lynx Conservation Assessment and Strategy). The current LCAS is available at: http://library.fws.gov/Pubs5/Lynx_consassess_2000.pdf
4) The project will not result in increased off-road vehicle/snowmobile access to lynx habitat during or following implementation.
5) Within suitable or occupied habitat for Canada lynx or its key prey species, snowshoe hare (*Lepus americanus*), use only herbicides listed under **General Conservation Measures for Terrestrial Species and Critical Habitats #4**.

h. Grizzly bear (*Ursus arctos horribilis*)

Description. The grizzly bear has a broad range of habitat tolerance. Contiguous, relatively undisturbed mountainous habitat having a high level of topographic and vegetative diversity characterizes most areas where the species remains. Forest cover is also especially important to grizzly bears. However, the search for food has a prime influence on grizzly bear movements and individuals will go where they are able to locate these resources.

Displacement of grizzly bears from trails (motorized and non-motorized) and roads has been well documented (Archibald et al. 1987, Mattson et al. 1987, McLellan and Shackleton 1988, 1989; Kasworm and Manley 1990; Mace and Waller 1996, 1998; Mace et al. 1996, 1999, Ciarniello et al. 2007). Factors related to human access include increased potential for poaching, collisions with vehicles, and chronic negative human interactions at campgrounds and campsites that are accessed by roads and trails (Claar et al. 1999, Wisdom et al. 2000, Ciarniello et al. 2005, Ciarniello et al. 2007). Human access is managed by assessing the quality and quantity of seasonal habitats within core areas (IGBC 1998). Core areas are defined as areas that are greater than 500 meters from an open road, motorized trail or high-use trail within the recovery zones identified below (Gaines et al. 2003).

Mating appears to occur from late May though mid-July with delayed implantation until late November. Den excavation starts as early as September or may take place just prior to entry in late November. Dens are usually at higher elevations dug on steep slopes where wind and topography cause an accumulation of deep snow that is unlikely to melt during warm periods. Birth of cubs occurs during hibernation near February 1. Upon emergence from the den they seek the lower elevations, drainage bottoms, avalanche chutes, and ungulate winter ranges where their food requirements can be met. Throughout late spring and early summer they follow plant phenology back to higher elevations. In late summer and fall, there is a transition to fruit and nut sources, as well as herbaceous materials that may occur at lower elevations.

Grizzly bears may occur both within and outside of recovery zones. Within the proposed action area, the following recovery zones have been identified for grizzly bear in Idaho, Montana, and Washington.

> ***Bitterroot Ecosystem Recovery Zone.*** The BE recovery zone is located primarily in northern Idaho with small portions in western Montana **(Appendix B-3)**.
>
> ***Cabinet-Yaak Ecosystem Recovery Zone.*** The CYE recovery zone is located primarily in northwestern Montana with small portions in northern Idaho **(Appendix B-4)**.
>
> ***North Cascades Ecosystem Recovery Zone.*** The NCASC recovery zone is in north-central Washington State **(Appendix B-5)**.
>
> ***Northern Continental Divide Ecosystem Recovery Zone.*** The NCDE is contained entirely within the State of Montana **(Appendix B-6)**.

Selkirk Mountains Ecosystem Recovery Zone. The SE recovery zone is located primarily in northern Idaho but also includes portions of Washington and Canada **(Appendix B-7)**.

Conservation Measures.

1) Restoration activities generating noise above ambient levels will not occur within 0.25 mile (1.0 mile for blasting and pile driving) of known grizzly bear den sites (based on current information from state wildlife agencies and the USFWS) from October 15 through May 15. Activities within 0.25 mile of a known den site at any time of year will be reviewed by the appropriate USFWS field office to confirm the project will have *no effect* or *is not likely to adversely affect* grizzly bear.
2) Restoration activities generating noise above ambient levels, motorized vehicle use (including helicopters), or increasing human use within 0.25 mile (1.0 mile for blasting and pile driving) of grizzly bear core areas is not covered by this programmatic BO and will require a separate Section 7 consultation.
3) Restoration activities will not degrade or destroy key grizzly bear foraging habitat (e.g., avalanche chutes, berry/shrub fields, fruit/nut sources).
4) Restoration activities will not increase trail or permanent road densities within core areas or areas actively used by grizzly bears.
5) Within recovery areas, or areas actively used by grizzly bears all attractants, including food and garbage, will be stored in a manner unavailable to wildlife at all times.
6) Within recovery areas, or areas actively used by grizzly bears, 25-ft no-cut buffers will be maintained in riparian zones to provide vegetative screening along streams and wetlands. Visual cover will also be maintained adjacent to roads and major habitat components such as snow chutes and shrub fields.
7) Within suitable suitable or occupied habitat use only herbicides listed under **General Conservation Measures for Terrestrial Species and Critical Habitats #4**.

Species Specific Conservation Measures for Birds

Within the Columbia River Basin, BPA funded activities may occur in areas that are near or occupied by the following avian ESA-listed species; (a) Streaked horned lark (*Eremophila alpestris strigata*), (b) Marbled murrelet (*Brachyramphus marmoratus*) and critical habitat, (c) Northern spotted owl (*Strix occidentalis caurina*) and critical habitat and (d) Western snowy plover (*Charadrius alexandrinus nivosus*) and their critical habitat (Pacific coast DPS).

a. Streaked horned lark (*Eremophila alpestris strigata*)

Description. Streaked horned lark and its critical habitat were proposed to be listed as threatened on October 11, 2012. The current range of the streaked horned lark can be divided into three regions: (1) Puget lowlands in Washington, (2) Washington coast and lower Columbia River islands (including dredge spoil deposition sites near the Columbia River in Portland, Oregon), and (3) Willamette Valley in Oregon.

Streaked horned larks prefer wide open spaces with no trees and few or no shrubs. They nest on the ground in sparsely vegetated sites dominated by grasses and forbs. Data indicate that sites used by larks are generally found in open (i.e., flat, treeless) landscapes of 120 hectares (ha)(300 acres) or more. Some patches with the appropriate characteristics (i.e., bare ground, low stature vegetation) may be smaller in size if the adjacent fields provide the required open landscape context. This situation is common in agricultural habitats and on sites next to water. For example, many of the sites used by larks on the islands in the Columbia River are small, but are adjacent to open water, which provides the landscape context needed.

Conservation Measures.

1) Restoration projects proposed at locations with suitable habitat will be surveyed for streaked horned larks (using a survey protocol approved by the USFWS) prior to project design. If streaked horned larks are identified, contact the appropriate USFWS field office to confirm the project is *not likely to adversely affect* streaked horned lark.
2) Restoration activities generating noise above ambient levels within 200 feet (1.0 mile for blasting and pile driving) of likely occupied nesting habitat will not occur from March 15 to August 15.
3) If an area is identified as likely to be occupied by larks, riparian plantings will not occur within 300 feet to maintain the open habitat suitable required by streaked horned larks unless individual project approval has been received from the appropriate FWS field office.

b. Marbled murrelet (*Brachyramphus marmoratus*) and critical habitat

Description. The marbled murrelet (MAMU) is a small, robin-sized, diving seabird that feeds primarily on fish and invertebrates in near-shore marine waters. It spends the majority of its time on the ocean, roosting and feeding, but comes inland up to 80 kilometers (50 miles) to nest in forest stands with old growth forest characteristics. These dense shady forests are generally characterized by large trees with large branches or deformities for use as nest platforms. Murrelets nest in stands varying in size from several acres to thousands of acres. However, larger, unfragmented stands of old growth appear to be the highest quality habitat for marbled murrelet nesting. Nesting stands are dominated by Douglas-fir in Oregon and Washington and by old-growth redwoods in California.

Marbled murrelets nest from mid-April to late September. The sexually mature adult murrelet (at age 2 or 3 of an average 15-year lifespan) generally lays a single egg on a mossy limb of an old-growth conifer tree. Both sexes incubate the egg in alternating 24-hour shifts for 30 days. Murrelet chicks are virtually helpless at hatching and rely on the adults for food. The adults feed the chick at least once per day, flying in (primarily at dawn and dusk) from feeding on the ocean, carrying one fish at a time. The young fledge from the nest in about 28 days and appear to fly directly to the sea upon leaving the nest. Marbled murrelets have a naturally low reproductive rate because they lay only one egg per nest and not all adults nest every year.

Definitions.

Suitable habitat: Conifer-dominated stands that generally are 80 years old or older and/or have trees greater than or equal to 18 inches mean diameter at breast height (dbh). Murrelet suitable habitat must include potential nesting structure.

Potential Nesting Structure: Consists of individual tree(s) with the following characteristics:

- It occurs within 50 miles (81 km) of the coast (USFWS 1997);
- It is a conifer tree (USFWS 1997)
- It is ≥ 19.1 in. (49 cm) (dbh) in diameter, > 107 ft. (33 m) in height, has at least one platform ≥ 4 in. (10 cm) in diameter, nesting substrate (e.g., moss, epiphytes, duff) on that platform, and an access route through the canopy that a murrelet could use to approach and land on the platform (Burger 2002, Nelson & Wilson 2002);
- It has a platform ≥ 32.5 ft. (9.9 m) above the ground (Nelson & Wilson 2002);
- And it has a tree branch or foliage, either on the tree with nesting structure or on an adjacent tree, that provides protective cover over the platform (Nelson & Wilson 2002)

Unsurveyed Habitat: Consists of suitable habitat or potential structure within younger stands that has not been surveyed by the established survey protocol (Evans et al. 2003). In cases of uncertainty such as stand occupancy, it is Service policy to give the benefit of the doubt to the listed species. On that basis, the Service considers unsurveyed habitat as occupied when analyzing effects to murrelets.

Nesting periods: In Washington the Service considers the murrelet nesting season to span from April 1 – September 23, while in Oregon the Service considers the murrelet nesting season to span from April 1 – September 15. The differences in applied nesting seasons are due to internal evaluations of murrelet biology and nesting season data, which are on-going. Within the murrelet nesting period in Oregon, the USFWS considers two distinct periods: the critical nesting season between April 1 – August 5, and the late nesting season between August 6 and September 15. In Washington, the USFWS does not incorporate a late nesting period into its management evaluations. During the late nesting season in Oregon, activities other than helicopters are *not likely to adversely affect* murrelets *provided that they don't begin until two hours after sunrise and cease prior to two hours before sunset.*

Conservation Measures.

1) Projects will not occur within the applicable disruption and disturbance distances from occupied MAMU nest trees or suitable nest trees in unsurveyed nesting habitat for MAMUs (**Table 3**) during the critical nesting period unless a protocol survey determines MAMUs are not present. Otherwise, in Oregon the project would be LAA and either delayed until August 6 (with 2-hr timing restrictions) at which point it would be considered NLAA, or until it is determined that young are not present, or counted toward the limited number of LAA projects covered under this programmatic (with 2-hr timing restrictions). In Washington, the project would be LAA and either delayed until September 4 (with 2-hr timing restrictions) or until it is determined that young are not present, or counted toward the limited number of LAA projects covered under this programmatic.
2) Projects within the applicable disruption and disturbance distances for MAMUs implemented between April 1 and September 15 would not begin until 2 hours after sunrise and would end 2 hours before sunset.
3) No suitable, potential, or critical MAMU habitat is to be modified as part of this action to the extent that the functionality is changed for MAMU.
4) Within suitable, potential, or critical habitat, garbage containing food and food trash generated by workers in project areas is secured or removed daily to minimize attraction of corvids, which have been identified as predators of murrelet eggs and young.
5) Table 3 shows MAMU disruption distances that are applicable to the proposed actions under this BO. Distances and times can be locally revised based on current information available from the appropriate FWS field office.
6) For large wood (LW) projects, follow conservation measures as outlined in the **Tree Removal for LW Projects under the Proposed Action's Special Actions, Action-Category Nine.**

Table 3. Disturbance and disruption distance thresholds for Marbled Murrelet during the nesting season (April 1 to September 15 for OR; April 1 to September 23 for WA). Distances are to a known occupied marbled murrelet nest tree or suitable nest trees in unsurveyed nesting habitat.

Action	Action Not Likely Detected Above Ambient Levels	Disturbance Distances	Disruption Distances	Increased Risk of Physical Injury and/or Mortality
Light maintenance (e.g., road brushing and grading), and heavily-used roads	> 0.25 mile	≤ 0.25 mile	NA[1]	NA
Log hauling on heavily-used roads (FS maintenance levels 3, 4, 5)	>0.25 mile	≤ 0.25 mile	NA[1]	NA
Chainsaws (includes felling hazard/danger trees)	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards[2]	Potential for mortality if trees felled contain platforms

Heavy equipment for road construction, road repairs, bridge construction, culvert replacements, piling removal, etc.	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards[2]	NA
Helicopter: Chinook 47d	>0.5 mile	266 yards to 0.5 mile	≤ 265 yards[5]	100 yards[6] (injury/mortality)
Helicopter: Boeing Vertol 107, Sikorsky S-64 (SkyCrane)	>0.25 mile	151 yards to 0.25 mile	≤ 150 yards[7]	50 yards[6] (injury/mortality)
Helicopters: K-MAX, Bell 206 L4, Hughes 500	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards[8]	50 yards[6] (injury/mortality)

7. NA = not applicable. We anticipate that marbled murrelets that select nest sites in close proximity to heavily used roads are either undisturbed by or habituate to the sounds and activities associated with these roads (Hamer and Nelson 1998, p. 21).
8. Based on recommendations from murrelet researchers that advised buffers of greater than 100 meters to reduce potential noise and visual disturbance to murrelets (Hamer and Nelson 1998, p. 13, USFWS 2012c, pp. 6-9).
9. Based on an estimated 92 dBA sound-contour (approximately 265 yards) for the Chinook 47d (Newman et al. 1984, Table D.1).
10. Because murrelet chicks are present at the nest until they fledge, they are vulnerable to direct injury or mortality from flying debris caused by intense rotor wash directly under a hovering helicopter. Hovering distance is based on a 300-ft radius rotor-wash zone for large helicopters hovering at < 500 above ground level (from WCB 2005, p. 2 – logging safety guidelines). We reduced the hovering helicopter rotor-wash zone to a 50-yard radius for all other helicopters based on the smaller rotor-span for all other ships.
11. Based on an estimated 92 dBA sound contour from sound data for the Boeing Vertol 107 the presented in the San Dimas Helicopter Logging Noise Report (USFS 2008, chapters 5, 6).
12. The estimated 92 dBA sound contours for these helicopters is less than 110 yards (e.g., K-MAX (100 feet) (USFS 2008, chapters 5, 6), and Bell 206 (85-89 dbA at 100 m)(Grubb et al. 2010, p. 1277).

c. Northern spotted owl (*Strix occidentalis caurina*) and critical habitat

Description. Northern spotted owls live in forests characterized by dense canopy closure of mature and old-growth trees, abundant logs, standing snags, and live trees with broken tops. Although they are known to nest, roost, and feed in a wide variety of habitat types, spotted owls prefer older forest stands with variety: multi-layered canopies of several tree species of varying size and age, both standing and fallen dead trees, and open space among the lower branches to allow flight under the canopy. Typically, forests do not attain these characteristics until they are at least 150 to 200 years old.

Like most owl species, the spotted owl nests in the tops of trees or in cavities of naturally deformed or diseased trees. Spotted owls primarily mate for life and may live up to 20 years. Although the breeding season varies with geographic location and elevation, spotted owls generally nest from February to June. One to four (usually two) pure white eggs are laid in the early spring and hatch about a month later. During incubation, the male typically does most of the foraging and brings food to the female and the young owlets. At three to four weeks of age, the owlets are able to perch away from the nest, but still depend on their parents for food. Predation on these juveniles by great horned owls and other predators is high at this time and many do not survive. Parental care of the juveniles generally lasts into September when the young owls finally take off on their own. This period, too, is hard for the young birds, and starvation is common in the first few months on their own.

Definitions.

Suitable habitat: Consists of stands with sufficient structure (large trees, snags, and downed wood) to provide opportunities for owl nesting, roosting, and foraging. Generally, these conditions are associated with conifer-dominated stands, 80 years old or older, multi-storied in structure, have trees greater than or equal to 18 inches mean diameter at breast height (dbh) and the canopy closure generally exceeds 60 percent. Stands are defined at a larger scale (e.g. province) as suitable based just on age or size (i.e. 80 years, >18") alone.

The Service's HIP III BO does not provide take for NSO. Only activities that are determined to have a "no effect" or "not likely to adversely affect" are covered under the concurrence section of this BO. Table 4 below is provided to assist with these determinations.

Conservation Measures.

1) Projects will not occur during the critical breeding period, generally between March 1 – July 15, but may vary by location. Timing can be locally revised based on current information available from the appropriate FWS field office. Projects should (a) be delayed until after the critical breeding season (unless action involves Type I helicopters, which extend critical nesting window to September 30 (check with appropriate FWS field office to determine if date applies to all locations)); (b) delayed until it is determined that young are not present.
2) The FWS wildlife biologist may extend the restricted season based on site-specific information (such as a late or recycle nesting attempt).
3) **Table 4** shows disruption distances applicable to the equipment types proposed in the BA. These distances can be locally altered based on current information.
4) No activity within this BO will cause adverse effects to spotted owl critical habitat when analyzed against the appropriate local scale as determined by the unit wildlife biologist.
5) For (LW) projects follow conservation measures as outlined in the **Tree Removal for LW Projects under Special Actions.**
6) No hovering or lifting within 500 feet of the ground within occupied spotted owl habitat during the critical breeding season by ICS Type I or II helicopters would occur as part of any proposed action addressed by this assessment.

Table 4. Disturbance, disruption (harass) and/or physical injury (harm) distance thresholds for Spotted Owls. Distances are to a known occupied spotted owl nest tree or suitable nest trees in unsurveyed habitat.

Project Activity	**No Effect (Mar 1 – Sept. 30)**	**NLAA** "may affect" disturbance distance **(Mar 1 – Sept. 30)**	**LAA – Harass** early nesting season disruption distance (**Mar 1–Jul 15[11]**)	**LAA – Harass** late nesting season disruption distance (**Jul 16[11]–Sep 30**)	**LAA – Harm** direct injury and/or mortality (**Mar 1 – Sept. 30)**
Light maintenance (e.g., road brushing and grading) and heavily-used roads	>0.25 mile	≤ 0.25 mile	NA[1]	NA	NA
Log hauling on heavily-used roads (FS maintenance levels 3, 4, and 5)	>0.25 mile	≤ 0.25 mile	NA[1]	NA	NA
Chainsaws (includes felling hazard/danger trees)	>0.25 mile -	66 yards to 0.25 mile -	≤ 65 yards[2]	NA	NA
Heavy equipment for road construction, road repairs, bridge construction, culvert replacements, piling removal, etc.	>0.25 mile	66 yards to 0.25 mile	≤ 65 yards[2]	NA	NA
Helicopter: Chinook 47d	>0.5 mile	266 yards to 0.5 mile	≤ 265 yards[5]	≤ 100 yards[6] (hovering only)	NA
Helicopter: Boeing Vertol 107, Sikorsky S-64 (SkyCrane)	>0.25 mile	151 yards to 0.25 mile	≤ 150 yards[7]	≤ 50 yards[6] (hovering only)	NA
Helicopters: K-MAX, Bell 206 L4, Hughes 500	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards[8]	≤ 50 yards[6] (hovering only)	NA

NLAA = "not likely to adversely affect." **LAA** = "likely to adversely affect" **≥ is greater than or equal to, ≤ is less than or equal to.**

Table 2 (Spotted Owl) Footnotes:

1. NA = not applicable. Based on information presented in Temple and Guttiérez (2003, p. 700), Delaney et al. (1999, p. 69), and Kerns and Allwardt (1992, p. 9), we anticipate that spotted owls that select nest sites in close proximity to open roads either are undisturbed by or habituate to the normal range of sounds and activities associated with these roads.
2. Based on Delaney et al. (1999, p. 67) which indicates that spotted owl flush responses to above-ambient equipment sound levels and associated activities are most likely to occur at a distance of 65 yards (60 m) or less.
3. Based on an estimated 92 dBA sound-contour (approximately 265 yards) from sound data for the Chinook 47d presented in Newman et al. (1984, Table D.1).
4. Rotor-wash from large helicopters is expected to be disruptive at any time during the nesting season due the potential for flying debris and shaking of trees located directly under a hovering helicopter. The hovering rotor-wash distance for the Chinook 47d is based on a 300-ft radius rotor-wash zone for large helicopters hovering at < 500 above ground level (from WCB 2005, p. 2 – logging safety guidelines). We reduced the hovering helicopter rotor-wash zone to a 50-yard radius for all other helicopters based on the smaller rotor-span for all other ships.
5. Based on an estimated 92 dBA sound contour from sound data for the Boeing Vertol 107 the presented in the San Dimas Helicopter Logging Noise Report (USFS 2008, chapters 5, 6).
6. The estimated 92 dBA sound contours for these helicopters is less than 110 yards (e.g., K-MAX (100 feet) (USFS 2008, chapters 5, 6), and Bell 206 (85-89 dbA at 100 m)(Grubb et al. 2010, p. 1277).

d. Western snowy plover (*Charadrius alexandrinus nivosus*) and critical habitat (Pacific coast DPS)

Description. The Pacific coast population of western snowy plovers (WSP) breeds on coastal beaches from southern Washington to southern Baja California, Mexico. Plovers lay their eggs in shallow depressions in sandy or salty areas that generally do not have much vegetation. Because the sites they choose are in loose sand or soil, nesting habitat is constantly changing under the influence of wind, waves, storms, and encroaching plants. The nesting season extends from early March through late September. Fledging of late-season broods may extend into the third week of September throughout the breeding range.

Conservation Measures.

1) Prior to initiating restoration activities on coastal beaches, project cooperators will coordinate with local FWS plover monitoring biologists to identify western snowy plover nesting areas.
2) Restoration activities occurring on coastal beaches will not occur within western snowy plover nesting or foraging habitat from March 15 to September 30.
3) Ground disturbing activities on coastal dunes will occur during the fall and winter months before the plover's critical nesting period (*i.e.,* March 15-September 15). These activities will include the control or removal of invasive and non-native vegetation on coastal dunes through manual, mechanical, and chemical methods.
4) Proposed restoration activities generating noise above ambient levels will not occur within 0.4 km (0.25 mi) of a western snowy plover occupied beach during the critical nesting period. Project cooperators will coordinate with local plover monitoring biologists to identify these areas.
5) In-channel nutrient enhancement activities will not occur in coastal streams between March 15-September 15 nor within 15 km (9.3 mi) of a western snowy plover occupied beach in order to not attract potential avian or mammalian predators to project sites.
6) Project personnel must take appropriate measures not to attract potential avian or mammalian predators to project sites in WSP habitat. These include eliminating human-introduced food sources, properly disposing of organic waste, and not planting vegetation that could be potential cover or perches for predators near designed critical or suitable habitats.

Species Specific Conservation Measures for Invertebrates

Within the Columbia River Basin, BPA funded activities may occur in areas that are near or occupied by the following invertebrate ESA-listed species; (a) Fender's blue butterfly (*Icaricia icarioides fenderi*), (b) Oregon silverspot butterfly (*Speyeria zerene Hippolyta*), (c) Taylor's (Edith's) checkerspot butterfly (*Euphydryas editha taylori*), (d) Banbury Springs limpet (*Lanx sp.),* (e) Bliss Rapids snail (*Taylorconcha serpenticola*), (f) Snake River Physa snail (*Haitia (Physa) natricina*) and (g) Bruneau Hot springsnail (*Pyrgulopsis bruneauensis*).

a. Fender's blue butterfly (*Icaricia icarioides fenderi*) and critical habitat

Description. Fender's blue butterfly occurs in native prairie habitats. Most Willamette Valley prairies are early seral (one stage in a sequential progression) habitats, requiring natural or human-induced disturbance for their maintenance. The vast majority of these prairies would eventually be forested if left undisturbed. Fender's blue butterfly is typically found in native upland prairies, dominated by red fescue (*Festuca rubra*) and/or Idaho fescue (*F. idahoensis*).

The butterfly uses three lupine species as larval food plants which include: Kincaid's lupine (*Lupinus sulphureus kincaidii*), sickle-keeled lupine (*L. albicaulis*) and spur lupine (*L. arbustus*). Kincaid's lupine (listed as Threatened), occurs on a few, small prairie remnants in the Willamette Valley. Adult Fender's blue butterflies use a variety of plants as nectar sources; these include: tapertip onion (*Allium acuminatum*), narrowleaf onion (*Allium amplectens*), Tolmie's mariposa lilly (*Calochortus tolmiei*), small camas (*Camassia quamash*), clearwater cryptantha (*Cryptantha intermedia*), Oregon sunshine (*Eriophyllum lanatum*), Oregon geranium (*Geranium oreganum*), toughleaf iris (*Iris tenax*), pale flax (*Linum angustifolium*), blue flax (*Linum perenne*), Meadow checkermallow (*Sidalcea campestris*), rose checker-mallow (*Sidalcea virgata*), Amercian vetch (*Vicia Americana*), bird vetch (*V. cracca*), common vetch (*V. sativa*), and tiny vetch (*V. hirsute*). Native plants that occur on native upland prairies serve as herbaceous indicators of prairie condition. These dry, fescue prairies make up the majority of habitat for Fender's blue butterfly. Although Fender's blue butterfly is occasionally found on steep, south-facing slopes and barren rocky cliffs, it does not appear to thrive in the xeric oatgrass communities often found there.

The life cycle of a Fender's blue butterfly begins in late spring or early summer when an adult female deposits an egg on the underside of a Kincaid's lupine leaflet. The egg soon hatches and the larva feeds on lupine leaflets. The larva may pass through one molt before dropping to the ground in mid-June or July where it goes into hibernation for the fall and winter. In the following March or April, the larva begins to feed on fresh lupine leaflets again. After three to four additional molts, it ecloses into a butterfly in May and begins the cycle again.

Conservation Measures.

1) Within the Willamette Valley, pre-project surveys will be conducted by a qualified biologist for adult Fender's blue butterfly during the mid-May to early-July flight period

on any project site that supports or may support Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*), longspur lupine (*L. arbustus*), or sickle-keeled lupine (*L. albicaulis*). Information acquired through population and vegetation surveys will be used to direct restoration/recovery activities away from key breeding areas.

2) Restoration activities will not remove or disturb Kincaid's lupine, spur lupine *(Lupinus laxiflorus = L. arbustus)* or sickle-keeled lupine *(L. albicaulis*) or remove habitat including the following nectar sources: tapertip onion (*Allium acuminatum*), narrowleaf onion (*Allium amplectens*), Tolmie's mariposa lilly (*Calochortus tolmiei*), small camas (*Camassia quamash*), clearwater cryptantha (*Cryptantha intermedia*), Oregon sunshine (*Eriophyllum lanatum*), Oregon geranium (*Geranium oreganum*), toughleaf iris (*Iris tenax*), pale flax (*Linum angustifolium*), blue flax (*Linum perenne*), Meadow checkermallow (*Sidalcea campestris*), rose checker-mallow (*Sidalcea virgata*), Amercian vetch (*Vicia Americana*), bird vetch (*V. cracca*), common vetch (*V. sativa*), and tiny vetch (*V. hirsute*) within the range of the Fender's blue butterfly.
3) Manual and mechanical treatments for invasive and non-native plant control may occur adjacent to occupied habitat or critical habitat for Fender's blue butterfly but will not occur during the butterfly flight period from mid-April to late May to avoid impacts to adults. Occupied areas include all nectar habitat within 0.5 km of occupied lupine habitat. Mowing, tilling, disking, plowing, excavation, or other extensive ground disturbing activities will not occur within 20 m (65 ft) of critical habitat or known Fender's blue butterfly or Kincaid's, spur, or sickle-keeled lupine occupied habitats.
4) Livestock grazing will not occur in critical habitat or any habitat occupied by the Fender's blue butterfly.
5) Hand applications of herbicides may be used to control or remove invasive native and non-native vegetation in prairie habitats but will not occur within a minimum distance of 20 m (65 ft) of occupied habitat or critical habitat for Fender's blue butterfly. Areas known to have high nectar plant densities will also be avoided. Herbicide treatments must be followed with native seed or plant introductions to minimize or eliminate the establishment of invasive and non-native vegetation.
6) Broadcast herbicide applications will not be used within 275 m (900 ft) of occupied habitat or critical habitat for Fender's blue butterfly.

b. Oregon silverspot butterfly (*Speyeria zerene Hippolyta*) and critical habitat

Description. The Oregon silverspot butterfly occupies three types of grassland habitat. One type consists of marine terrace and coastal headland salt-spray meadows (e.g., Cascade Head, Bray Point Rock Creek-Big Creek and portions of Del Norte sites). The second consists of stabilized dunes as found at the Long Beach Peninsula, Clatsop Plains, and the remainder of Del Norte. Both of these habitats are strongly influenced by proximity to the ocean, mild temperatures, high rainfall, and persistent fog. The third habitat type consists of montane grasslands found on Mount Hebo and Fairview Mountains. Conditions at these sites include colder temperatures, significant snow accumulations, less coastal fog, and no salt spray. See **Appendix B-8** for a map of Oregon silverspot butterfly habitat locations.

The most important feature of the habitat of the Oregon silverspot butterfly is the presence of the early blue violet. This plant is normally the only species on which the Oregon silverspot butterfly can successfully feed and develop as larva. This plant is part of the salt-spray meadow vegetation and is an obligatory component of the butterfly's habitat. Other features of optimum habitat include moderate grass cover, including red fescue (*Festuca rubra*) used as a shelter for larvae, and a mixture of herbaceous plants such as California aster (*Aster chilensis*) used for nectaring by adults. Apparently the more inland meadow sites occupied by related subspecies of silverspots are not accessible to Oregon silverspot butterfly. The habitat is similar on Mount Hebo with *Viola adunca* as the key component. The distribution and composition of the flora may differ slightly, but the habitat functions similarly to the salt-spray meadow. The shallow soil apparently helps to keep this area in the meadow stage.

Upon eclosion (metamorphosis of the pupa into the adult butterfly), the adults generally move out of the meadows into the fringe of conifers or brush where there is shelter for more efficient heat conservation and nectaring flights. The forest shelter may also be used for courtship and mating. Where such sheltered conditions exist, the adults will use various nectar sources, including native and exotic plants, particularly composites such as the native California aster, yarrow (*Achillea millefolium*), Canada goldenrod (*Solidago canadensis*), Pearly everlasting (*Anaphalis margaritacea*) and Indian thistle (*Cirsium edule*) and some exotics such as false dandelion (*Hypochaeris radieata*) and tansy ragwort (*Senecio jacobaea*).

The life history of the Oregon silverspot butterfly revolves around its obligatory host plant, the early blue violet (*Viola adunca*). Females oviposit up to 200+ eggs singly amongst the salt-spray meadow vegetation near the violet host plant, usually in late August and early September. Sites with good sun exposure are favored. The eggs hatch in approximately 16 days and the newly hatched larvae wander short distances to find a suitable site for diapause (suspended growth for overwintering). The larvae end diapause sometime in early spring and begin to feed on the violet leaves. As the larvae grow, they pass through five molts (shed outer covering) before they enter the intermediate stage between larval and adult forms (pupate). Approximately two or more weeks later, the butterflies emerge from their pupal case (eclose). Adult emergence starts in July and extends into September. Shortly thereafter, their wings and other body parts harden and they escape the windy, cool meadows for nearby forests or brush lands.

Mating occurs through August and September. Those individuals (male and female) which are most efficient at basking and maintaining proper body temperature will be able to operate longer and deeper in the windy meadow zone, thus improving their opportunities for successful reproduction.

Conservation Measures

1) Population surveys for Oregon silverspot butterfly will be required prior to restoration activities proposed in areas with suitable habitat for the butterfly. Surveys using direct observation will be conducted for Oregon silverspot butterfly from mid to July-

September 30 during the flight period using a modified Pollard walk method in occupied habitat (Pickering et al. 1992). Habitat surveys for early blue violets (*Viola adunca*) (violets) will be done during the peak violet blooming period April-May. Information acquired through population and vegetation surveys will be used to direct restoration/recovery activities away from key breeding areas.

2) Manual and mechanical treatments will only be used to maintain or increase meadow size in unsuitable habitat areas which do not contain early blue violets or Oregon silverspot butterfly larvae or pupae. These activities may occur adjacent to occupied habitat but will not occur during the butterfly flight period from mid to July-September 30 to avoid impacts to adults. Mowing, tilling, disking, plowing, excavation, or other extensive ground disturbing activities will not occur during the butterfly flight period or within 20 m (65 ft) of critical habitat or known Oregon silverspot butterfly or early blue violet occupied habitats.
3) Livestock grazing will not occur in critical habitat or any habitat occupied by the Oregon silverspot butterfly or early blue violet.
4) Hand application of herbicides may be used to control or remove invasive native and non-native plants, but will not occur within a minimum distance of 20 m (65 ft) of occupied habitat or critical habitat for the Oregon silverspot butterfly. Areas known to have high nectar plant densities will also be avoided (see above description of nectar species). Herbicide treatments must be followed with native seed or plant introductions to minimize or eliminate the establishment of invasive and non-native vegetation.
5) Broadcast herbicide applications will not be used within 275 m (900 ft) of occupied habitat or critical habitat for Oregon silverspot butterfly.

c. Taylor's (Edith's) checkerspot butterfly (*Euphydryas editha taylori*) and proposed critical habitat

Description. Habitat requirements for the Taylor's checkerspot butterfly consist of open grasslands and grass/oak woodland sites where food plants for larvae and nectar sources for adults are available. These sites include coastal and inland prairies on post-glacial, gravelly outwash and balds. In Oregon, Taylor's checkerspot butterflies occur along the Bonneville Power Administration (BPA) right-of-way corridor in an area known as Fitton Green in Benton County and on grassland openings within the Beazell Memorial Forest in Benton County. These two locations for Taylor's checkerspot butterfly are currently the only occupied patches known from Oregon. Known occurrences in Washington are located outside the proposed action area.

Taylor's checkerspot larvae have been documented feeding on members of the figwort or snapdragon family (Scrophulariaceae), including paintbrush (*Castilleja hispida*) as well as native and non-native *Plantago spp*. in the plantain family (Plantaginacea). The population in Oregon also depends upon *P. lanceolata.*Adults emerge in the spring, during April and May, when they mate and lay clusters of as many as 1,200 eggs. Larvae emerge and grow until the fourth or fifth instar. Larvae feeding on wildflowers in Puget Trough have been documented to enter diapause in mid-June to early July, hibernating through the winter.

Conservation Measures.

1) Population surveys for Taylor's checkerspot butterfly will be required prior to restoration activities proposed in areas with suitable habitat for the butterfly. Surveys using direct observation will be conducted for Taylor's checkerspot butterfly from April through May during the flight period using a survey approved by the Oregon Fish and Wildlife Office. Information acquired through population surveys will be used to direct restoration/recovery activities away from key breeding areas.
2) Manual and mechanical treatments for invasive and non-native plant control may occur adjacent to occupied habitat or critical habitat for Taylor's checkerspot butterfly but will not occur during the butterfly flight period from April to May to avoid impacts to adults. Mowing, tilling, disking, plowing, excavation, or other extensive ground disturbing activities will not occur within 20 m (65 ft) of known Taylor's checkerspot butterfly occupied habitats or proposed critical habitat.
3) Livestock grazing will not occur in critical habitat or any habitat occupied by the Taylor's checkerspot butterfly.
4) Hand application of herbicides may be used to control or remove invasive native and non-native vegetation but will not occur within a minimum distance of 20 m (65 ft) of occupied habitat or proposed critical habitat for Taylor's checkerspot butterfly. Areas known to have high nectar plant densities will also be avoided. Herbicide treatments must be followed with native seed or plant introductions to minimize or eliminate the establishment of invasive and non-native vegetation.
5) Broadcast herbicide applications will not be used within 275 m (900 ft) of occupied habitat or critical habitat for Taylor's checkerspot butterfly.

d. Banbury Springs limpet (*Lanx sp.)*

Description. *Lanx* requires cold, clear and well-oxygenated water with swift currents. *Lanx* are found on smooth basalt, boulders, or cobble-sized grounds ranging from 2 to 20 inches deep, but they avoid areas with green algae. Currently this species only exists at four cold-spring locations in Idaho that are isolated from each other: Thousand Springs, Box Canyon Springs, Briggs Springs and Banbury Springs **Appendix B-9**.

Conservation Measure.

Prior to initiating restoration activities in Thousand Springs, Box Canyon Springs, Briggs Springs and Banbury Springs in Gooding County, Idaho contact the appropriate USFWS field office to confirm the project will have *no effect* or is *not likely to adversely affect* the limpet.

e. Bliss Rapids snail (*Taylorconcha serpenticola*)

Description. The Bliss Rapids snail occurs in cold water springs and spring-fed tributaries to the Snake River, and in some reaches of the Snake River. The Bliss Rapids snail is primarily found on cobble boulder substrate, and in water temperatures between 59 and 61 degrees Fahrenheit. Recent surveys indicate the species is distributed discontinuously over 22 miles, from River Mile (RM) 547-560, RM 566-572, and at RM 580 on the Snake River **Appendix B-10**. The species is also known to occur in 14 springs or tributaries to the Snake River. The species does not occur in reservoirs.

Conservation Measure.

Prior to initiating restoration activities in habitat occupied by the Bliss Rapids snail, contact the appropriate USFWS field office to confirm the project will have *no effect* or *is not likely to adversely affect* the Bliss Rapids snail.

f. Snake River Physa snail (*Haitia (Physa) natricina*)

Description. The Snake River physa snail occurs in the mainstem Snake River, between rkm 890 to 1086 (RM 553 to 775), inhabiting areas of swift current on sand to boulder-sized substrate **Appendix B-11**.

Conservation Measure.

Prior to initiating restoration activities in habitat occupied by the Snake River physa snail, contact the appropriate USFWS field office to confirm the project will have *no effect* or *is not likely to adversely affect* the Snake River physa snail.

g. Bruneau Hot springsnail (*Pyrgulopsis bruneauensis*)

Description. The Bruneau Hot springsnail is only found in geothermal springs and seeps along an 8-kilometer length of the Bruneau River in Southwest Idaho (**Appendix B-12)**. It prefers wetted rock faces of springs and flowing water, with large cobbles and boulders. Spring temperatures are the predominant factor that determines the springsnail's distribution and abundance; the springsnail requires constant springwater temperatures to survive.

Conservation Measure.

Prior to initiating restoration activities in habitat occupied by the Bruneau Hot springsnail, contact the appropriate USFWS field office to confirm the project will have *no effect* or *is not likely to adversely affect* the Bruneau Hot springsnail.

Species Specific Conservation Measures for Plants

Within the Columbia River Basin, BPA funded activities may occur in areas that are near or occupied by the following ESA-listed plant species; Bradshaw's lomatium (*Lomatium bradshawii*), Cook's lomatium (*Lomatium cookie*) and their critical habitat, Gentner's fritillary (*Fritillaria gentneri*), Golden paintbrush (*Castilleja levisecta*), Howell's spectacular thelypody (*Thelypodium howellii spectabilis*), Kincaid's lupine (*Lupinus sulphureus ssp.* Kincaidii) and their critical habitat, Large-flowered wooly meadowfoam (*Limnanthes floccosa*) and their critical habitat, Malheur wire-lettuce (*Stephanomeria malheurensis*) and their critical habitat, McFarlane's four o'clock (*Mirabilis macfarlanei*), Nelson's checkermallow (*Sidalcea nelsoniana*), Rough popcorn flower (*Plagiobothrys hirtus*), Showy stickseed (*Hackelia hispida*), Slickspot peppergrass (*Lepidium papilliferum*) and their proposed critical habitat, Spalding's catchfly (*Silene spaldingii*), Umtanum Desert buckwheat (*Eriogonum codium*) and their critical habitat, Ute ladies' tresses (*Spiranthes diluvialis*), Water howellia (*Howellia aquatilis*), Wenatchee Mountain checkermallow (*Sidalcea oregana var. calva*) and their critical habitat, Western lily (*Lilium* occidentale), Willamette daisy (*Erigeron decumbens*) and their critical habitat, and White Bluffs bladderpod (*Physaria douglasii*) and their critical habitat.

Surveys.

If an ESA- listed plant is located within the county where a project is proposed (based on a review of the most recent USFWS county species list), contact the appropriate USFWS field office to determine whether there are known ESA-listed plants or suitable unsurveyed habitat for ESA-listed plants in the project area. If a known site of an ESA-listed plant is within 0.4 km (0.25 mi) of the project action area, or suitable or potential habitat may be affected by project activities, then a BPA contract botanist will conduct a site visit/vegetation survey to determine whether ESA-listed plants are within the project area. This visit and survey will be conducted at the appropriate time of year to identify the species and determine whether individual listed plants or potential habitat are present and may be adversely affected by project activities (**Table 5**). If listed plants are present and likely to be adversely affected by the project, then an individual consultation with the USFWS under Section 7 of the ESA must be initiated.

Table 5 – Optimal Survey Times for Flowering Periods of Listed Plants in Oregon and Washington

Species	Optimal Survey Time Period*
Bradshaw's Lomatium (*Lomatium bradshawii*)	April to mid-May
Cook's Lomatium (*Lomatium cookii*)	Mid-March through May (varies with spring moisture)
Gentner's Fritillary (*Fritillaria gentneri*)	April to June
Golden Paintbrush (*Castilleja levisecta*)	April to September
Howell's Spectacular Thelypody (*Thelypodium howellii* ssp. *spectabilis*)	June through July
Kincaid's Lupine (*Lupinus sulphureus* ssp. *kincaidii*)	May through July
Large-flowered Wooly Meadowfoam (*Limnanthes floccose*)	Mid-March to May (varies with spring moisture)
Malheur Wire-Lettuce (*Stephanomeria malheurensis*)	July through August
MacFarlane's four o'clock (*Mirabilis macfarlanei*)	May through June
Nelson's Checkermallow (*Sidalcea nelsoniana*)	Late May to Mid-July
Rough Popcornflower (*Plagiobothrys hirtus*)	Mid-June to early July
Showy Stickseed (*Hackelia venusta*)	May to July
Slickspot peppergrass (*Lepidium papilliferum*)	Mid-May to Mid-July
Spalding's Catchfly (*Silene spaldingii*)	June to September
Umtanum Desert Buckwheat (*Eriogonum codium*)	June through July
Ute Ladies'-Tresses (*Spiranthes diluvialis*)	July to late August
Water Howellia (*Howellia aquatilis*)	May through August
Wenatchee Mountains Checker-Mallow (*Sidalcea oregano* var. *calva*)	June to Mid-August
Western Lily (*Lilium occidentale*)	May to July
Willamette Daisy (*Erigeron decumbens* var. *decumbens*)	Mid-June to early July
White Bluffs Bladderpod (*Physaria douglasii* ssp. *tuplashensis*)	Mid-May to Mid-June

Conservation Measures.

For all of the above mentioned ESA-listed plant species that may occur in project areas within the scope of this proposed action, the following criteria will be applied:

1) Prior to restoration activities at areas with listed plants, all project staff will be familiarized with identification of any ESA-listed plants in the area and will be aware of ESA-listed plant locations within the project area.
2) Access points and tracks within occupied or suitable habitats for ESA-listed plant species must be limited and clearly marked to avoid soil compaction and damage to ESA-listed plant species from vehicles and/or foot traffic.
3) Revegetation activities in habitats where ESA-listed plants may occur or within their critical habitat must be approved by the USFWS field office prior to implementation.
4) Dust-abatement additives and stabilization chemicals will not be applied within 10 m (33 ft) of listed plants or critical habitat for listed plants.
5) Restoration activities will avoid actions that cause soil compaction, erosion, or deposition, or change the hydrology or drainage of a site with listed plants or critical habitat for listed plants.
6) Vehicle and equipment staging areas will be located at least 15 m (50 ft) from listed plants or critical habitat for listed plants.

Invasive and Non-native Plant Control

1) Listed plants must be clearly flagged or fenced prior to restoration activities to avoid inadvertently affecting listed plants.
2) When using manual methods at project sites occupied by a federally listed plant species, a buffer of 3 m (10 ft) will be required around green growing plants until after senescence. Manual control and removal activities may occur year round in occupied habitat or critical habitat for listed plants except at sites occupied by listed butterflies (see above for information on Fender's blue butterfly). Chips, sawdust, brush accumulations, and other plant waste materials will be removed from project site to the extent possible.
3) Mowing, tilling, disking, plowing, excavation, raking or sod rolling (*i.e.,* larger scale sub-surface ground disturbances) will not occur within 10 m (33 ft) of known federally listed plant species or critical habitat for listed plants at any time. Listed plants must be clearly flagged or fenced prior to restoration activities to avoid inadvertently affecting listed plants. Additional requirements for mechanical treatments include the following.
   a) Use of low ground impact (*e.g.,* rubber tired or tracked) and appropriately sized equipment to prevent soil compaction.
   b) Mower deck heights must be set to prevent soil gouging.
   c) Chips, sawdust, brush accumulations, and other plant waste materials must be removed from project site to the extent possible.
   d) Mechanical treatments must not alter the existing hydrology at a project site.

   e) All equipment must be cleaned of invasive and non-native plant materials before entering a project site occupied by a listed plant species to prevent the dispersal of seeds or other reproductive plant parts.
   f) Ground-disturbance activities (*e.g.* tilling, disking, and plowing) must be followed with native seed or plant introductions to minimize or eliminate the establishment of invasive and non-native vegetation.
4) Herbicides applications may be used to control or remove invasive native and non-native vegetation in accordance with the conservation measures identified in the proposed action of the biological assessment.
5) Herbicides will not be applied at locations where nearby listed plants may be in the path of surface runoff from the project.
6) <u>Hand applications</u> of herbicide will maintain a minimum distance of 5 m (16 ft) from listed plants or critical habitat. Spraying will only take place during calm periods (wind velocities less than 3 mph). Listed plants will be physically shielded (e.g., covered with buckets or some other barrier that will not harm the plants) as needed to protect them from spray or drift, unless they are dormant; plants will be uncovered immediately after spraying has been completed.
7) <u>Broadcast applications</u> of herbicide will not occur within 275 m (900 ft) of occupied habitat or critical habitat for listed plants.
8) Herbicide treatments must be followed with native seed or plant introductions to minimize or eliminate the establishment of invasive and non-native vegetation.
9) The following conservation measures are specific for the type of herbicide application to be used at project sites when listed plant species are nearby.
   a) <u>Wick and wipe applications</u>
      i) The appropriate type and size of equipment will be used to apply herbicides onto the target foliage and stems.
      ii) Herbicide applications will be made in a manner that prevents herbicide runoff onto the ground.
   b) <u>Basal bark applications</u>
      i) Applicators will avoid unnecessary run-off when applying herbicide to stems of target vegetation.
      ii) Herbicide applications will be applied using the lowest nozzle pressure that will allow adequate coverage.
      iii) Applicator will apply herbicides while facing away from listed plants.
   c) <u>Spot and patch applications</u>
      i) Herbicides applications may be used with hand applicators.
      ii) Herbicide will be applied in a manner where the spray is directed towards the application area and away from listed plants.
      iii) The spray nozzle will be kept within three feet of the ground when herbicide is being applied within 50 feet of listed plants. Beyond 50 feet, the nozzle may be held up to six feet above ground if needed to treat taller clumps of competing vegetation.
   d) <u>Cut surface and hack and squirt/injection applications</u>. Herbicide applications will be made in a manner that prevents herbicide runoff onto the ground.

e) Spot applications of dry granules, pellets, and dust. A 5 m (16 ft) buffer will be maintained between listed plants and application areas to prevent exposure to listed plants.

Terrestrial Wildlife and Aquatic Invertebrate Species Maps

The following pages include distribution/range maps for a number of terrestrial wildlife, plant and aquatic invertebrate species:

Figure 1. Columbian White Tailed Deer

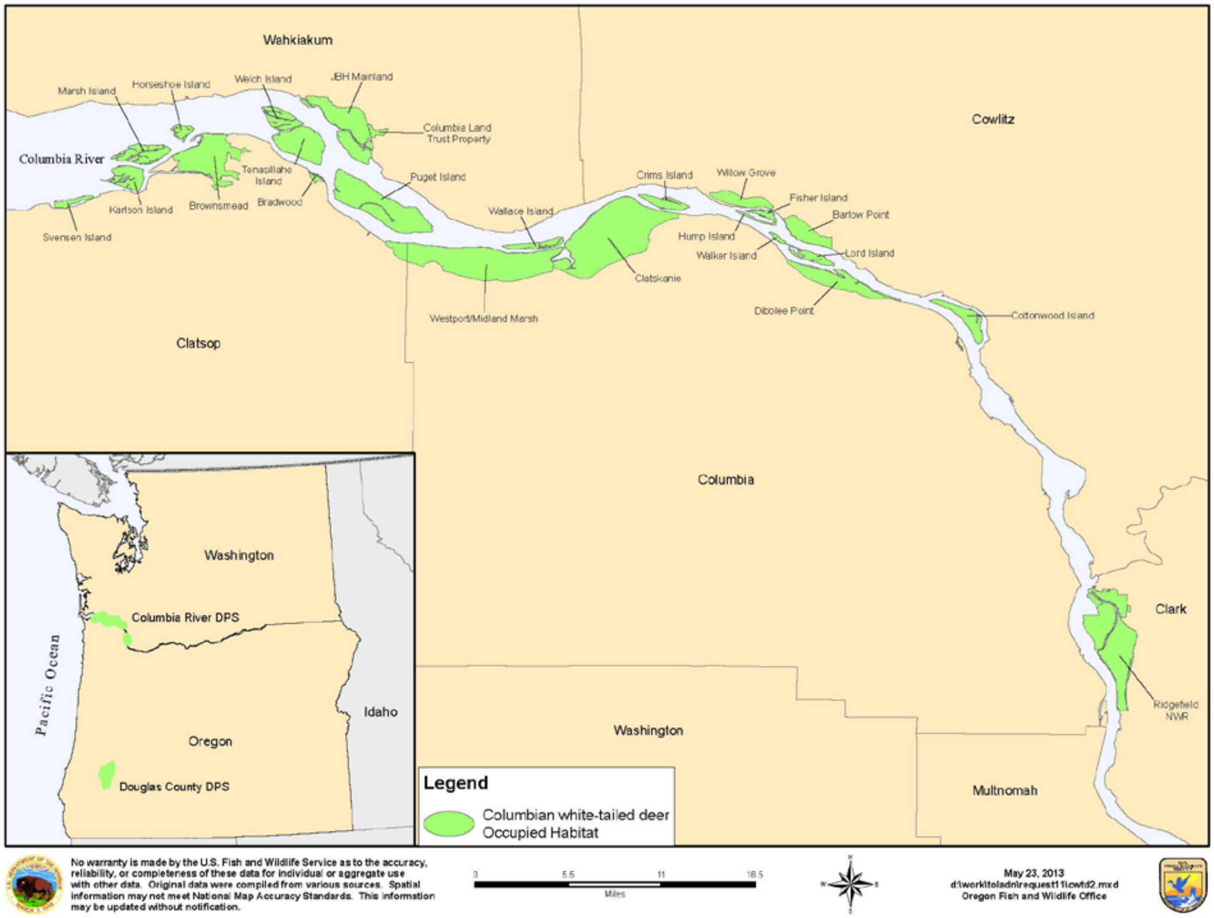


Figure 2a, 2b, 2c and 2d. Grizzly Bear

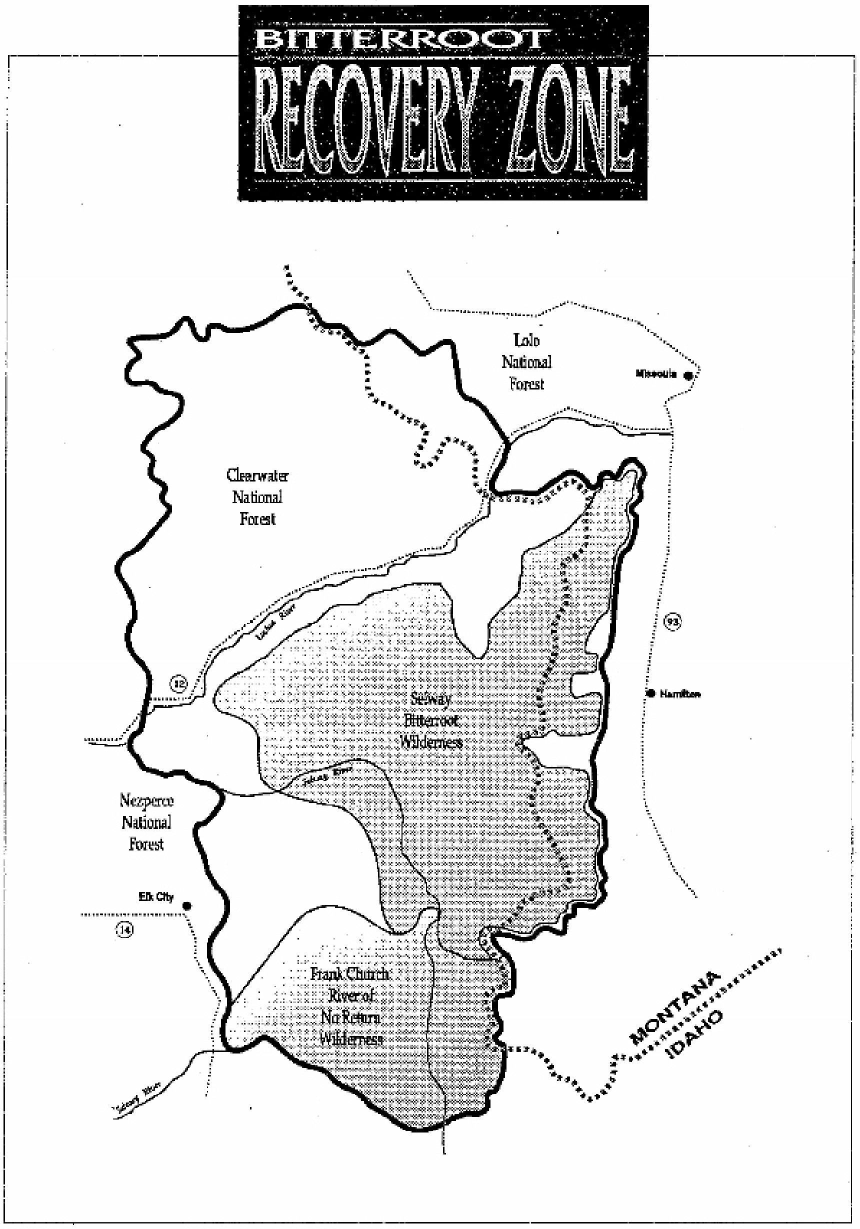


Figure 12.

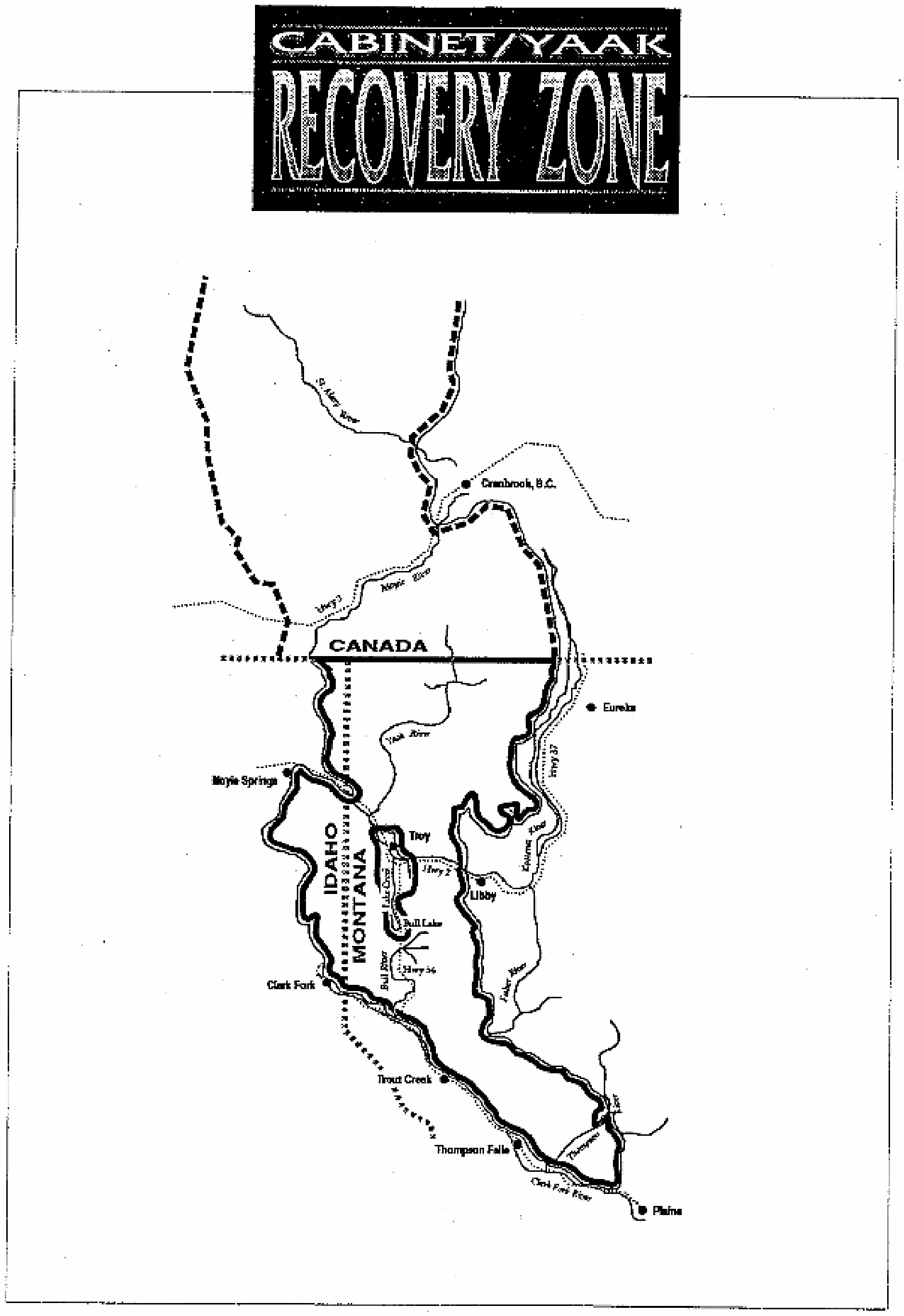

CABINET/YAAK
RECOVERY ZONE
Cranbrook, B.C.
CANADA
Eureka
Moyie Springs
IDAHO
MONTANA
Troy
Libby
Bull Lake
Clark Fork
Trout Creek
Thompson Falls
Plains

Figure 10.

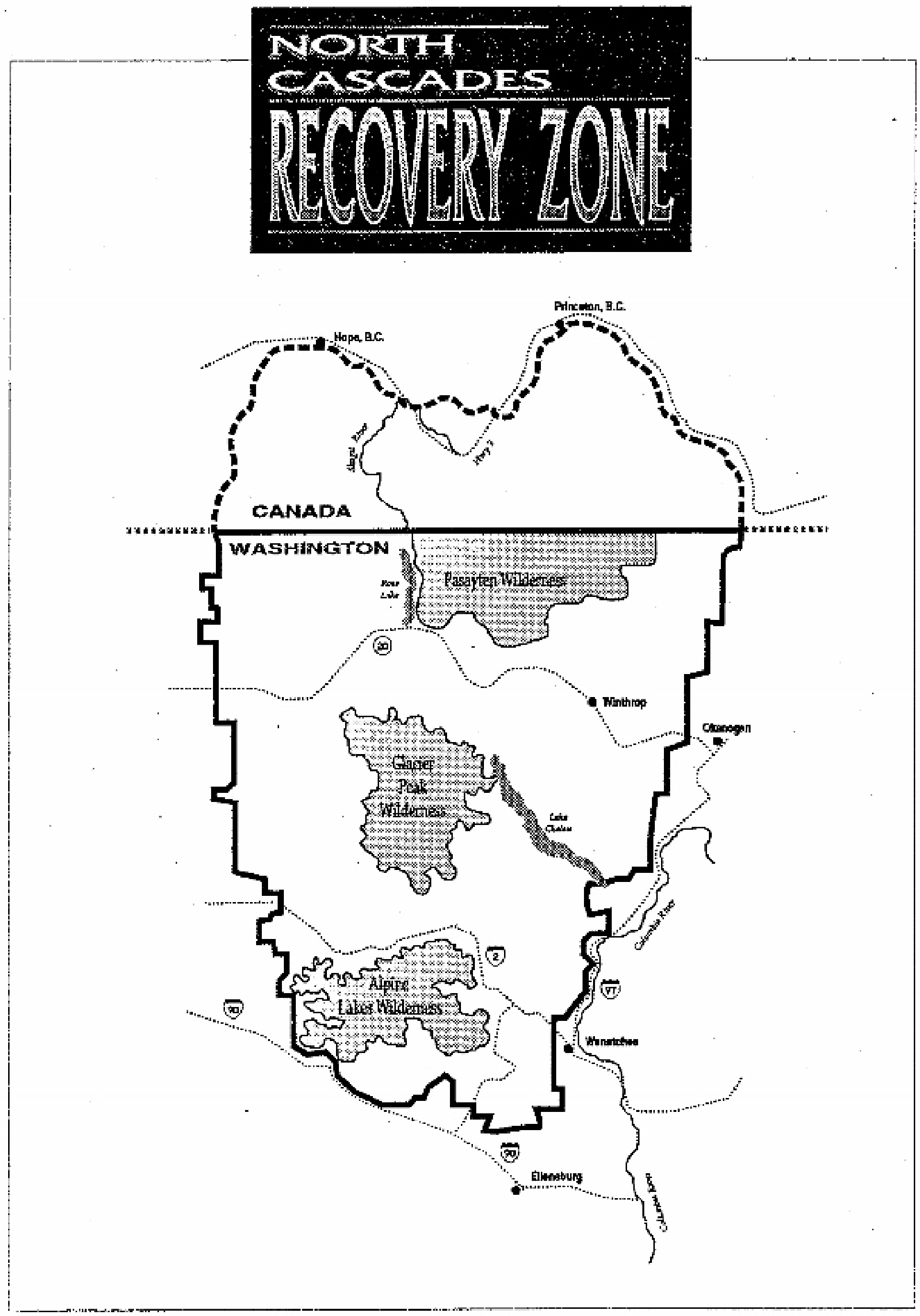

NORTH
CASCADES
RECOVERY ZONE
Princeton, B.C.
Hope, B.C.
CANADA
WASHINGTON
Pasayten Wilderness
Winthrop
Okanogen
Glacier
Peak
Wilderness
Alpine
Lakes Wilderness
Wenatchee
Ellensburg

Figure 13.

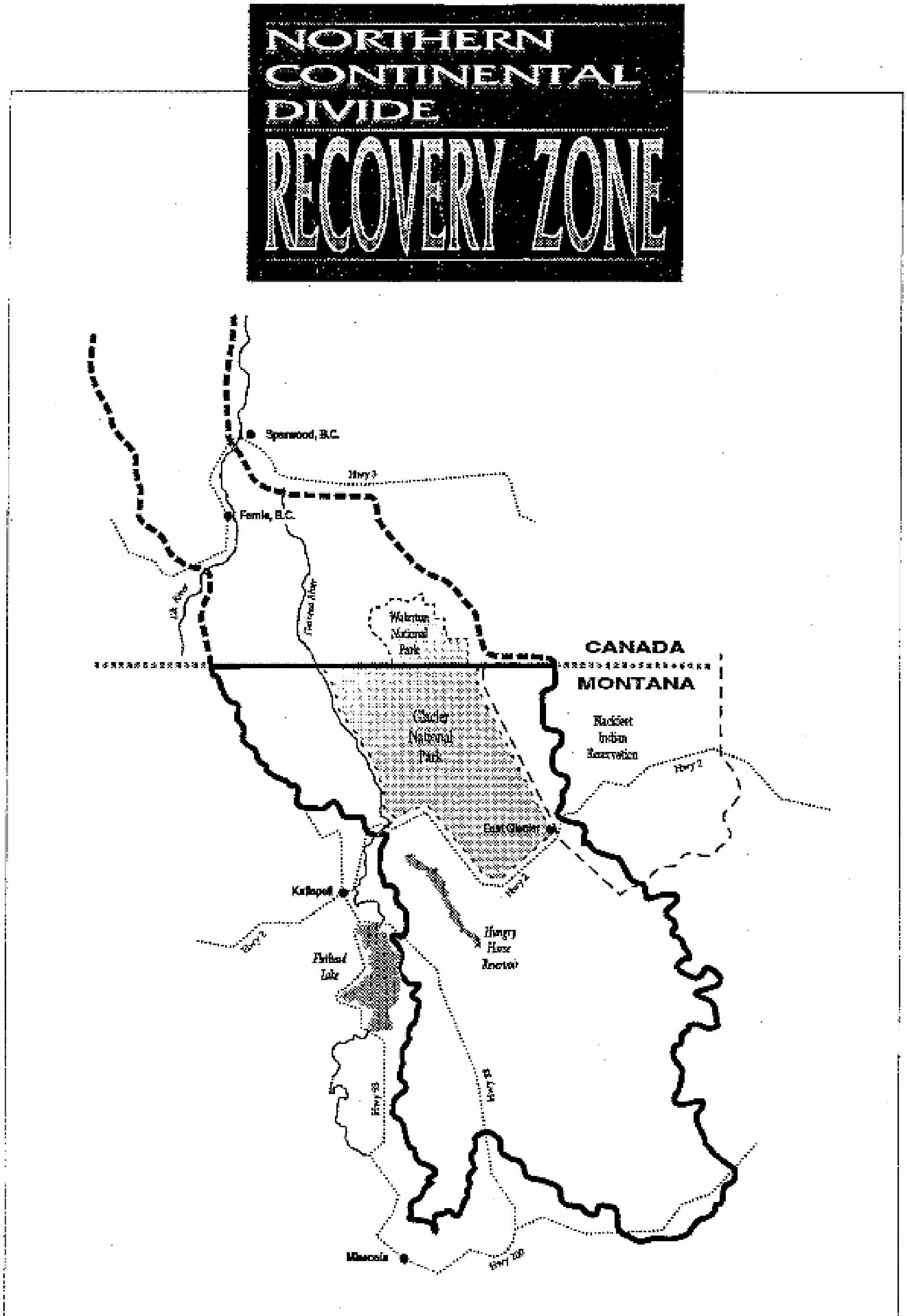

NORTHERN
CONTINENTAL
DIVIDE
RECOVERY ZONE
Sparwood, B.C.
Fernie, B.C.
CANADA
MONTANA
Glacier
National
Park
Blackfeet
Indian
Reservation
East Glacier
Kalispell
Flathead
Lake
Hungry
Horse
Reservoir
Missoula

Figure 7.

Figure 3. Northern Idaho Ground Squirrel

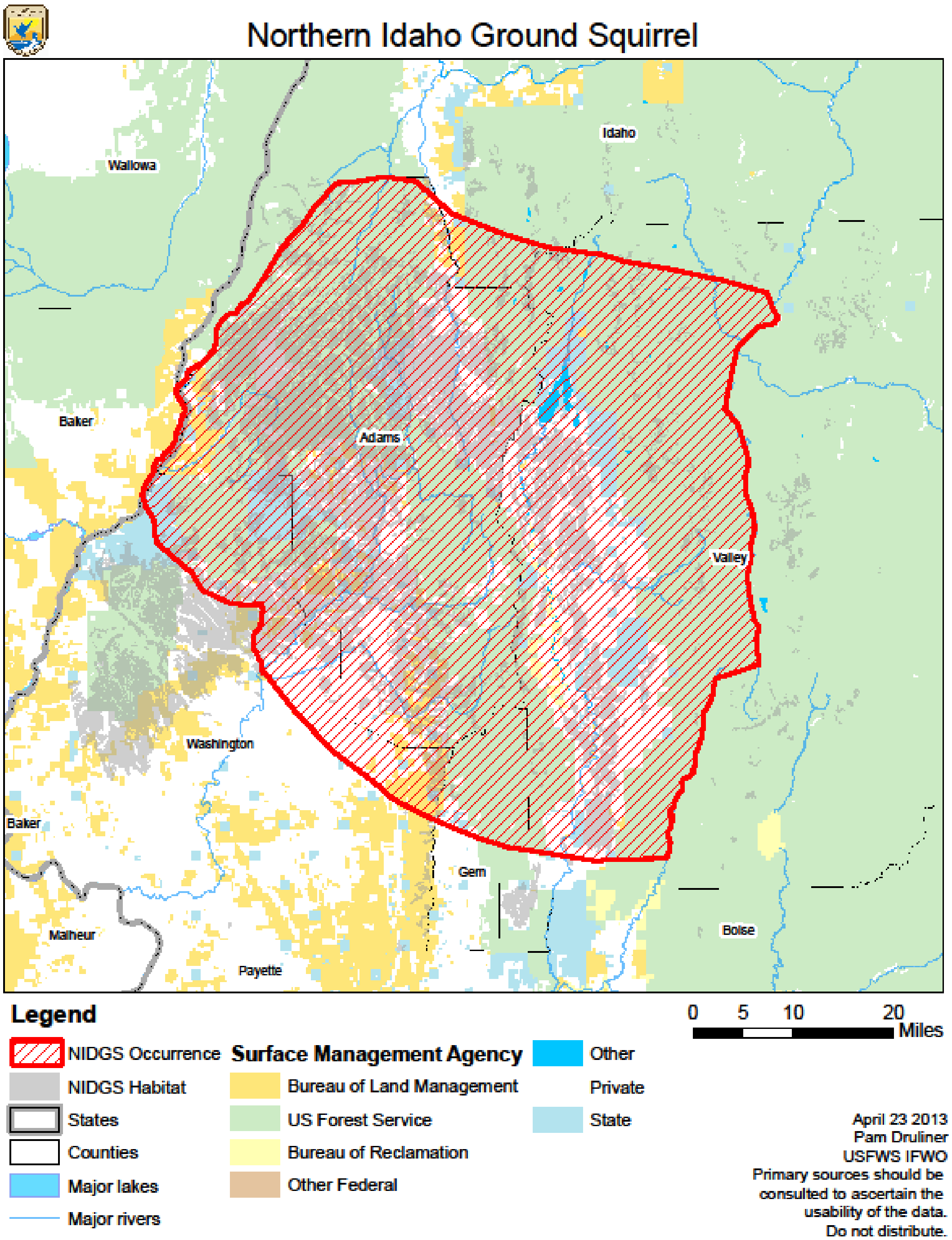
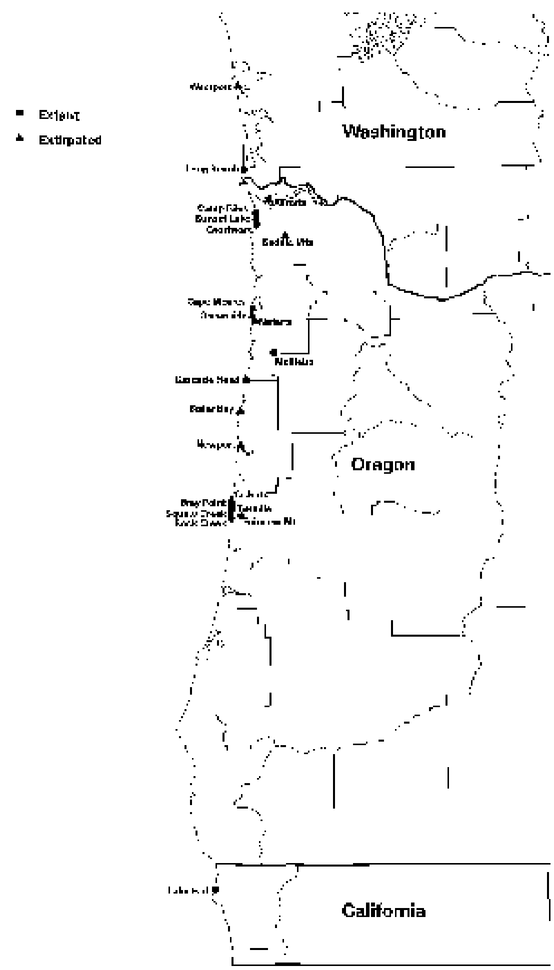


Figure 4. Distribution of the Oregon Silverspot Butterfly

Figure 4. Distribution of the Oregon silverspot butterfly.



9

Figure 6. Banbury Springs Lanx Occurrence

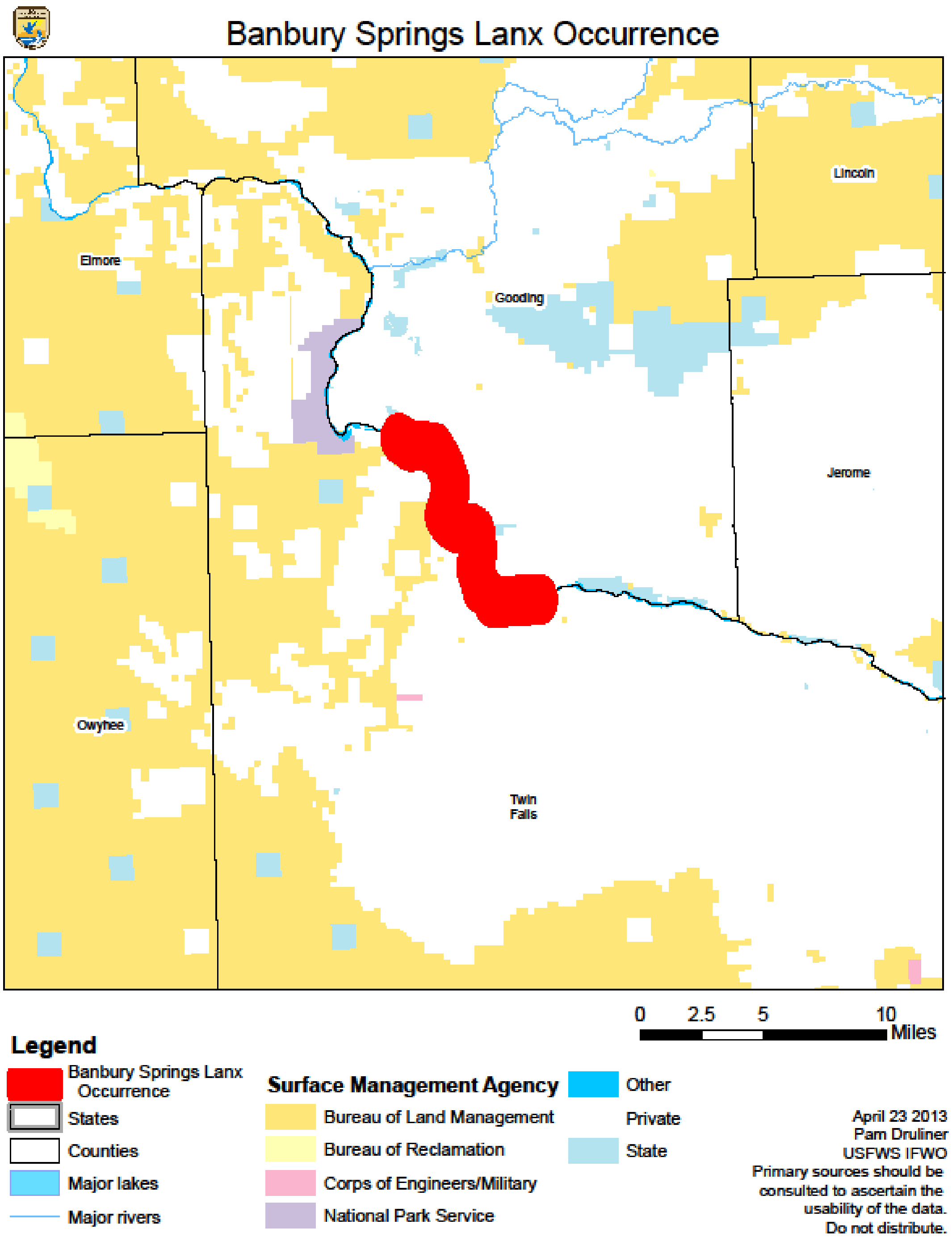


Figure 7. Bliss Rapids Snail Occurrence

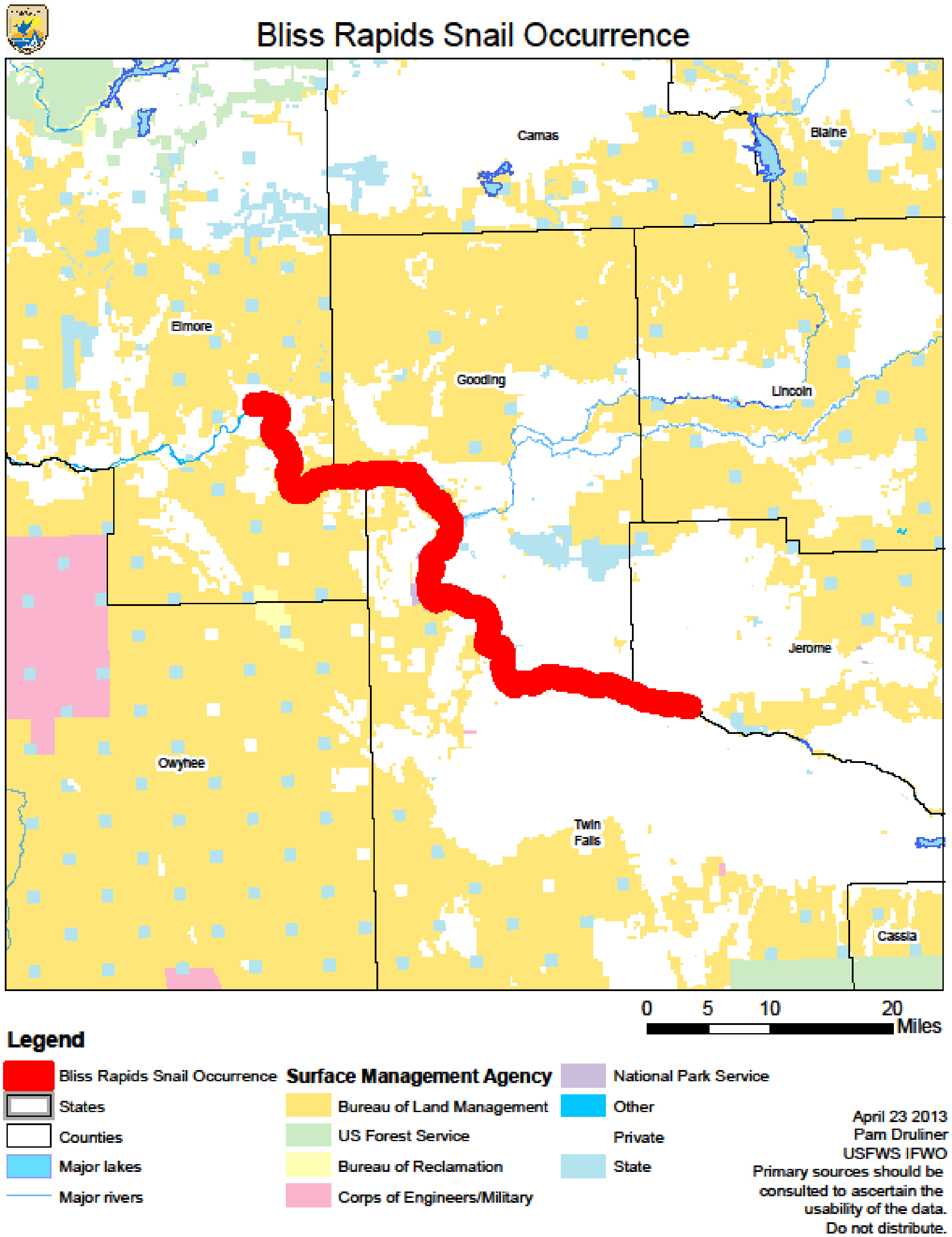


Figure 8. Snake River Physa Occurrence in Idaho

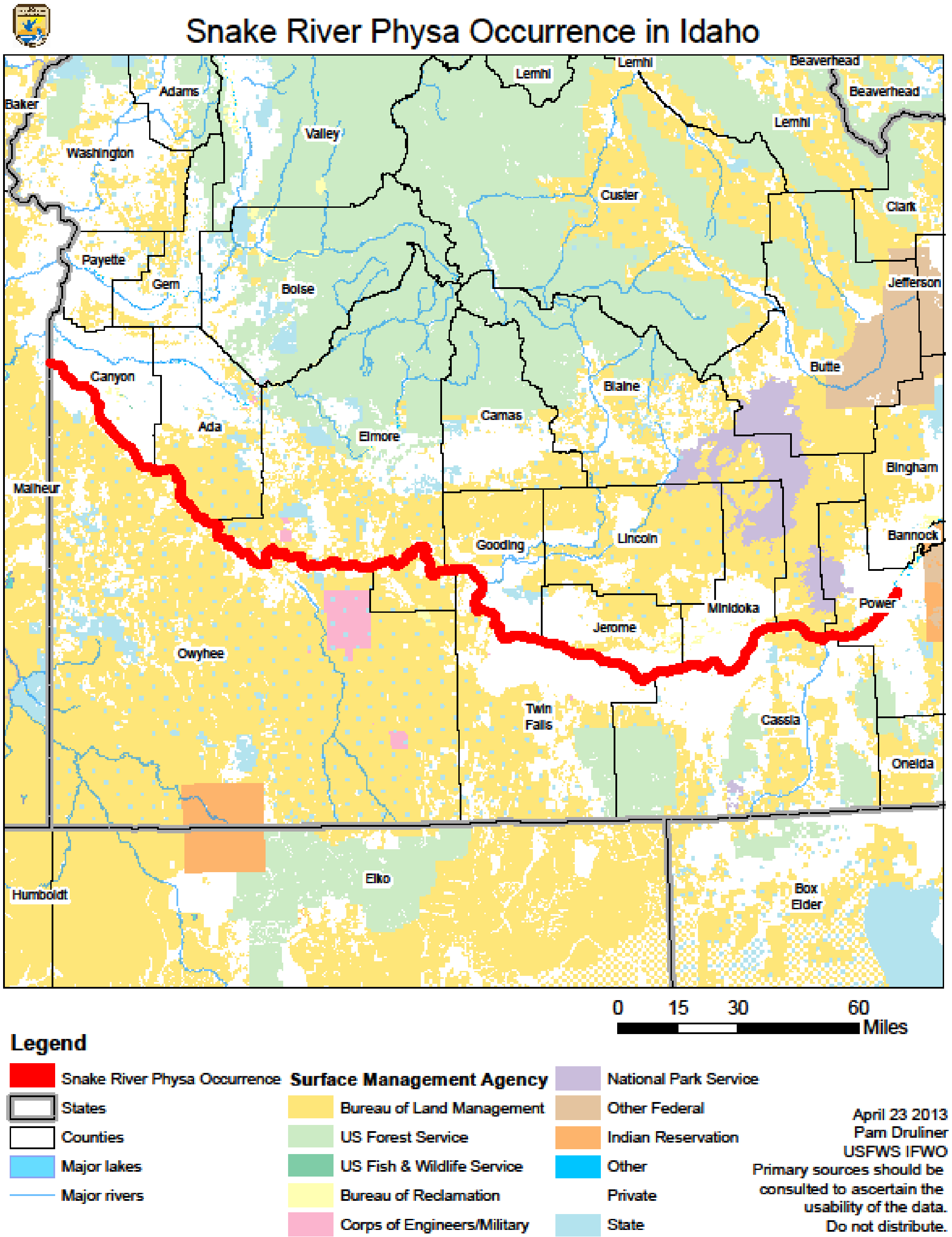


Figure 9. Bruneau Hot Spring Snail Occurrence

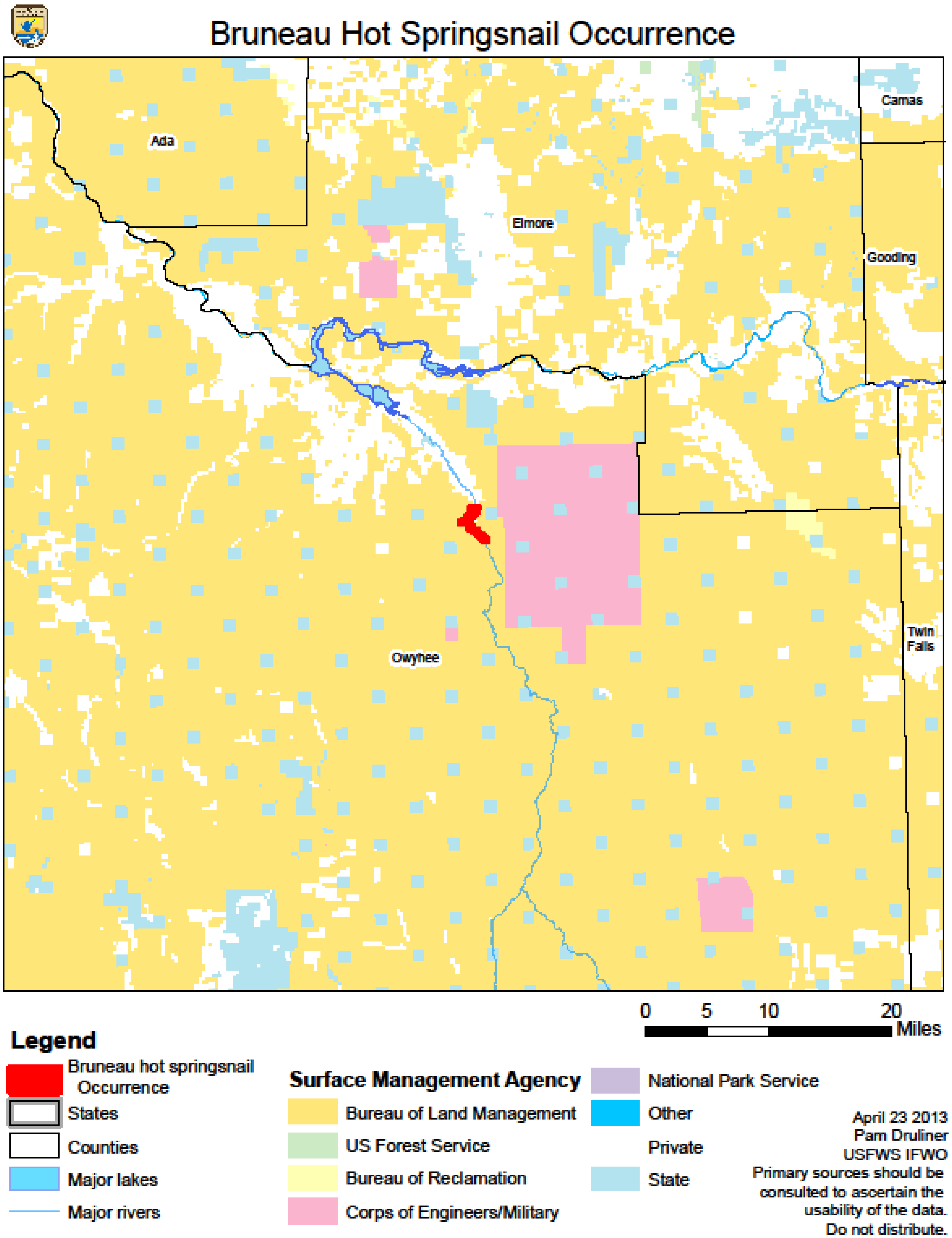


Figure 10. MacFarlane's Four-O'Clock Occurrence in Idaho

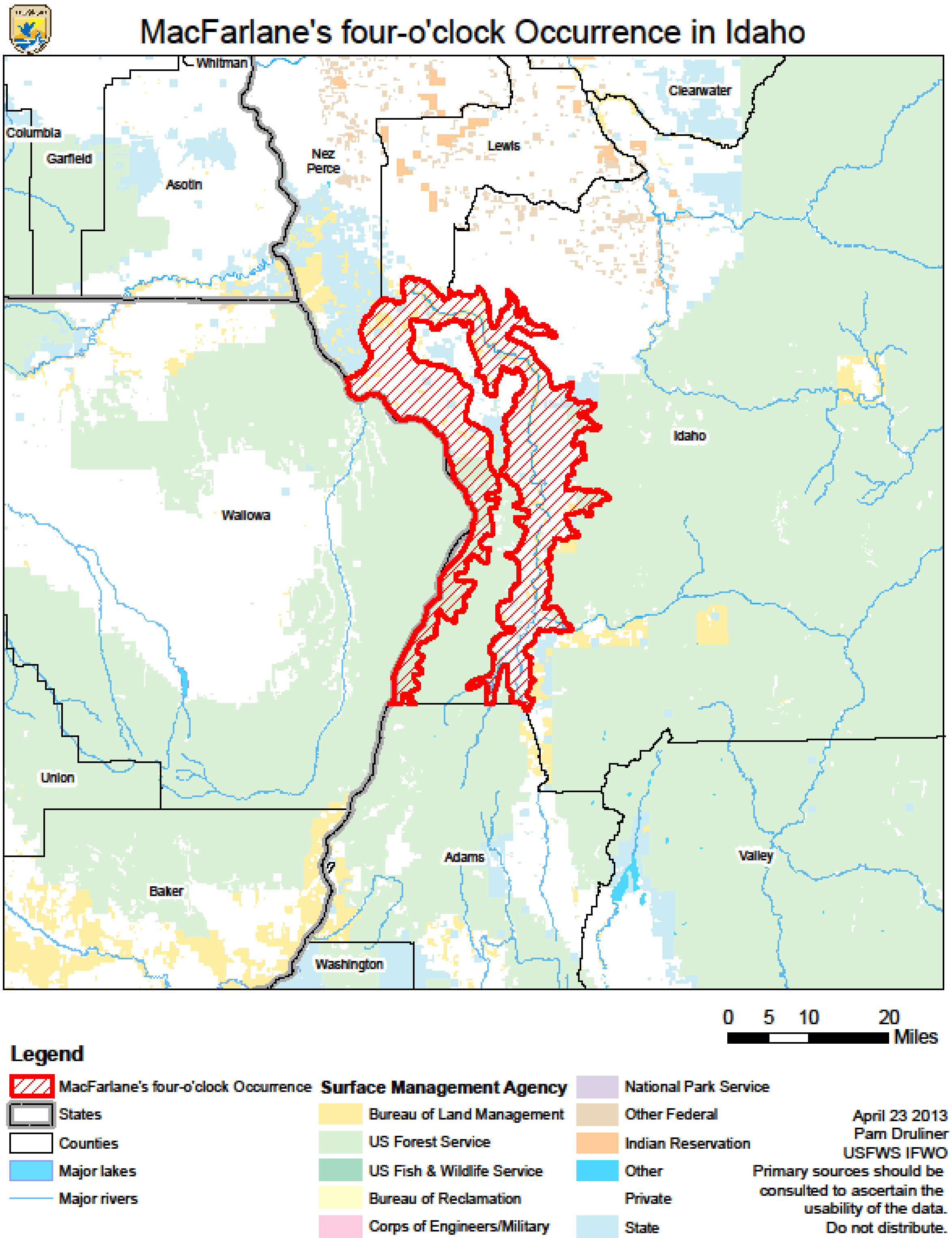


Figure 11. Spalding's Catchfly Occurrence in Idaho.

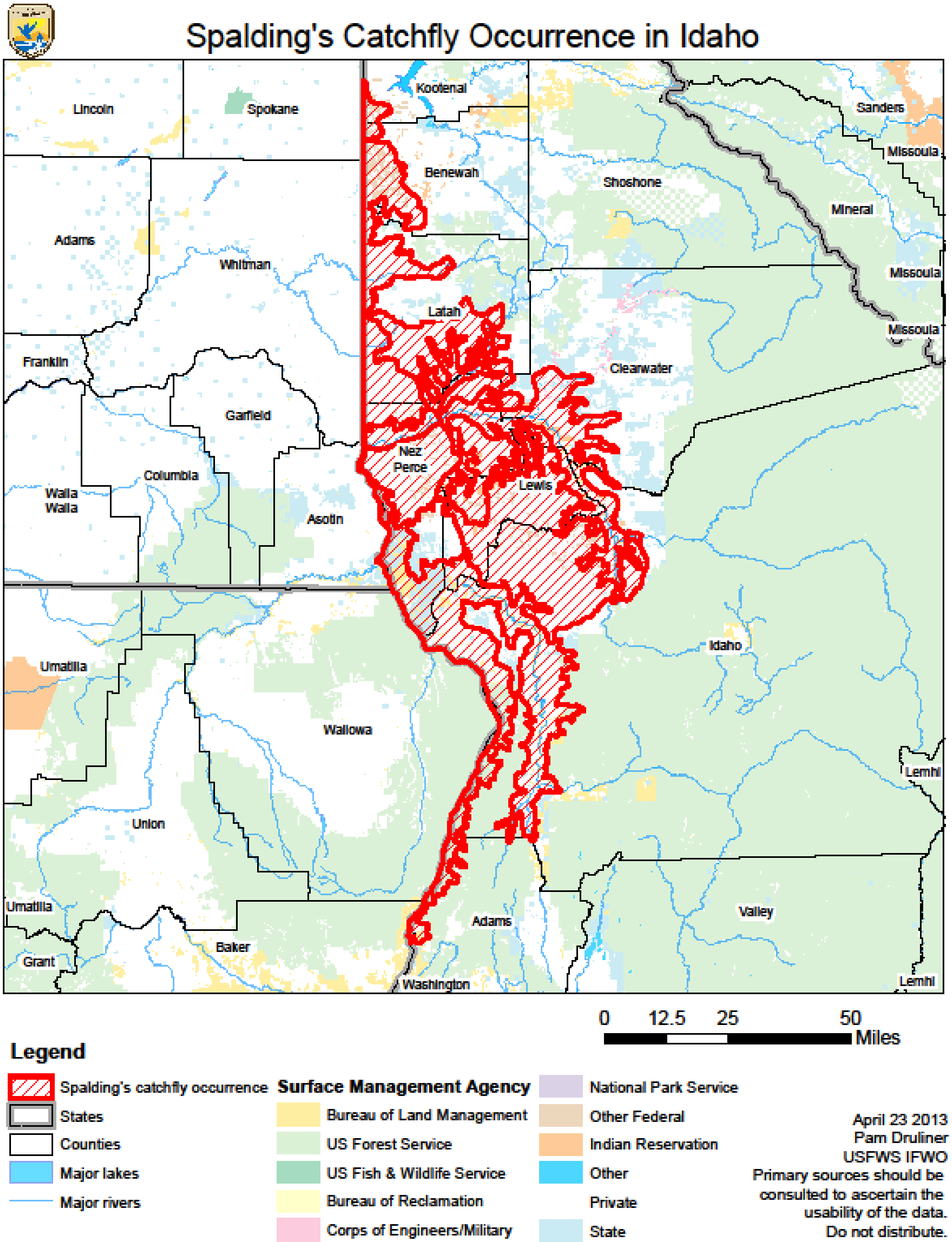


Figure 12. Ute Ladies'-Tresses

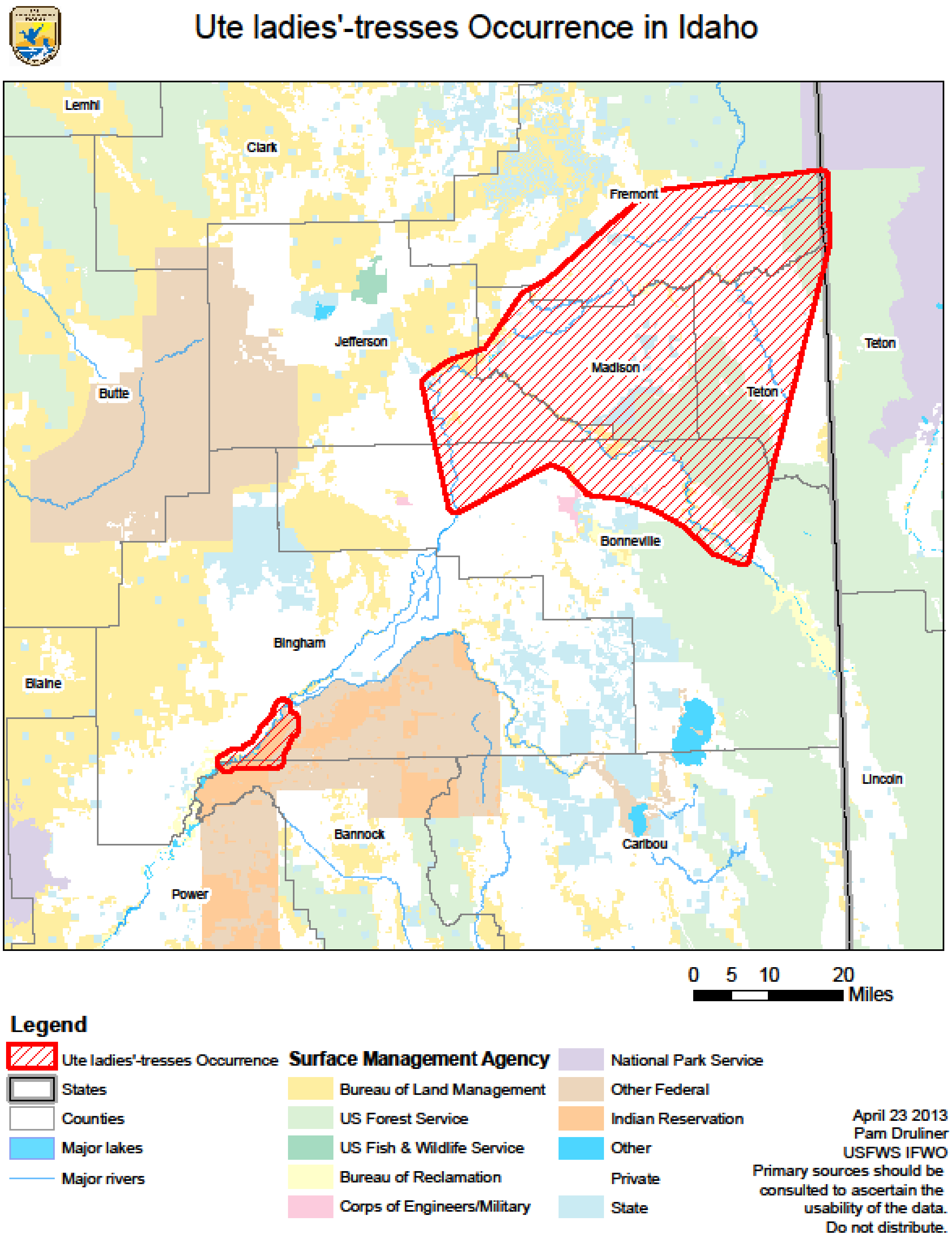
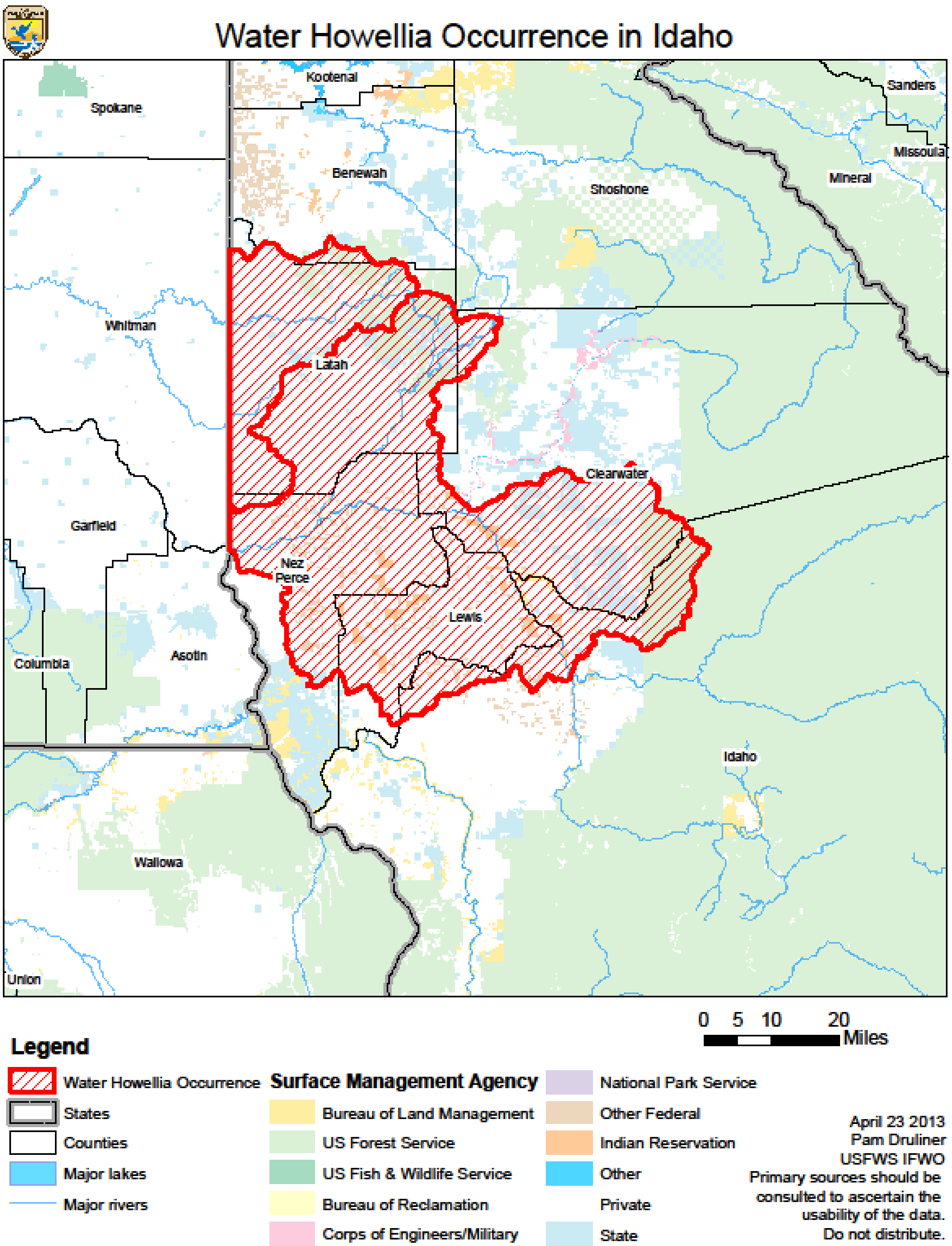


Figure 13. Water Howellia



Appendix E - Bull Trout Columbia River Interim Recovery Unit – Management Unit Maps and Table of Management Units, Core Areas, Local Populations

This appendix provides a list of all management units (n=23; generally major river basins) present within the Columbia River Interim Recovery Unit (IRU), and corresponding core areas and local populations. The accompanying management unit maps, which follow the table, depict spawning and rearing areas (SR) denoted in red, and foraging, migration and overwintering habitat (FMO) denoted in blue. Due to the scale of the maps it was generally not possible to label all stream names designated SR or FMO habitats. In combination, the table and maps should allow project sponsors to determine if their project occurs in bull trout occupied habitat (either SR or FMO habitat). If the table and accompanying maps do not provide the level of detail required to make a determination, please contact the appropriate FWS field office based on the field office jurisdiction maps and contact information provided in Appendix B of this document. A more refined tool to help determine if a project is occurring in bull trout occupied habitat and/or critical habitat is available by accessing the Service's bull trout critical habitat unit maps at the following link:

http://www.fws.gov/pacific/bulltrout/CH2010_Maps.cfm#CHMaps

The critical habitat unit maps generally mimic the management unit maps below (i.e., major river basins) but provide much more detail. For example, the Salmon River Basin critical habitat unit is subsequently broken into 66 different maps with an identifier (label) for every stream that is designated critical habitat. Although there are some exceptions, most bull trout occupied habitat (SR or FMO) is also designated critical habitat.

Please note in the table below (right-hand column) that Pop Type 1 refers to a Local Population; and Pop Type 2 refers to a Potential Local Population. A *local population* is defined as a group of bull trout that spawn within a particular stream or portion of a stream system. Multiple local populations may exist within a core area. A local population is considered to be the smallest group of fish that is known to represent an interacting reproductive unit. For most waters where specific information is lacking, a local population may be represented by a single headwater tributary or complex of headwater tributaries. Gene flow may occur between local populations (e.g., those within a core area), but is assumed to be infrequent compared with that among individuals within a local population. A *potential local population* is defined as a population that likely exists but has not been adequately documented, or that is likely to develop in the foreseeable future if habitat or connectivity is restored in that area or if bull trout re-colonize or are reintroduced in the area.

Data for this table was provided by Columbia River Fisheries Program Office (CRFPO, D. Hines) June 2013.

Columbia River Interim Recovery Unit

Management Unit	Core_Area	Local Pop Name	Pop Type
Deschutes River Basin	Lower Deschutes River	Canyon/Jack/Heising complex	1
Deschutes River Basin	Lower Deschutes River	Jefferson/Candle/Abbot complex	1
Deschutes River Basin	Lower Deschutes River	Shitike Creek	1
Deschutes River Basin	Lower Deschutes River	Warm Springs River	1
Deschutes River Basin	Lower Deschutes River	Whitewater River	1
Deschutes River Basin	Odell Lake	Odell Creek	2
Deschutes River Basin	Odell Lake	Trapper Creek	1
Hood River Basin	Hood River	Clear Branch	1
Hood River Basin	Hood River	Hood River	1
Lower Columbia River Basin	Klickitat River	West Fork Klickitat River	1
Lower Columbia River Basin	Lewis River	Cougar Creek	1
Lower Columbia River Basin	Lewis River	Pine Creek	1
Lower Columbia River Basin	Lewis River	Rush Creek	1
Lower Columbia River Basin	Lewis River	Swift By-pass Reach	2
Lower Columbia River Basin	Lewis River	Upper Lewis River	2
Willamette River Basin	Upper Willamette River	McKenzie River	1
Willamette River Basin	Upper Willamette River	Middle Fork Willamette River	1
Willamette River Basin	Upper Willamette River	South Fork McKenzie River	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Willamette River Basin	Upper Willamette River	Trail Bridge Res. complex	1
Clark Fork River Basin	Akokala Lake	Akokala Creek	1
Clark Fork River Basin	Arrow Lake	Camas Creek	1
Clark Fork River Basin	Big Salmon Lake	Big Salmon Creek	1
Clark Fork River Basin	Bitterroot River	Bass Creek	2
Clark Fork River Basin	Bitterroot River	Blodgett Creek	1
Clark Fork River Basin	Bitterroot River	Boulder Creek	1
Clark Fork River Basin	Bitterroot River	Burnt Fork Bitterroot River	1
Clark Fork River Basin	Bitterroot River	Chaffin Creek	2
Clark Fork River Basin	Bitterroot River	East Fork Bitterroot River	1
Clark Fork River Basin	Bitterroot River	Fred Burr Creek	1
Clark Fork River Basin	Bitterroot River	Gird Creek	2
Clark Fork River Basin	Bitterroot River	Laird Creek	2
Clark Fork River Basin	Bitterroot River	Lolo Creek	1
Clark Fork River Basin	Bitterroot River	Lost Horse Creek	1
Clark Fork River Basin	Bitterroot River	Mill Creek	2
Clark Fork River Basin	Bitterroot River	Nez Perce Fork	1
Clark Fork River Basin	Bitterroot River	O'Brien Creek	1
Clark Fork River Basin	Bitterroot River	Roaring Lion Creek	2
Clark Fork River Basin	Bitterroot River	Rye Creek	2
Clark Fork River	Bitterroot River	Sawtooth Creek	2

Management Unit	Core_Area	Local Pop Name	Pop Type
Basin			
Clark Fork River Basin	Bitterroot River	Skalkaho Creek	1
Clark Fork River Basin	Bitterroot River	Sleeping Child Creek	1
Clark Fork River Basin	Bitterroot River	Sweathouse Creek	2
Clark Fork River Basin	Bitterroot River	Tin Cup Creek	1
Clark Fork River Basin	Bitterroot River	Tolan Creek	1
Clark Fork River Basin	Bitterroot River	Trapper Creek	2
Clark Fork River Basin	Bitterroot River	Warm Springs Creek	1
Clark Fork River Basin	Bitterroot River	West Fork Bitterroot River	1
Clark Fork River Basin	Bitterroot River	Willow Creek	2
Clark Fork River Basin	Blackfoot River	Alice Creek	2
Clark Fork River Basin	Blackfoot River	Arrastra Creek	2
Clark Fork River Basin	Blackfoot River	Bear Creek	2
Clark Fork River Basin	Blackfoot River	Belmont Creek	1
Clark Fork River Basin	Blackfoot River	Blackfoot River	1
Clark Fork River Basin	Blackfoot River	Chamberlain Creek	2
Clark Fork River Basin	Blackfoot River	Copper Creek	1
Clark Fork River Basin	Blackfoot River	Cottonwood Creek	1
Clark Fork River Basin	Blackfoot River	Dry Creek	2
Clark Fork River Basin	Blackfoot River	East Twin Creek	2
Clark Fork River Basin	Blackfoot River	Gold Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Clark Fork River Basin	Blackfoot River	Johnson Gulch	2
Clark Fork River Basin	Blackfoot River	Keep Cool Creek	2
Clark Fork River Basin	Blackfoot River	Landers Fork	1
Clark Fork River Basin	Blackfoot River	Monture Creek	1
Clark Fork River Basin	Blackfoot River	North Fork Blackfoot River	1
Clark Fork River Basin	Blackfoot River	Poorman Creek	1
Clark Fork River Basin	Blackfoot River	Rock Creek	2
Clark Fork River Basin	Blackfoot River	Salmon Creek	2
Clark Fork River Basin	Blackfoot River	Sauerkraut Creek	2
Clark Fork River Basin	Blackfoot River	West Twin Creek	2
Clark Fork River Basin	Bowman Lake	Bowman Creek	1
Clark Fork River Basin	Clark Fork River (Section 1)	Boulder Creek	1
Clark Fork River Basin	Clark Fork River (Section 1)	Flint Creek	1
Clark Fork River Basin	Clark Fork River (Section 1)	Harvey Creek	1
Clark Fork River Basin	Clark Fork River (Section 1)	Racetrack Creek	1
Clark Fork River Basin	Clark Fork River (Section 1)	Warm Springs Creek	1
Clark Fork River Basin	Clark Fork River (Section 2)	Albert Creek	1
Clark Fork River Basin	Clark Fork River (Section 2)	Cedar Creek	1
Clark Fork River Basin	Clark Fork River (Section 2)	Dry Creek	2
Clark Fork River Basin	Clark Fork River (Section 2)	Fish Creek	1 & 2
Clark Fork River	Clark Fork River (Section 2)	Grant Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Basin			
Clark Fork River Basin	Clark Fork River (Section 2)	Ninemile Creek	2
Clark Fork River Basin	Clark Fork River (Section 2)	Petty Creek	1
Clark Fork River Basin	Clark Fork River (Section 2)	Rattlesnake Creek	1
Clark Fork River Basin	Clark Fork River (Section 2)	St. Regis River	1 & 2
Clark Fork River Basin	Clark Fork River (Section 2)	Trout Creek	1
Clark Fork River Basin	Clearwater River & Lakes	Clearwater River	1 & 2
Clark Fork River Basin	Clearwater River & Lakes	Deer Creek	1
Clark Fork River Basin	Clearwater River & Lakes	Morrell Creek	1 & 2
Clark Fork River Basin	Clearwater River & Lakes	Placid Creek	1 & 2
Clark Fork River Basin	Clearwater River & Lakes	West Fork Clearwater River	1
Clark Fork River Basin	Cyclone Lake	Cyclone Creek	1
Clark Fork River Basin	Doctor Lake	Doctor Creek	1
Clark Fork River Basin	Flathead Lake	Bear Creek	1 & 2
Clark Fork River Basin	Flathead Lake	Big Creek	1 & 2
Clark Fork River Basin	Flathead Lake	Bowl Creek	1
Clark Fork River Basin	Flathead Lake	Clack Creek	1
Clark Fork River Basin	Flathead Lake	Coal Creek	1 & 2
Clark Fork River Basin	Flathead Lake	Dirtyface Creek	2
Clark Fork River Basin	Flathead Lake	Granite Creek	1 & 2
Clark Fork River Basin	Flathead Lake	Hay Creek	2

Management Unit	Core_Area	Local Pop Name	Pop Type
Clark Fork River Basin	Flathead Lake	Kishenehn Creek	1
Clark Fork River Basin	Flathead Lake	Long Creek	1 & 2
Clark Fork River Basin	Flathead Lake	Moose Creek	2
Clark Fork River Basin	Flathead Lake	Morrison Creek	1
Clark Fork River Basin	Flathead Lake	Nyack Creek	1
Clark Fork River Basin	Flathead Lake	Ole Creek	1
Clark Fork River Basin	Flathead Lake	Park Creek	1
Clark Fork River Basin	Flathead Lake	Pinchot Creek	2
Clark Fork River Basin	Flathead Lake	Red Meadow Creek	1
Clark Fork River Basin	Flathead Lake	Sage (B.C.) *	1
Clark Fork River Basin	Flathead Lake	Schafer Creek	1
Clark Fork River Basin	Flathead Lake	Starvation (B.C.) *	1
Clark Fork River Basin	Flathead Lake	Strawberry Creek	1 & 2
Clark Fork River Basin	Flathead Lake	Trail Creek	1
Clark Fork River Basin	Flathead Lake	Whale Creek	1
Clark Fork River Basin	Frozen Lake	Frozen Creek	1
Clark Fork River Basin	Harrison Lake	Harrison Creek	1
Clark Fork River Basin	Holland Lake	Holland Creek	1
Clark Fork River Basin	Hungry Horse Reservoir	Bunker Creek	1
Clark Fork River Basin	Hungry Horse Reservoir	Danaher Creek	1
Clark Fork River	Hungry Horse Reservoir	Doris Creek	2

Management Unit	Core_Area	Local Pop Name	Pop Type
Basin			
Clark Fork River Basin	Hungry Horse Reservoir	Felix Creek	2
Clark Fork River Basin	Hungry Horse Reservoir	Gordon Creek	1
Clark Fork River Basin	Hungry Horse Reservoir	Little Salmon Creek	1
Clark Fork River Basin	Hungry Horse Reservoir	Lost Johnny Creek	2
Clark Fork River Basin	Hungry Horse Reservoir	Lower Twin Creek	2
Clark Fork River Basin	Hungry Horse Reservoir	Spotted Bear River	1
Clark Fork River Basin	Hungry Horse Reservoir	Sullivan Creek	1 & 2
Clark Fork River Basin	Hungry Horse Reservoir	Taylor Creek	2
Clark Fork River Basin	Hungry Horse Reservoir	Tin Creek	2
Clark Fork River Basin	Hungry Horse Reservoir	Twin Creek	2
Clark Fork River Basin	Hungry Horse Reservoir	Wheeler Creek	1
Clark Fork River Basin	Hungry Horse Reservoir	White River	1
Clark Fork River Basin	Hungry Horse Reservoir	Wounded Buck Creek	1
Clark Fork River Basin	Hungry Horse Reservoir	Youngs Creek	1 & 2
Clark Fork River Basin	Isabel Lakes	Park Creek	1
Clark Fork River Basin	Kintla Lake	Kintla Creek	1
Clark Fork River Basin	Lake Pend Oreille	Char Creek	1
Clark Fork River Basin	Lake Pend Oreille	East Fork Creek	1
Clark Fork River Basin	Lake Pend Oreille	Gold Creek	1
Clark Fork River Basin	Lake Pend Oreille	Granite Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Clark Fork River Basin	Lake Pend Oreille	Grouse Creek	1
Clark Fork River Basin	Lake Pend Oreille	Johnson Creek	1
Clark Fork River Basin	Lake Pend Oreille	Lightning Creek	1
Clark Fork River Basin	Lake Pend Oreille	Middle Fork East River	1
Clark Fork River Basin	Lake Pend Oreille	Morris Creek	1
Clark Fork River Basin	Lake Pend Oreille	North Fork East River	2
Clark Fork River Basin	Lake Pend Oreille	North Gold Creek	1
Clark Fork River Basin	Lake Pend Oreille	Pack River	1
Clark Fork River Basin	Lake Pend Oreille	Porcupine Creek	1
Clark Fork River Basin	Lake Pend Oreille	Rattle Creek	1
Clark Fork River Basin	Lake Pend Oreille	Savage Creek	1
Clark Fork River Basin	Lake Pend Oreille	Strong Creek	1
Clark Fork River Basin	Lake Pend Oreille	Trestle Creek	1
Clark Fork River Basin	Lake Pend Oreille	Twin Creek	2
Clark Fork River Basin	Lake Pend Oreille	Uleda Creek	1
Clark Fork River Basin	Lake Pend Oreille	Wellington Creek	1
Clark Fork River Basin	Lincoln Lake	Lincoln Creek	1
Clark Fork River Basin	Lindbergh Lake	Swan River	1
Clark Fork River Basin	Logging Lake	Logging Creek	1
Clark Fork River Basin	Lower Clark Fork River Complex	Bull River	1
Clark Fork River	Lower Clark Fork River	Dry Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Basin	Complex		
Clark Fork River Basin	Lower Clark Fork River Complex	Fishtrap Creek	1
Clark Fork River Basin	Lower Clark Fork River Complex	Graves Creek	1
Clark Fork River Basin	Lower Clark Fork River Complex	Jocko River	1
Clark Fork River Basin	Lower Clark Fork River Complex	Middle Fork Jocko River	1
Clark Fork River Basin	Lower Clark Fork River Complex	Mission Creek	1
Clark Fork River Basin	Lower Clark Fork River Complex	North Fork Jocko River	1
Clark Fork River Basin	Lower Clark Fork River Complex	Post Creek	1
Clark Fork River Basin	Lower Clark Fork River Complex	Prospect Creek	1
Clark Fork River Basin	Lower Clark Fork River Complex	Rock Creek	1
Clark Fork River Basin	Lower Clark Fork River Complex	South Fork Jocko River	1
Clark Fork River Basin	Lower Clark Fork River Complex	Swamp Creek	1
Clark Fork River Basin	Lower Clark Fork River Complex	Vermilion River	1
Clark Fork River Basin	Lower Clark Fork River Complex	West Fork Thompson River	1 & 2
Clark Fork River Basin	Lower Quartz Lake	Quartz Creek	1
Clark Fork River Basin	Pend Oreille River	Calispell Creek (complex)	2
Clark Fork River Basin	Pend Oreille River	Cedar Creek	2
Clark Fork River Basin	Pend Oreille River	Indian Creek	2
Clark Fork River Basin	Pend Oreille River	Le Clerc Creek (complex)	2
Clark Fork River Basin	Pend Oreille River	Mill Creek	2
Clark Fork River Basin	Pend Oreille River	Ruby Creek	2

Management Unit	Core_Area	Local Pop Name	Pop Type
Clark Fork River Basin	Pend Oreille River	Sullivan Creek	2
Clark Fork River Basin	Pend Oreille River	Tacoma Creek	2
Clark Fork River Basin	Priest Lakes	Bench Creek	2
Clark Fork River Basin	Priest Lakes	Caribou Creek	2
Clark Fork River Basin	Priest Lakes	Cedar Creek	1
Clark Fork River Basin	Priest Lakes	Gold Creek	1
Clark Fork River Basin	Priest Lakes	Granite Creek	2
Clark Fork River Basin	Priest Lakes	Hughes Fork	1
Clark Fork River Basin	Priest Lakes	Indian Creek	1
Clark Fork River Basin	Priest Lakes	Jackson Creek	2
Clark Fork River Basin	Priest Lakes	Lime Creek	2
Clark Fork River Basin	Priest Lakes	Lion Creek	2
Clark Fork River Basin	Priest Lakes	North Fork Granite Creek	1
Clark Fork River Basin	Priest Lakes	Rock Creek	2
Clark Fork River Basin	Priest Lakes	South Fork Granite Creek	2
Clark Fork River Basin	Priest Lakes	Trapper Creek	2
Clark Fork River Basin	Priest Lakes	Two Mouth Creek	2
Clark Fork River Basin	Priest Lakes	Upper Priest River	1
Clark Fork River Basin	Quartz Lakes	Quartz Creek	1
Clark Fork River Basin	Rock Creek	Brewster Creek	1
Clark Fork River	Rock Creek	Butte Cabin Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Basin			
Clark Fork River Basin	Rock Creek	Cinnabar Creek	2
Clark Fork River Basin	Rock Creek	Copper Creek	2
Clark Fork River Basin	Rock Creek	Cougar Creek	1
Clark Fork River Basin	Rock Creek	Eagle Creek	2
Clark Fork River Basin	Rock Creek	East Fork Rock Creek	1
Clark Fork River Basin	Rock Creek	Gilbert Creek	1
Clark Fork River Basin	Rock Creek	Hogback Creek	1
Clark Fork River Basin	Rock Creek	Hutsinpilar Creek	2
Clark Fork River Basin	Rock Creek	Middle Fork Rock Creek	1
Clark Fork River Basin	Rock Creek	Ranch Creek	1
Clark Fork River Basin	Rock Creek	Rock Creek	1
Clark Fork River Basin	Rock Creek	Ross Fork Rock Creek	1
Clark Fork River Basin	Rock Creek	Sawmilll Creek	2
Clark Fork River Basin	Rock Creek	Stony Creek	1
Clark Fork River Basin	Rock Creek	Upper Willow Creek	1
Clark Fork River Basin	Rock Creek	Wahlquist Creek	1
Clark Fork River Basin	Rock Creek	Welcome Creek	1
Clark Fork River Basin	Rock Creek	West Fork Rock Creek	1
Clark Fork River Basin	Rock Creek	Wyman Gulch	1
Clark Fork River Basin	Swan Lake	Buck Creek	2

Management Unit	Core_Area	Local Pop Name	Pop Type
Clark Fork River Basin	Swan Lake	Cedar Creek	2
Clark Fork River Basin	Swan Lake	Cold Creek	1
Clark Fork River Basin	Swan Lake	Cooney Creek	2
Clark Fork River Basin	Swan Lake	Dog Creek	2
Clark Fork River Basin	Swan Lake	Elk Creek	1
Clark Fork River Basin	Swan Lake	Glacier Creek	2
Clark Fork River Basin	Swan Lake	Goat Creek	1 & 2
Clark Fork River Basin	Swan Lake	Holland Creek (lower)	2
Clark Fork River Basin	Swan Lake	Jim Creek	1
Clark Fork River Basin	Swan Lake	Kraft Creek	2
Clark Fork River Basin	Swan Lake	Lion Creek	1
Clark Fork River Basin	Swan Lake	Lost Creek	1
Clark Fork River Basin	Swan Lake	Piper Creek	1
Clark Fork River Basin	Swan Lake	Soup Creek	1
Clark Fork River Basin	Swan Lake	Woodward Creek	1
Clark Fork River Basin	Trout Lake	Camas Creek	1
Clark Fork River Basin	Upper Kintla Lake	Kintla Creek	1
Clark Fork River Basin	Upper Stillwater Lake	Stillwater River	1
Clark Fork River Basin	Upper Whitefish Lake	East Fork Swift Creek	1
Clark Fork River Basin	West Fork Bitterroot River	Blue Joint Creek	1
Clark Fork River	West Fork Bitterroot River	Chicken Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Basin			
Clark Fork River Basin	West Fork Bitterroot River	Deer Creek	1
Clark Fork River Basin	West Fork Bitterroot River	Hughes Creek	1
Clark Fork River Basin	West Fork Bitterroot River	Little Boulder Creek	1
Clark Fork River Basin	West Fork Bitterroot River	Overwhich Creek	1
Clark Fork River Basin	West Fork Bitterroot River	Slate Creek	1
Clark Fork River Basin	West Fork Bitterroot River	West Fork Bitterroot River	1
Clark Fork River Basin	Whitefish Lake	Swift Creek	1
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Bean Creek (complex)	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Boulder Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	California Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Cougar Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Downey Creek (complex)	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Entente Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Fly Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Gold Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Heller Creek	1
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Independence Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Marble Creek (complex)	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Medicine Creek	1
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	North Fork Coeur d'Alene River	2

Management Unit	Core_Area	Local Pop Name	Pop Type
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Quartz Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Red Ives Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Sherlock Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Shoshone Creek (complex)	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Simmons Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	St. Joe River	1
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Steamboat Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Tepee Creek (complex)	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Timber Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	West Fork Eagle Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Wisdom Creek	1
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Yankee Bar Creek	2
Coeur d'Alene Lake Basin	Coeur d'Alene Lake	Yellow Dog Creek	2
Kootenai River Basin	Bull Lake	Camp Creek	2
Kootenai River Basin	Bull Lake	Keeler Creek	1
Kootenai River Basin	Kootenai River	Boulder Creek	1
Kootenai River Basin	Kootenai River	Callahan Creek	1
Kootenai River Basin	Kootenai River	Flower Creek	2
Kootenai River Basin	Kootenai River	Libby Creek	1 & 2
Kootenai River Basin	Kootenai River	Long Canyon Creek	1
Kootenai River Basin	Kootenai River	O'Brien Creek	1
Kootenai River Basin	Kootenai River	Partmenter Creek	2
Kootenai River Basin	Kootenai River	Pipe Creek	1
Kootenai River Basin	Kootenai River	Quartz Creek	1
Kootenai River Basin	Kootenai River	West Fisher Creek	1
Kootenai River Basin	Kootenai River	Yaak River	2
Kootenai River Basin	Lake Koocanusa	Grave Creek	1 & 2

Management Unit	Core_Area	Local Pop Name	Pop Type
Kootenai River Basin	Lake Koocanusa	Sinclair Creek	2
Kootenai River Basin	Lake Koocanusa	Therriaulte Creek	2
Kootenai River Basin	Lake Koocanusa	Wigwam River	1
Kootenai River Basin	Lake Koocanusa	Young Creek	2
Kootenai River Basin	Sophie Lake	Phillips Creek	1
Clearwater River Basin	Fish Lake (Lochsa River)	Fish Lake Creek	1
Clearwater River Basin	Fish Lake (North Fork Clearwater River)	Fish Creek	1
Clearwater River Basin	Lochsa River	Boulder Creek	2
Clearwater River Basin	Lochsa River	Brushy Fork complex	1
Clearwater River Basin	Lochsa River	Canyon Creek	2
Clearwater River Basin	Lochsa River	Colt Killed complex	1
Clearwater River Basin	Lochsa River	Coolwater Creek	?
Clearwater River Basin	Lochsa River	Crooked Fork complex	1
Clearwater River Basin	Lochsa River	Deadman Creek	?
Clearwater River Basin	Lochsa River	Fire Creek	?
Clearwater River Basin	Lochsa River	Fishing (Squaw) Creek	1
Clearwater River Basin	Lochsa River	Hungery-Fish Creek	2
Clearwater River Basin	Lochsa River	Indian Grave Creek	2
Clearwater River Basin	Lochsa River	Lake Creek	1
Clearwater River Basin	Lochsa River	Legendary Bear (Papoose) Creek	1
Clearwater River Basin	Lochsa River	Lower Warm Springs Creek	1
Clearwater River Basin	Lochsa River	Old Man Creek	2
Clearwater River Basin	Lochsa River	Pete King Creek	2

Management Unit	Core_Area	Local Pop Name	Pop Type
Clearwater River Basin	Lochsa River	Post Office Creek	2
Clearwater River Basin	Lochsa River	Split Creek	2
Clearwater River Basin	Lochsa River	Walton Creek	1
Clearwater River Basin	Lochsa River	Weir Creek	2
Clearwater River Basin	Lower Middle Fork Clearwater River	Clear Creek	2
Clearwater River Basin	Lower Middle Fork Clearwater River	Lolo Creek	1
Clearwater River Basin	North Fork Clearwater River	Beaver Creek	2
Clearwater River Basin	North Fork Clearwater River	Cayuse Creek	1
Clearwater River Basin	North Fork Clearwater River	Cold Springs Creek	2
Clearwater River Basin	North Fork Clearwater River	Floodwood Creek	1
Clearwater River Basin	North Fork Clearwater River	Fourth of July Creek	1
Clearwater River Basin	North Fork Clearwater River	Isabella Creek	1
Clearwater River Basin	North Fork Clearwater River	Kelly Creek	1
Clearwater River Basin	North Fork Clearwater River	Little North Fork Clearwater River	1
Clearwater River Basin	North Fork Clearwater River	Moose Creek	1
Clearwater River Basin	North Fork Clearwater River	Orogrande Creek	1
Clearwater River Basin	North Fork Clearwater River	Quartz Creek	1
Clearwater River Basin	North Fork Clearwater River	Rock Creek	2
Clearwater River Basin	North Fork Clearwater River	Skull Creek	1
Clearwater River Basin	North Fork Clearwater River	Stoney Creek	1
Clearwater River	North Fork Clearwater River	Upper North Fork Clearwater	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Basin			
Clearwater River Basin	North Fork Clearwater River	Weitas Creek	1
Clearwater River Basin	Selway River	Bear Creek	1
Clearwater River Basin	Selway River	Deep Creek	1
Clearwater River Basin	Selway River	Gedney Creek	2
Clearwater River Basin	Selway River	Indian Creek	1
Clearwater River Basin	Selway River	Little Clearwater Creek	1
Clearwater River Basin	Selway River	Magruder Creek	1
Clearwater River Basin	Selway River	Marten Creek	2
Clearwater River Basin	Selway River	Meadow Creek	1
Clearwater River Basin	Selway River	Mink Creek	2
Clearwater River Basin	Selway River	Moose Creek	1
Clearwater River Basin	Selway River	O'Hara Creek	2
Clearwater River Basin	Selway River	Running Creek	1
Clearwater River Basin	Selway River	Three Links Creek	2
Clearwater River Basin	Selway River	Upper Selway River	1
Clearwater River Basin	Selway River	White Cap Creek	1
Clearwater River Basin	South Fork Clearwater River	American River	2
Clearwater River Basin	South Fork Clearwater River	Crooked River	1
Clearwater River Basin	South Fork Clearwater River	Johns Creek	1
Clearwater River Basin	South Fork Clearwater River	Meadow Creek	2

Management Unit	Core_Area	Local Pop Name	Pop Type
Clearwater River Basin	South Fork Clearwater River	Mill Creek	2
Clearwater River Basin	South Fork Clearwater River	Newsome Creek	1
Clearwater River Basin	South Fork Clearwater River	Red River	1
Clearwater River Basin	South Fork Clearwater River	Tenmile Creek	1
Grande Ronde River Basin	Grande Ronde River	Catherine Creek	1
Grande Ronde River Basin	Grande Ronde River	Indian Creek	1
Grande Ronde River Basin	Grande Ronde River	Lookingglass Creek	1
Grande Ronde River Basin	Grande Ronde River	Lostine River/Bear Creek	1
Grande Ronde River Basin	Grande Ronde River	Minam River/Deer Creek	1
Grande Ronde River Basin	Grande Ronde River	Upper Grande Ronde River	1
Grande Ronde River Basin	Grande Ronde River	Upper Hurricane Creek	1
Grande Ronde River Basin	Grande Ronde River	Wenaha River	1
Grande Ronde River Basin	Little Minam River	Little Minam River	1
Hells Canyon Complex	Pine, Indian & Wildhorse Creeks	Bear Creek	1
Hells Canyon Complex	Pine, Indian & Wildhorse Creeks	Clear Creek	1
Hells Canyon Complex	Pine, Indian & Wildhorse Creeks	Crooked River	1
Hells Canyon Complex	Pine, Indian & Wildhorse Creeks	Duck Creek	2
Hells Canyon Complex	Pine, Indian & Wildhorse Creeks	East Pine Creek	1
Hells Canyon Complex	Pine, Indian & Wildhorse Creeks	Elk Creek	1
Hells Canyon Complex	Pine, Indian & Wildhorse Creeks	Fall Creek	2
Hells Canyon	Pine, Indian & Wildhorse	Fish Creek	2

Management Unit	Core_Area	Local Pop Name	Pop Type
Complex	Creeks		
Hells Canyon Complex	Pine, Indian & Wildhorse Creeks	Indian Creek	1
Hells Canyon Complex	Pine, Indian & Wildhorse Creeks	Lick Creek	2
Hells Canyon Complex	Pine, Indian & Wildhorse Creeks	Little Elk Creek	2
Hells Canyon Complex	Pine, Indian & Wildhorse Creeks	Upper Pine Creek	1
Imnaha River Basin	Imnaha River	Cabin Creek	1
Imnaha River Basin	Imnaha River	Cliff Creek	1
Imnaha River Basin	Imnaha River	Lower Big Sheep Creek	1
Imnaha River Basin	Imnaha River	Lower Imnaha River	1
Imnaha River Basin	Imnaha River	McCully Creek	1
Imnaha River Basin	Imnaha River	Redmont Creek	1
Imnaha River Basin	Imnaha River	Upper Big Sheep Creek	1
Imnaha River Basin	Imnaha River	Upper Imnaha River	1
Imnaha River Basin	Imnaha River	Upper Little Sheep Creek	1
John Day River Basin	Middle Fork John Day River	Big Boulder Creek	2
John Day River Basin	Middle Fork John Day River	Big Creek	1
John Day River Basin	Middle Fork John Day River	Butte Creek	2
John Day River Basin	Middle Fork John Day River	Clear Creek	1
John Day River Basin	Middle Fork John Day River	Granite Boulder Creek	1
John Day River Basin	Middle Fork John Day River	Vinegar Creek	2
John Day River Basin	North Fork John Day River	Cable Creek	2
John Day River Basin	North Fork John Day River	Davis Creek	2
John Day River Basin	North Fork John Day River	Desolation Creek	1
John Day River Basin	North Fork John Day River	Dry Creek	2
John Day River Basin	North Fork John Day River	Hidaway Creek	2

Management Unit	Core_Area	Local Pop Name	Pop Type
John Day River Basin	North Fork John Day River	Indian Creek	2
John Day River Basin	North Fork John Day River	Lower Clear Creek	1
John Day River Basin	North Fork John Day River	Upper Clear Creek/Lightning complex	1
John Day River Basin	North Fork John Day River	Upper Granite Creek	1
John Day River Basin	North Fork John Day River	Upper Middle Fork John Day River	2
John Day River Basin	North Fork John Day River	Upper North Fork John Day River	1
John Day River Basin	North Fork John Day River	Upper South Fork Desolation Creek	1
John Day River Basin	North Fork John Day River	Winom Creek	2
John Day River Basin	Upper Mainstem John Day River	Canyon Creek	2
John Day River Basin	Upper Mainstem John Day River	Indian Creek	1
John Day River Basin	Upper Mainstem John Day River	Pine Creek	2
John Day River Basin	Upper Mainstem John Day River	Strawberry Creek	2
John Day River Basin	Upper Mainstem John Day River	Upper John Day River	1
Lower Snake Basin	Asotin Creek	Charley Creek	1
Lower Snake Basin	Asotin Creek	Cougar Creek	1
Lower Snake Basin	Asotin Creek	George Creek	2
Lower Snake Basin	Asotin Creek	North Fork Asotin Creek	1
Lower Snake Basin	Asotin Creek	South Fork Asotin Creek	2
Lower Snake Basin	Tucannon River	Bear Creek	1
Lower Snake Basin	Tucannon River	Cold Creek	1
Lower Snake Basin	Tucannon River	Cummings Creek	1
Lower Snake Basin	Tucannon River	Hixon Creek	2
Lower Snake Basin	Tucannon River	Little Turkey Creek	1
Lower Snake Basin	Tucannon River	Meadow Creek	1
Lower Snake Basin	Tucannon River	Panjab Creek	1
Lower Snake Basin	Tucannon River	Sheep Creek	1
Lower Snake Basin	Tucannon River	Turkey Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Lower Snake Basin	Tucannon River	Upper Tucannon River	1
Middle Columbia Basin		Stehekin River	?
Middle Columbia Basin	Entiat River	Entiat River	1
Middle Columbia Basin	Entiat River	Mad River	1
Middle Columbia Basin	Methow River	Beaver Creek	1
Middle Columbia Basin	Methow River	Chewuch River	1
Middle Columbia Basin	Methow River	Early Winters Creek	1
Middle Columbia Basin	Methow River	Goat Creek	1
Middle Columbia Basin	Methow River	Gold Creek	1
Middle Columbia Basin	Methow River	Lake Creek	1
Middle Columbia Basin	Methow River	Lost River	1
Middle Columbia Basin	Methow River	Twisp River	1
Middle Columbia Basin	Methow River	Upper Methow River	1
Middle Columbia Basin	Methow River	Wolf Creek	1
Middle Columbia Basin	Wenatchee River	Chiwaukum Creek	1
Middle Columbia Basin	Wenatchee River	Chiwawa River	1
Middle Columbia Basin	Wenatchee River	Icicle Creek	1
Middle Columbia Basin	Wenatchee River	Little Wenatchee River	1
Middle Columbia Basin	Wenatchee River	Nason Creek	1
Middle Columbia Basin	Wenatchee River	Peshastin Creek	1
Middle Columbia Basin	Wenatchee River	White River	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Powder River	Powder River	Anthony Creek	1
Powder River	Powder River	Big Muddy Creek	1
Powder River	Powder River	Eagle Creek	2
Powder River	Powder River	Lake Creek	1
Powder River	Powder River	North Powder River	1
Powder River	Powder River	Rock Creek	1
Powder River	Powder River	Salmon Creek	1
Powder River	Powder River	Upper Powder River	1
Powder River	Powder River	Wolf Creek	1
Sheep / Granite Creeks	Granite Creek	Granite Creek	1
Sheep / Granite Creeks	Sheep Creek	Sheep Creek	1
Umatilla River Basin	Umatilla River	North Fork Meacham Creek	2
Umatilla River Basin	Umatilla River	North Fork Umatilla River	1
Umatilla River Basin	Umatilla River	Ryan Creek	2
Umatilla River Basin	Umatilla River	South Fork Umatilla River	2
Walla Walla River Basin	Touchet River	North Fork Touchet River	1
Walla Walla River Basin	Touchet River	South Fork Touchet River	1
Walla Walla River Basin	Touchet River	Wolf Fork Touchet River	1
Walla Walla River Basin	Walla Walla River	North Fork Walla Walla River	1
Walla Walla River Basin	Walla Walla River	South Fork Walla Walla River	1
Walla Walla River Basin	Walla Walla River	Upper Mill Creek	1
Yakima River	Yakima River	Ahtanum Creek	1
Yakima River	Yakima River	American River	1
Yakima River	Yakima River	Box Cayon Creek	1
Yakima River	Yakima River	Bumping River	1
Yakima River	Yakima River	Cle Elum River	1
Yakima River	Yakima River	Cold Creek	?
Yakima River	Yakima River	Cowiche Creek	?
Yakima River	Yakima River	Crow Creek	1
Yakima River	Yakima River	Deep Creek	1
Yakima River	Yakima River	Gold Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Yakima River	Yakima River	Indian Creek	1
Yakima River	Yakima River	Kachess River	1
Yakima River	Yakima River	Little Naches River	2
Yakima River	Yakima River	Nile Creek	?
Yakima River	Yakima River	North Fork Tieton River	1
Yakima River	Yakima River	Rattlesnake Creek	1
Yakima River	Yakima River	South Fork Tieton River	1
Yakima River	Yakima River	Taneum Creek	2
Yakima River	Yakima River	Teanaway River	1
Yakima River	Yakima River	Upper Yakima River	1
Yakima River	Yakima River	Waptus River	1
Little Lost River Basin	Little Lost River	Badger Creek	1
Little Lost River Basin	Little Lost River	Iron Creek	1
Little Lost River Basin	Little Lost River	Mill Creek	1
Little Lost River Basin	Little Lost River	Smithie Fork Creek	1
Little Lost River Basin	Little Lost River	Squaw Creek	1
Little Lost River Basin	Little Lost River	Timber Creek	1
Little Lost River Basin	Little Lost River	Upper Little Lost River	1
Little Lost River Basin	Little Lost River	Warm Creek	1
Little Lost River Basin	Little Lost River	Wet Creek	1
Little Lost River Basin	Little Lost River	Williams Creek	1
Malheur River Basin	Malheur River	Big Creek	1
Malheur River Basin	Malheur River	Crane Creek	1
Malheur River Basin	Malheur River	Elk Creek	1
Malheur River Basin	Malheur River	Lake Creek	1
Malheur River Basin	Malheur River	Meadow Fork	1
Malheur River Basin	Malheur River	Sheep Creek	1
Malheur River Basin	Malheur River	Swamp Creek	1
Malheur River Basin	Malheur River	Upper North Fork Malheur	1

Management Unit	Core_Area	Local Pop Name	Pop Type
		River	
Salmon River Basin	Lake Creek	Lake Creek	1
Salmon River Basin	Lemhi River	Agency Creek	2
Salmon River Basin	Lemhi River	Bohannon Creek	1
Salmon River Basin	Lemhi River	Geertson Creek	1
Salmon River Basin	Lemhi River	Hawley Creek	1
Salmon River Basin	Lemhi River	Hayden Creek	1
Salmon River Basin	Lemhi River	Kenney Creek	1
Salmon River Basin	Lemhi River	Pattee Creek	1
Salmon River Basin	Lemhi River	Sandy Creek	2
Salmon River Basin	Lemhi River	Upper Lemhi River	1
Salmon River Basin	Lemhi River	Withington Creek	2
Salmon River Basin	Little-Lower Salmon River	Boulder Creek	1
Salmon River Basin	Little-Lower Salmon River	Elkhorn Creek	2
Salmon River Basin	Little-Lower Salmon River	French Creek	2
Salmon River Basin	Little-Lower Salmon River	Hard Creek	1
Salmon River Basin	Little-Lower Salmon River	John Day Creek	1
Salmon River Basin	Little-Lower Salmon River	Lake Creek	1
Salmon River Basin	Little-Lower Salmon River	Partridge Creek	1
Salmon River Basin	Little-Lower Salmon River	Rapid River	1
Salmon River Basin	Little-Lower Salmon River	Slate Creek	1
Salmon River Basin	Middle Fork Salmon River	Bear Valley Creek	1
Salmon River Basin	Middle Fork Salmon River	Beaver Creek	1
Salmon River Basin	Middle Fork Salmon River	Big Creek 1	1
Salmon River Basin	Middle Fork Salmon River	Big Creek 4	1
Salmon River Basin	Middle Fork Salmon River	Big Ramey Creek	1
Salmon River Basin	Middle Fork Salmon River	Camas Creek	1
Salmon River Basin	Middle Fork Salmon River	Crooked-Buck	1
Salmon River Basin	Middle Fork Salmon River	Indian Creek	1
Salmon River Basin	Middle Fork Salmon River	Little Loon Creek	1
Salmon River Basin	Middle Fork Salmon River	Loon Creek	1
Salmon River Basin	Middle Fork Salmon River	Lower Middle Fork 2	1
Salmon River Basin	Middle Fork Salmon River	Lower Middle Fork 3	1
Salmon River Basin	Middle Fork Salmon River	Lower-Middle Fork 1	1
Salmon River Basin	Middle Fork Salmon River	Marble Creek	1
Salmon River Basin	Middle Fork Salmon River	Marsh Creek	1
Salmon River Basin	Middle Fork Salmon River	Mayfield Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Salmon River Basin	Middle Fork Salmon River	Monumental Creek	1
Salmon River Basin	Middle Fork Salmon River	Pistol Creek	1
Salmon River Basin	Middle Fork Salmon River	Rapid Creek	1
Salmon River Basin	Middle Fork Salmon River	Rush Creek	1
Salmon River Basin	Middle Fork Salmon River	Silver Creek	1
Salmon River Basin	Middle Fork Salmon River	Sulphur Creek	1
Salmon River Basin	Middle Fork Salmon River	Upper Middle Fork Salmon 1	1
Salmon River Basin	Middle Fork Salmon River	Upper Middle Fork Salmon 2	1
Salmon River Basin	Middle Fork Salmon River	Warm Spring Creek	1
Salmon River Basin	Middle Fork Salmon River	Wilson Creek	1
Salmon River Basin	Middle Fork Salmon River	Yellow Jacket Creek	1
Salmon River Basin	Middle Salmon River-Chamberlain	Bargamin Creek	1
Salmon River Basin	Middle Salmon River-Chamberlain	Big Squaw Creek	1
Salmon River Basin	Middle Salmon River-Chamberlain	California Creek	1
Salmon River Basin	Middle Salmon River-Chamberlain	Chamberlain Creek	1
Salmon River Basin	Middle Salmon River-Chamberlain	Crooked Creek	2
Salmon River Basin	Middle Salmon River-Chamberlain	Fall Creek	1
Salmon River Basin	Middle Salmon River-Chamberlain	Sabe Creek	1
Salmon River Basin	Middle Salmon River-Chamberlain	Sheep Creek	1
Salmon River Basin	Middle Salmon River-Chamberlain	Warren Creek	1
Salmon River Basin	Middle Salmon River-Chamberlain	Wind River	1
Salmon River Basin	Middle Salmon River-Panther	Allison Creek	1
Salmon River Basin	Middle Salmon River-Panther	Boulder Creek	1
Salmon River Basin	Middle Salmon River-Panther	Carmen Creek	1
Salmon River Basin	Middle Salmon River-Panther	Cow Creek	1
Salmon River Basin	Middle Salmon River-	Fourth of July Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
	Panther		
Salmon River Basin	Middle Salmon River-Panther	Hat Creek	1
Salmon River Basin	Middle Salmon River-Panther	Horse Creek	1
Salmon River Basin	Middle Salmon River-Panther	Indian Creek	1
Salmon River Basin	Middle Salmon River-Panther	Iron Creek	1
Salmon River Basin	Middle Salmon River-Panther	Jesse Creek	1
Salmon River Basin	Middle Salmon River-Panther	McKim Creek	1
Salmon River Basin	Middle Salmon River-Panther	Napias Creek	1
Salmon River Basin	Middle Salmon River-Panther	North Fork Salmon River	1
Salmon River Basin	Middle Salmon River-Panther	Owl Creek	1
Salmon River Basin	Middle Salmon River-Panther	Panther Creek	1
Salmon River Basin	Middle Salmon River-Panther	Pine Creek	1
Salmon River Basin	Middle Salmon River-Panther	Spring Creek	1
Salmon River Basin	Middle Salmon River-Panther	Squaw Creek	1
Salmon River Basin	Middle Salmon River-Panther	Twelvemile Creek	1
Salmon River Basin	Middle Salmon River-Panther	Williams Creek	1
Salmon River Basin	Opal Lake	Opal Lake	1
Salmon River Basin	Pahsimeroi River	Big Creek	1
Salmon River Basin	Pahsimeroi River	Burnt Creek	1
Salmon River Basin	Pahsimeroi River	Ditch Creek	1
Salmon River Basin	Pahsimeroi River	Falls Creek	1
Salmon River Basin	Pahsimeroi River	Goldburg Creek	1
Salmon River Basin	Pahsimeroi River	Little Morgan Creek	1
Salmon River Basin	Pahsimeroi River	Morse Creek	1
Salmon River Basin	Pahsimeroi River	Patterson Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Salmon River Basin	Pahsimeroi River	Tater Creek	1
Salmon River Basin	Pahsimeroi River	Upper Pahsimeroi River	1
Salmon River Basin	South Fork Salmon River	Bear Creek	2
Salmon River Basin	South Fork Salmon River	Blackmare Creek	1
Salmon River Basin	South Fork Salmon River	Buckhorn Creek	1
Salmon River Basin	South Fork Salmon River	Burntlog Creek	1
Salmon River Basin	South Fork Salmon River	Camp Phoebe Creek	1
Salmon River Basin	South Fork Salmon River	Cougar Creek	1
Salmon River Basin	South Fork Salmon River	Curtis Creek	1
Salmon River Basin	South Fork Salmon River	Dollar-Six Bit Creek	1
Salmon River Basin	South Fork Salmon River	Elk Creek	1
Salmon River Basin	South Fork Salmon River	Fitsum Creek	1
Salmon River Basin	South Fork Salmon River	Fourmile Creek	1
Salmon River Basin	South Fork Salmon River	Fritser Creek	1
Salmon River Basin	South Fork Salmon River	Grouse-Flat Creek	1
Salmon River Basin	South Fork Salmon River	Lick Creek	1
Salmon River Basin	South Fork Salmon River	Loon Creek	1
Salmon River Basin	South Fork Salmon River	Pony Creek	1
Salmon River Basin	South Fork Salmon River	Porphyry Creek	2
Salmon River Basin	South Fork Salmon River	Profile Creek	1
Salmon River Basin	South Fork Salmon River	Quartz Creek	1
Salmon River Basin	South Fork Salmon River	Riordan Creek	1
Salmon River Basin	South Fork Salmon River	Ruby Creek	1
Salmon River Basin	South Fork Salmon River	Sheep Creek-South Fork Salmon	2
Salmon River Basin	South Fork Salmon River	Sugar Creek	1
Salmon River Basin	South Fork Salmon River	Summit Creek	1
Salmon River Basin	South Fork Salmon River	Tamarack Creek	1
Salmon River Basin	South Fork Salmon River	Trapper Creek	1
Salmon River Basin	South Fork Salmon River	Upper East Fork South Fork Salmon River	1
Salmon River Basin	South Fork Salmon River	Upper East Fork South Fork Salmon River	1
Salmon River Basin	South Fork Salmon River	Upper Johnson Creek	2
Salmon River Basin	South Fork Salmon River	Upper Lake Creek	1
Salmon River Basin	South Fork Salmon River	Upper South Fork Salmon	1
Salmon River Basin	South Fork Salmon River	Victor Creek	1
Salmon River Basin	South Fork Salmon River	Warm Lake Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
Salmon River Basin	South Fork Salmon River	Zena Creek	1
Salmon River Basin	Upper Salmon River	Alturas Lake Creek	1
Salmon River Basin	Upper Salmon River	Basin Creek	1
Salmon River Basin	Upper Salmon River	Bayhorse Creek	1
Salmon River Basin	Upper Salmon River	Challis Creek	1
Salmon River Basin	Upper Salmon River	Champion Creek	1
Salmon River Basin	Upper Salmon River	East Fork Salmon River	1
Salmon River Basin	Upper Salmon River	Fourth of July Creek	1
Salmon River Basin	Upper Salmon River	Garden Creek	1
Salmon River Basin	Upper Salmon River	Germania Creek	1
Salmon River Basin	Upper Salmon River	Kinnikinic Creek	1
Salmon River Basin	Upper Salmon River	Morgan Creek	1
Salmon River Basin	Upper Salmon River	Pettit Lake	1
Salmon River Basin	Upper Salmon River	Redfish Lake Creek	1
Salmon River Basin	Upper Salmon River	Slate Creek	1
Salmon River Basin	Upper Salmon River	Squaw Creek	1
Salmon River Basin	Upper Salmon River	Thompson Creek	1
Salmon River Basin	Upper Salmon River	Upper Salmon River	1
Salmon River Basin	Upper Salmon River	Valley Creek	1
Salmon River Basin	Upper Salmon River	Warm Springs Creek	1
Salmon River Basin	Upper Salmon River	Yankee Fork Creek	1
Salmon River Basin	Upper Salmon River	Yellowbelly Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Bear Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Big Peak Creek	2
Southwest Idaho River Basins	Anderson Ranch Reservoir	Big Smokey Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Big Water Gulch	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Blackhorse, Redrock, and Carrie Creeks	2
Southwest Idaho River Basins	Anderson Ranch Reservoir	Boardman-Smokey Dome	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Deadwood Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Deer Creek	2
Southwest Idaho	Anderson Ranch Reservoir	Dog Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
River Basins			
Southwest Idaho River Basins	Anderson Ranch Reservoir	Elk Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Emma Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Fall Creek	2
Southwest Idaho River Basins	Anderson Ranch Reservoir	Feather River	2
Southwest Idaho River Basins	Anderson Ranch Reservoir	Grindstone Creek	2
Southwest Idaho River Basins	Anderson Ranch Reservoir	Grouse Creek	2
Southwest Idaho River Basins	Anderson Ranch Reservoir	Johnson Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Little Smokey Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Middle Fork Lime Creek	2
Southwest Idaho River Basins	Anderson Ranch Reservoir	North Fork Big Smokey Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	North Fork Lime Creek	2
Southwest Idaho River Basins	Anderson Ranch Reservoir	Ross Fork Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Salt Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Skeleton Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	South Fork Lime, Maxfield, Hunter Creeks	2
Southwest Idaho River Basins	Anderson Ranch Reservoir	Trinity Creek	2
Southwest Idaho River Basins	Anderson Ranch Reservoir	Wagontown Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Willow Creek	1
Southwest Idaho River Basins	Anderson Ranch Reservoir	Worswick Creek	2
Southwest Idaho River Basins	Arrowrock Reservoir	Bald Mountain and Eagle Creeks	2

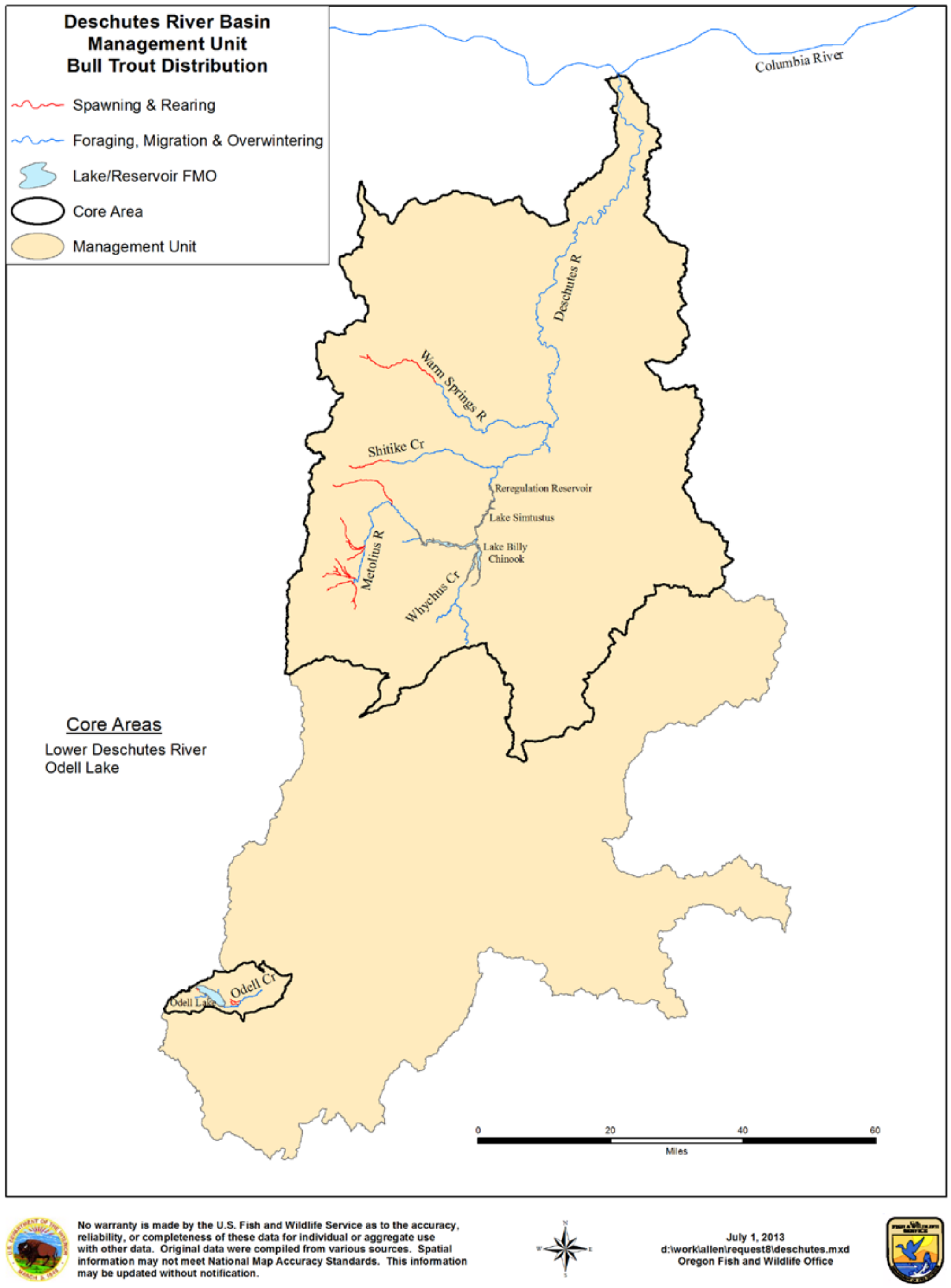
Management Unit	Core_Area	Local Pop Name	Pop Type
Southwest Idaho River Basins	Arrowrock Reservoir	Bear River	1
Southwest Idaho River Basins	Arrowrock Reservoir	Beaver and Edna Creeks	2
Southwest Idaho River Basins	Arrowrock Reservoir	Big Owl and Wren Creeks	2
Southwest Idaho River Basins	Arrowrock Reservoir	Big Silver Creek	1
Southwest Idaho River Basins	Arrowrock Reservoir	Blackwarrior and Steel Creek	1
Southwest Idaho River Basins	Arrowrock Reservoir	Buck Creek	1
Southwest Idaho River Basins	Arrowrock Reservoir	Cottonwood Creek	2
Southwest Idaho River Basins	Arrowrock Reservoir	Joe Daley and Leggit Creeks	2
Southwest Idaho River Basins	Arrowrock Reservoir	Johnson Creek	1
Southwest Idaho River Basins	Arrowrock Reservoir	Little Queens River	1
Southwest Idaho River Basins	Arrowrock Reservoir	Lodgepole Creek	1
Southwest Idaho River Basins	Arrowrock Reservoir	Logging and Haga Creeks	2
Southwest Idaho River Basins	Arrowrock Reservoir	Lost Man Creek	2
Southwest Idaho River Basins	Arrowrock Reservoir	Meadow and French Creeks	2
Southwest Idaho River Basins	Arrowrock Reservoir	Pikes Fork	2
Southwest Idaho River Basins	Arrowrock Reservoir	Queens River	1
Southwest Idaho River Basins	Arrowrock Reservoir	Rabbit Creek	2
Southwest Idaho River Basins	Arrowrock Reservoir	Rattlesnake Creek	1
Southwest Idaho River Basins	Arrowrock Reservoir	Roaring River	1
Southwest Idaho River Basins	Arrowrock Reservoir	Sheep Creek	1
Southwest Idaho	Arrowrock Reservoir	Swanholm and Hot Creeks	2

Management Unit	Core_Area	Local Pop Name	Pop Type
River Basins			
Southwest Idaho River Basins	Arrowrock Reservoir	Upper Crooked River	1
Southwest Idaho River Basins	Arrowrock Reservoir	Upper Middle Fork Boise River	2
Southwest Idaho River Basins	Arrowrock Reservoir	Upper North Fork Boise	1
Southwest Idaho River Basins	Arrowrock Reservoir	Upper Smith Creek	2
Southwest Idaho River Basins	Arrowrock Reservoir	Yuba River	1
Southwest Idaho River Basins	Deadwood River	Beaver Creek	1
Southwest Idaho River Basins	Deadwood River	Deer Creek	1
Southwest Idaho River Basins	Deadwood River	Trail Creek	1
Southwest Idaho River Basins	Deadwood River	Upper Deadwood River	1
Southwest Idaho River Basins	Deadwood River	Wildbuck Creek	1
Southwest Idaho River Basins	Lucky Peak Reservoir	Mores Creek	1
Southwest Idaho River Basins	Middle Fork Payette River	Lightning Creek	1
Southwest Idaho River Basins	Middle Fork Payette River	Silver Creek	1
Southwest Idaho River Basins	Middle Fork Payette River	Sixmile Creek	2
Southwest Idaho River Basins	Middle Fork Payette River	Upper Middle Fork Payette	1
Southwest Idaho River Basins	Middle Fork Payette River	West Fork Creek	2
Southwest Idaho River Basins	Middle Fork Payette River	Wet Foot Creek	2
Southwest Idaho River Basins	North Fork Payette River	Fisher Creek	2
Southwest Idaho River Basins	North Fork Payette River	Gold Fork River	1
Southwest Idaho River Basins	North Fork Payette River	Kennally Creek	2

Management Unit	Core_Area	Local Pop Name	Pop Type
Southwest Idaho River Basins	North Fork Payette River	Lake Fork Creek	2
Southwest Idaho River Basins	North Fork Payette River	North Fork Lake Fork Creek	2
Southwest Idaho River Basins	North Fork Payette River	South Fork Lake Fork Creek	2
Southwest Idaho River Basins	North Fork Payette River	Upper North Fork Payette River	2
Southwest Idaho River Basins	Squaw Creek	Pine Creek	2
Southwest Idaho River Basins	Squaw Creek	Sage Hen Creek	2
Southwest Idaho River Basins	Squaw Creek	Second Fork Squaw Creek	1
Southwest Idaho River Basins	Squaw Creek	Squaw Creek	1
Southwest Idaho River Basins	Squaw Creek	Third Fork Squaw Creek	1
Southwest Idaho River Basins	Upper South Fork Payette River	Canyon Creek	1
Southwest Idaho River Basins	Upper South Fork Payette River	Chapman Creek	1
Southwest Idaho River Basins	Upper South Fork Payette River	Clear Creek	1
Southwest Idaho River Basins	Upper South Fork Payette River	Eightmile Creek	1
Southwest Idaho River Basins	Upper South Fork Payette River	Fivemile Creek	2
Southwest Idaho River Basins	Upper South Fork Payette River	Rock Creek	2
Southwest Idaho River Basins	Upper South Fork Payette River	Scott Creek	1
Southwest Idaho River Basins	Upper South Fork Payette River	Tenmile Creek	1
Southwest Idaho River Basins	Upper South Fork Payette River	Upper South Fork Payette River	1
Southwest Idaho River Basins	Upper South Fork Payette River	Wapiti Creek	1
Southwest Idaho River Basins	Upper South Fork Payette River	Warm Springs Creek-Gates Creek	1
Southwest Idaho	Upper South Fork Payette	Wilson Creek	1

Management Unit	Core_Area	Local Pop Name	Pop Type
River Basins	River		
Southwest Idaho River Basins	Weiser River	Anderson Creek	1
Southwest Idaho River Basins	Weiser River	East Fork Weiser	1
Southwest Idaho River Basins	Weiser River	Goodrich Creek	2
Southwest Idaho River Basins	Weiser River	Johnson Creek	2
Southwest Idaho River Basins	Weiser River	Lost Creek	2
Southwest Idaho River Basins	Weiser River	Pine Creek	2
Southwest Idaho River Basins	Weiser River	Rush Creek	2
Southwest Idaho River Basins	Weiser River	Sheep Creek	1
Southwest Idaho River Basins	Weiser River	Upper Hornet Creek	1
Southwest Idaho River Basins	Weiser River	Upper Little Weiser River	1
Southwest Idaho River Basins	Weiser River	Upper Weiser River	2
Southwest Idaho River Basins	Weiser River	West Fork Weiser River	2

The following management unit maps are presented in the same order by which they appear in the table above.


Deschutes River Basin
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Lake/Reservoir FMO
Core Area
Management Unit
Columbia River
Deschutes R
Warm Springs R
Shitike Cr
Reregulation Reservoir
Lake Simtustus
Lake Billy Chinook
Metolius R
Whychus Cr
Odell Lake
Odell Cr
Core Areas
Lower Deschutes River
Odell Lake
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40
60
Miles
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July 1, 2013
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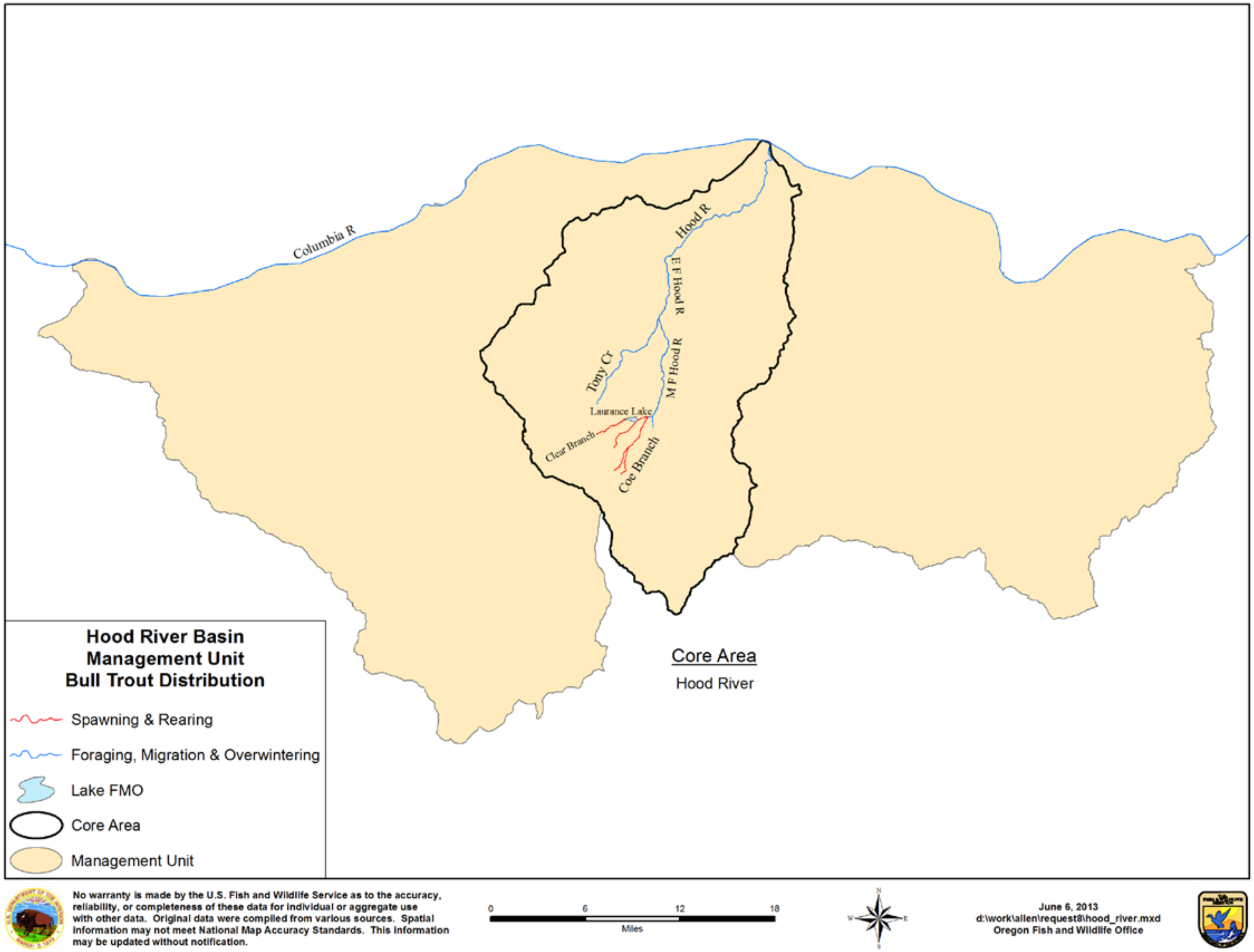
Oregon Fish and Wildlife Office


Columbia R
Hood R
E F Hood R
M F Hood R
Tony Cr
Laurance Lake
Clear Branch
Coe Branch
Core Area
Hood River
Hood River Basin
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Lake FMO
Core Area
Management Unit
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June 6, 2013
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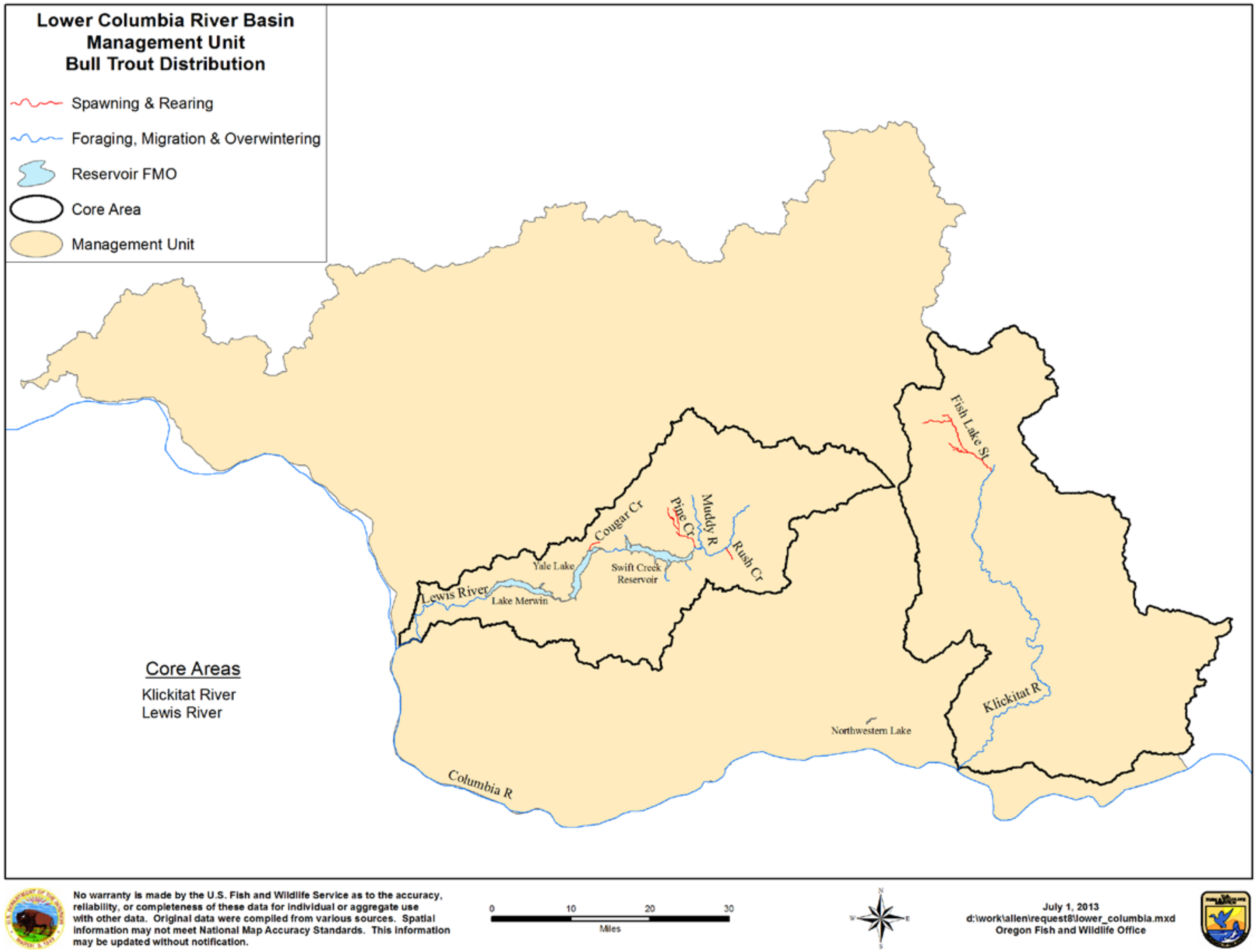
Oregon Fish and Wildlife Office


Lower Columbia River Basin
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Reservoir FMO
Core Area
Management Unit
Core Areas
Klickitat River
Lewis River
Fish Lake St
Cougar Cr
Pine Cr
Muddy R
Rush Cr
Yale Lake
Swift Creek Reservoir
Lewis River
Lake Merwin
Klickitat R
Northwestern Lake
Columbia R
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July 1, 2013
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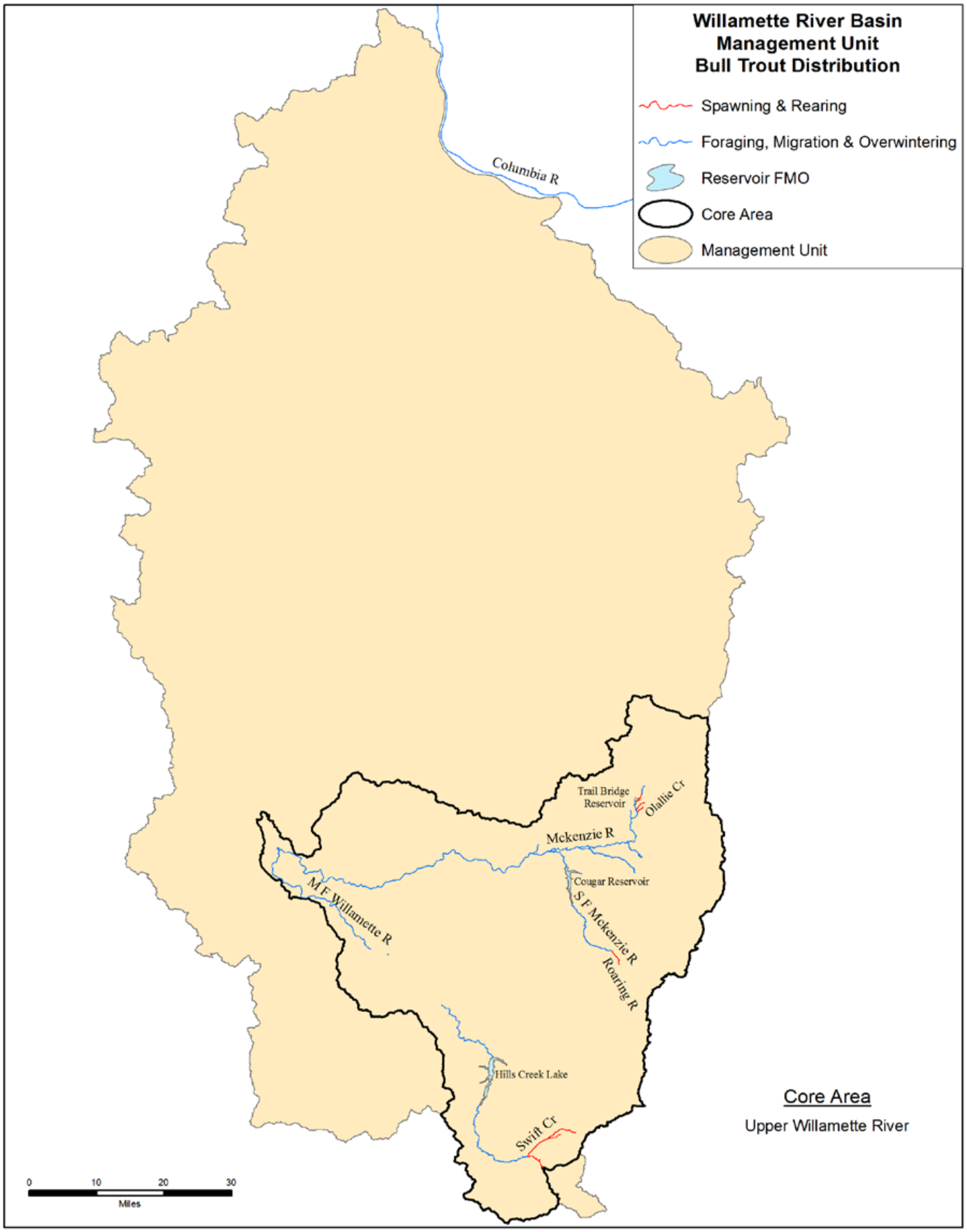
Oregon Fish and Wildlife Office



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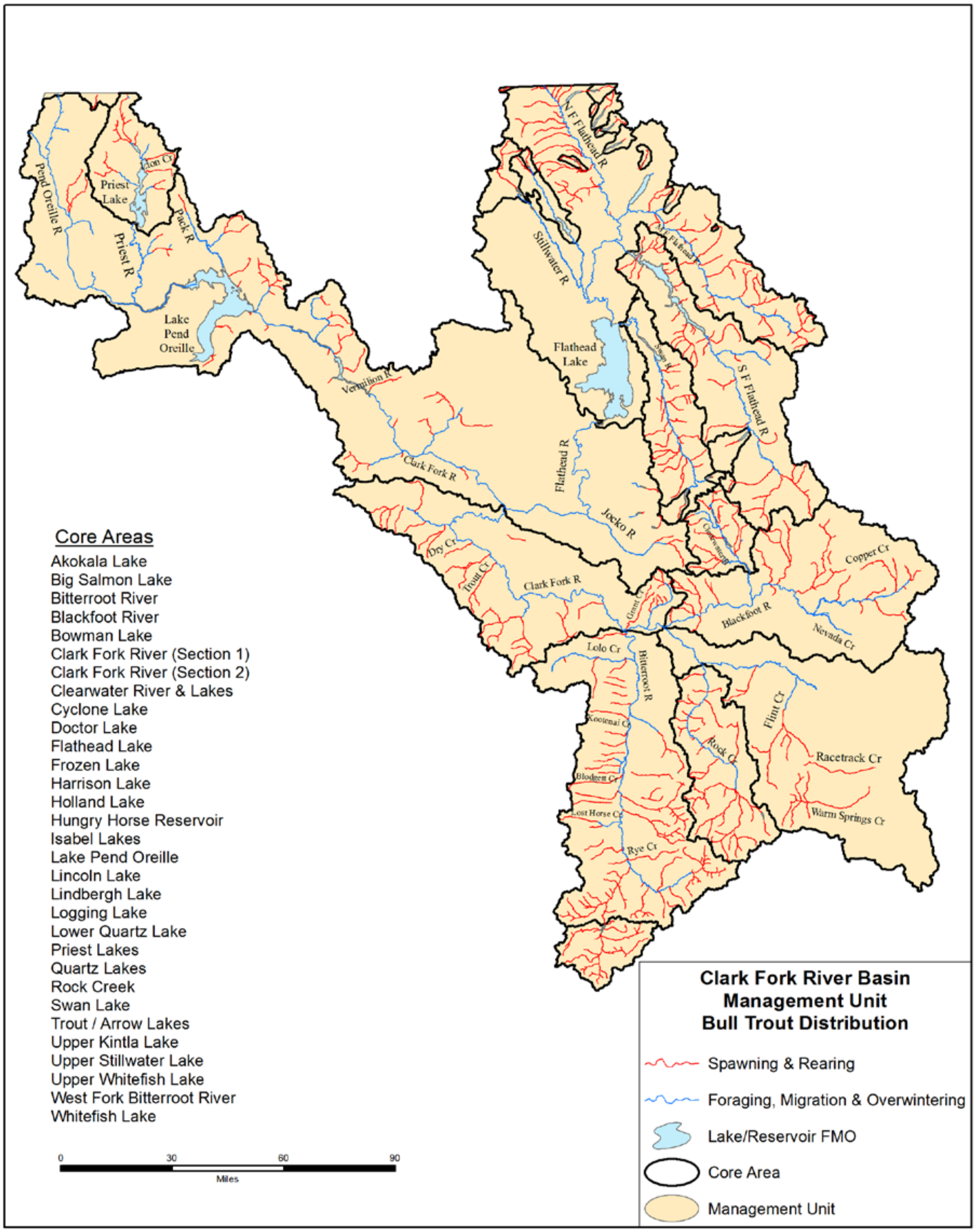

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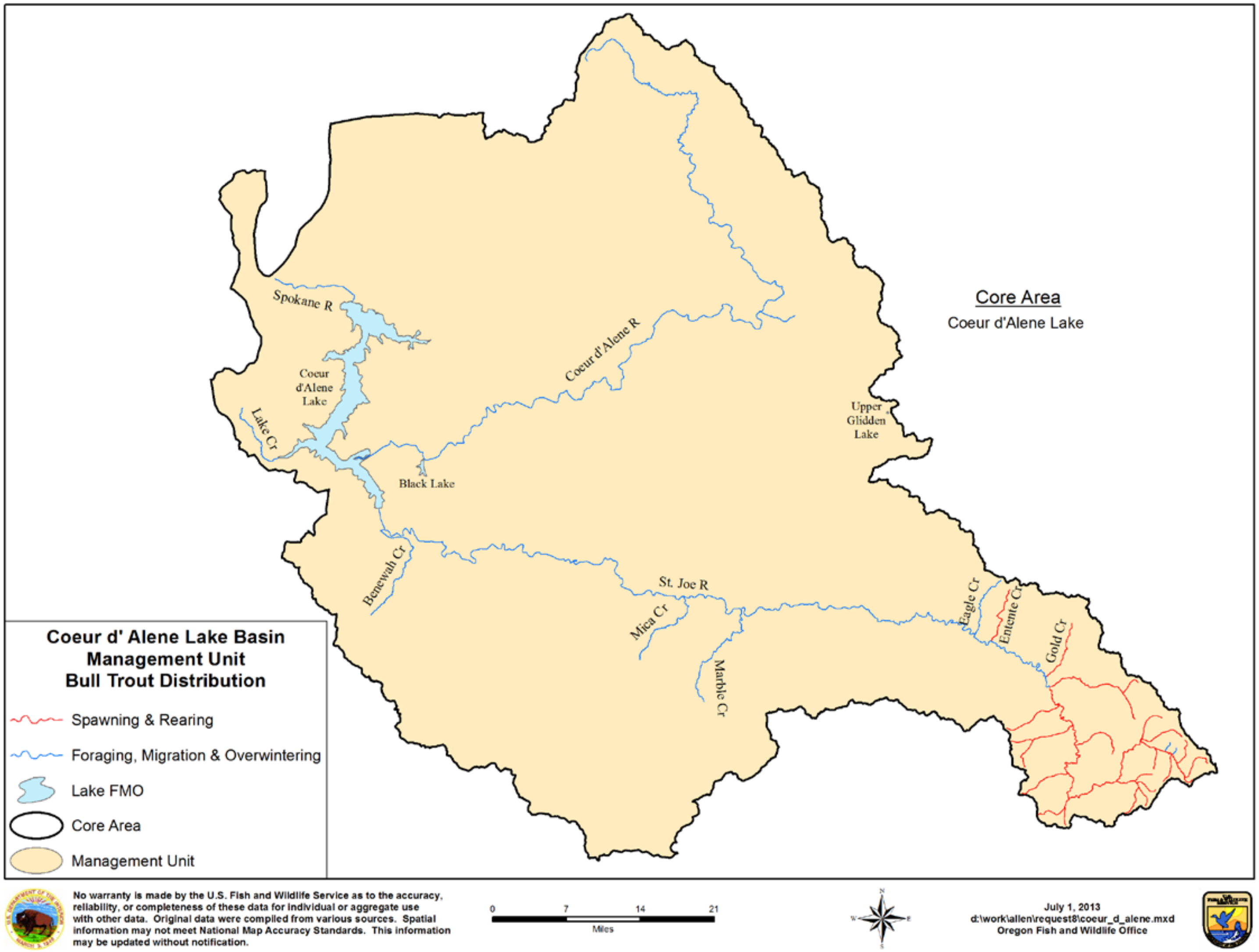
Core Area
Coeur d'Alene Lake
Spokane R
Coeur d'Alene Lake
Lake Cr
Black Lake
Coeur d'Alene R
Upper Glidden Lake
Benewah Cr
St. Joe R
Mica Cr
Marble Cr
Eagle Cr
Entente Cr
Gold Cr
Coeur d' Alene Lake Basin
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Lake FMO
Core Area
Management Unit
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July 1, 2013
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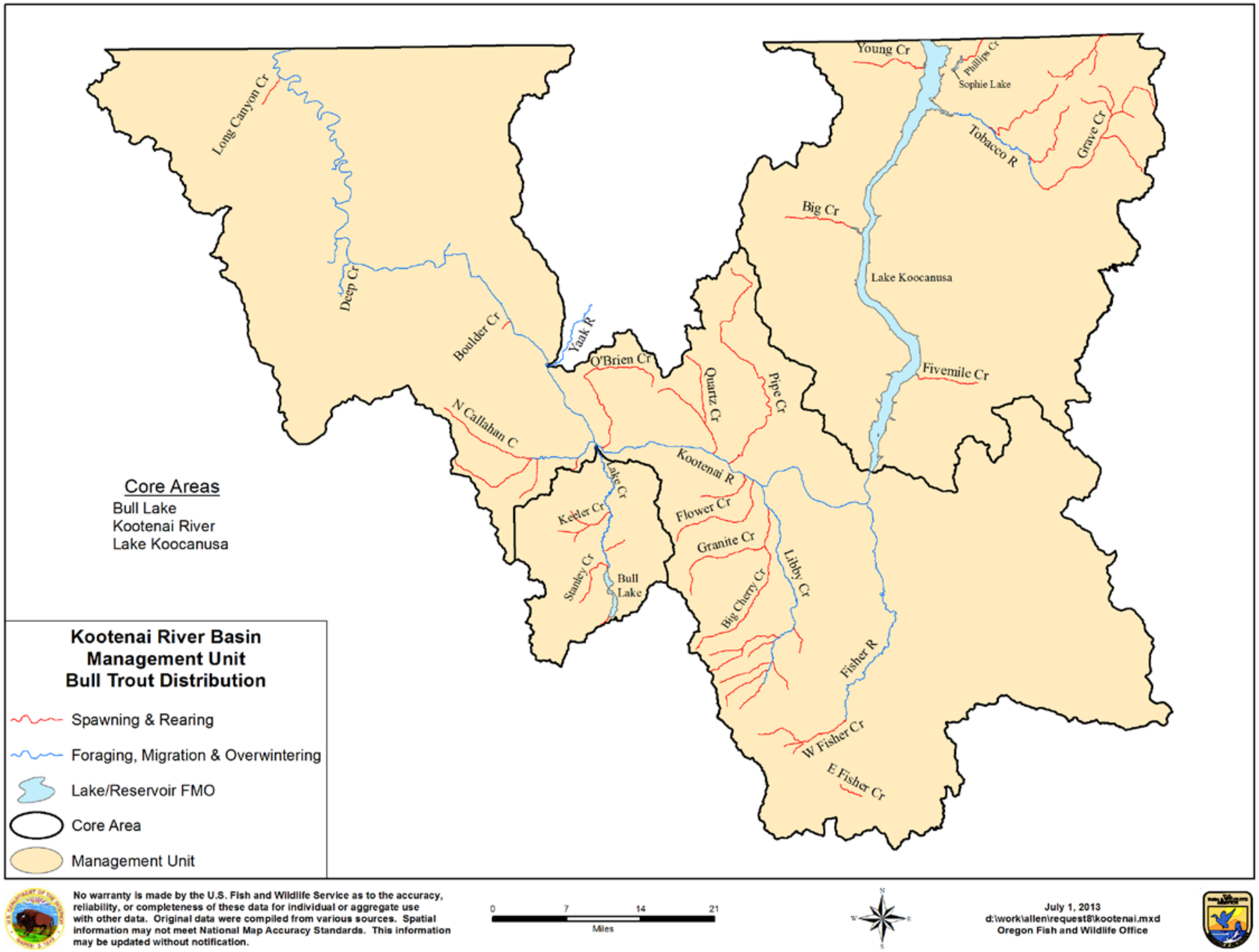
Oregon Fish and Wildlife Office


Kootenai River Basin
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Lake/Reservoir FMO
Core Area
Management Unit
Core Areas
Bull Lake
Kootenai River
Lake Koocanusa
Long Canyon Cr
Deep Cr
Boulder Cr
Yaak R
O'Brien Cr
N Callahan C
Lake Cr
Keeler Cr
Stanley Cr
Bull Lake
Quartz Cr
Pipe Cr
Kootenai R
Flower Cr
Granite Cr
Big Cherry Cr
Libby Cr
Fisher R
W Fisher Cr
E Fisher Cr
Young Cr
Phillips Cr
Sophie Lake
Tobacco R
Grave Cr
Big Cr
Lake Koocanusa
Fivemile Cr
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0
7
14
21
Miles
July 1, 2013
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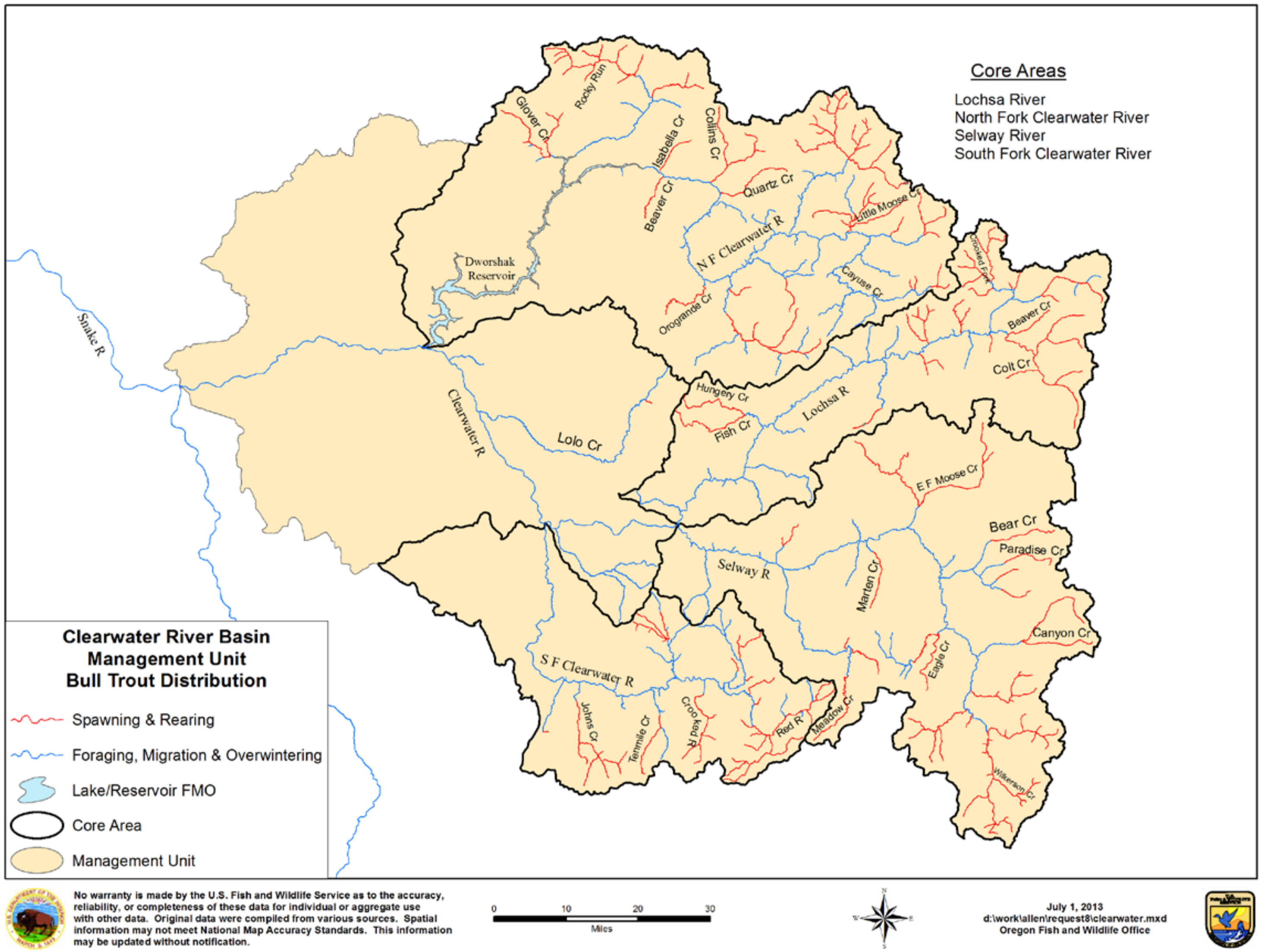
Oregon Fish and Wildlife Office


Core Areas
Lochsa River
North Fork Clearwater River
Selway River
South Fork Clearwater River
Clearwater River Basin
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Lake/Reservoir FMO
Core Area
Management Unit
Dworshak Reservoir
Snake R
Clearwater R
Lolo Cr
N F Clearwater R
Lochsa R
Selway R
S F Clearwater R
Glover Cr
Rocky Run
Isabella Cr
Collins Cr
Beaver Cr
Quartz Cr
Little Moose Cr
Cayuse Cr
Orogrande Cr
Hungery Cr
Fish Cr
Colt Cr
E F Moose Cr
Bear Cr
Paradise Cr
Marten Cr
Canyon Cr
Eagle Cr
Meadow Cr
Red R
Crooked R
Tenmile Cr
Johns Cr
Wilkerson Cr
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0 10 20 30
Miles
July 1, 2013
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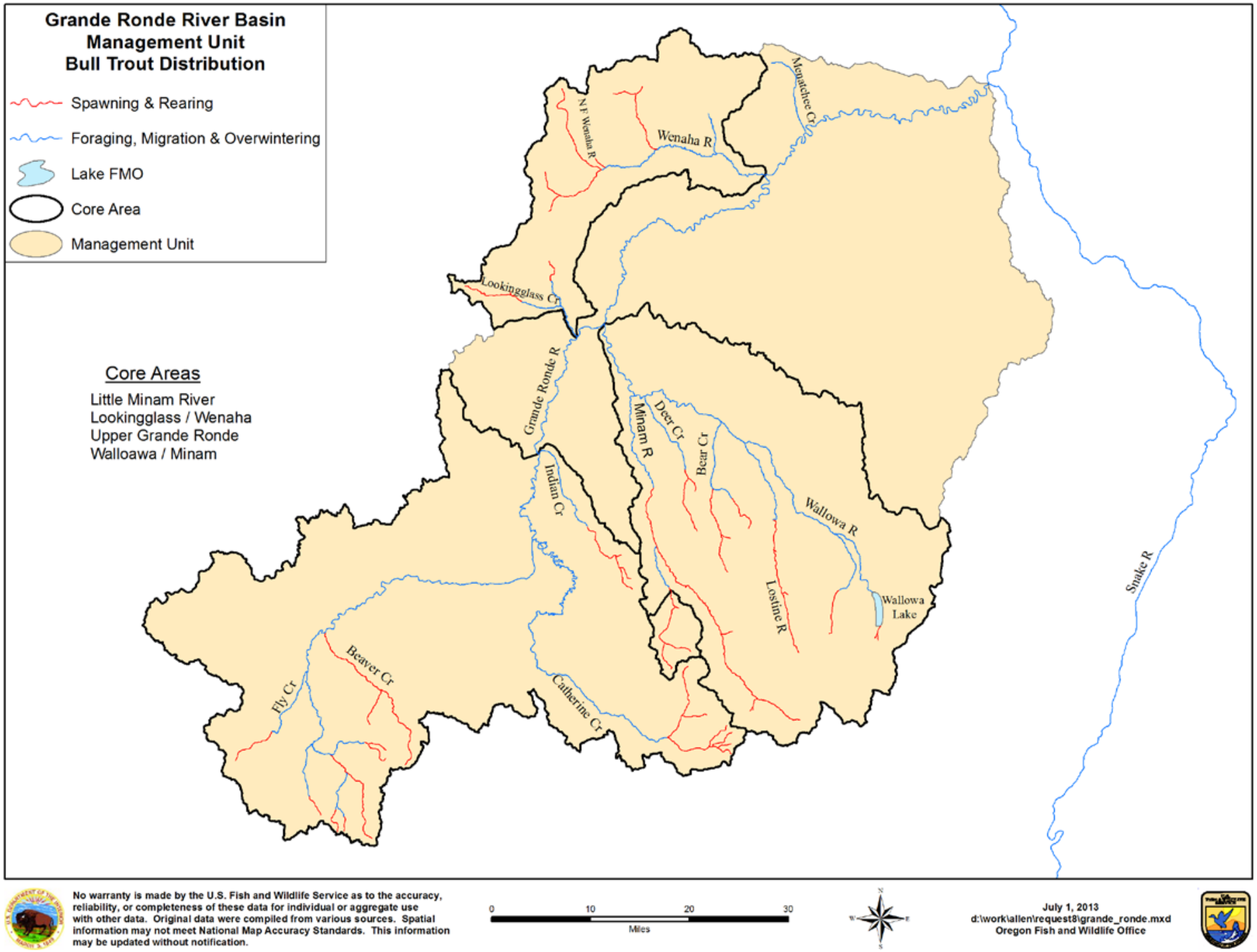
Oregon Fish and Wildlife Office


Grande Ronde River Basin
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Lake FMO
Core Area
Management Unit
Core Areas
Little Minam River
Lookingglass / Wenaha
Upper Grande Ronde
Walloawa / Minam
N F Wenaha R
Wenaha R
Menatchee Cr
Lookingglass Cr
Grande Ronde R
Minam R
Deer Cr
Bear Cr
Indian Cr
Wallowa R
Lostine R
Wallowa
Lake
Snake R
Beaver Cr
Fly Cr
Catherine Cr
No warranty is made by the U.S. Fish and Wildlife Service as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.
0
10
20
30
Miles
July 1, 2013
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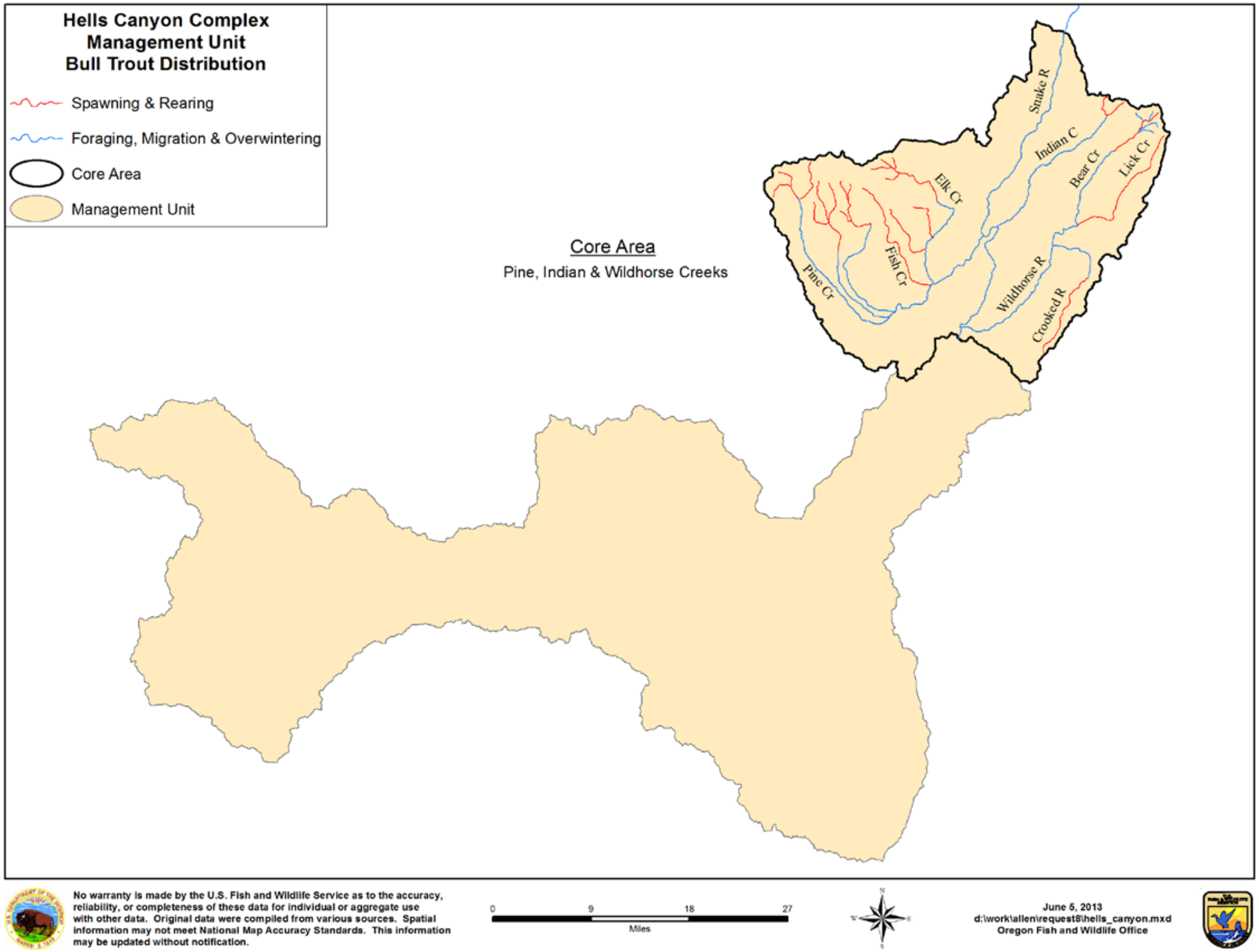
Oregon Fish and Wildlife Office


Hells Canyon Complex
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Core Area
Management Unit
Core Area
Pine, Indian & Wildhorse Creeks
Snake R
Indian C
Bear Cr
Lick Cr
Elk Cr
Fish Cr
Pine Cr
Wildhorse R
Crooked R
No warranty is made by the U.S. Fish and Wildlife Service as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.
0
9
18
27
Miles
June 5, 2013
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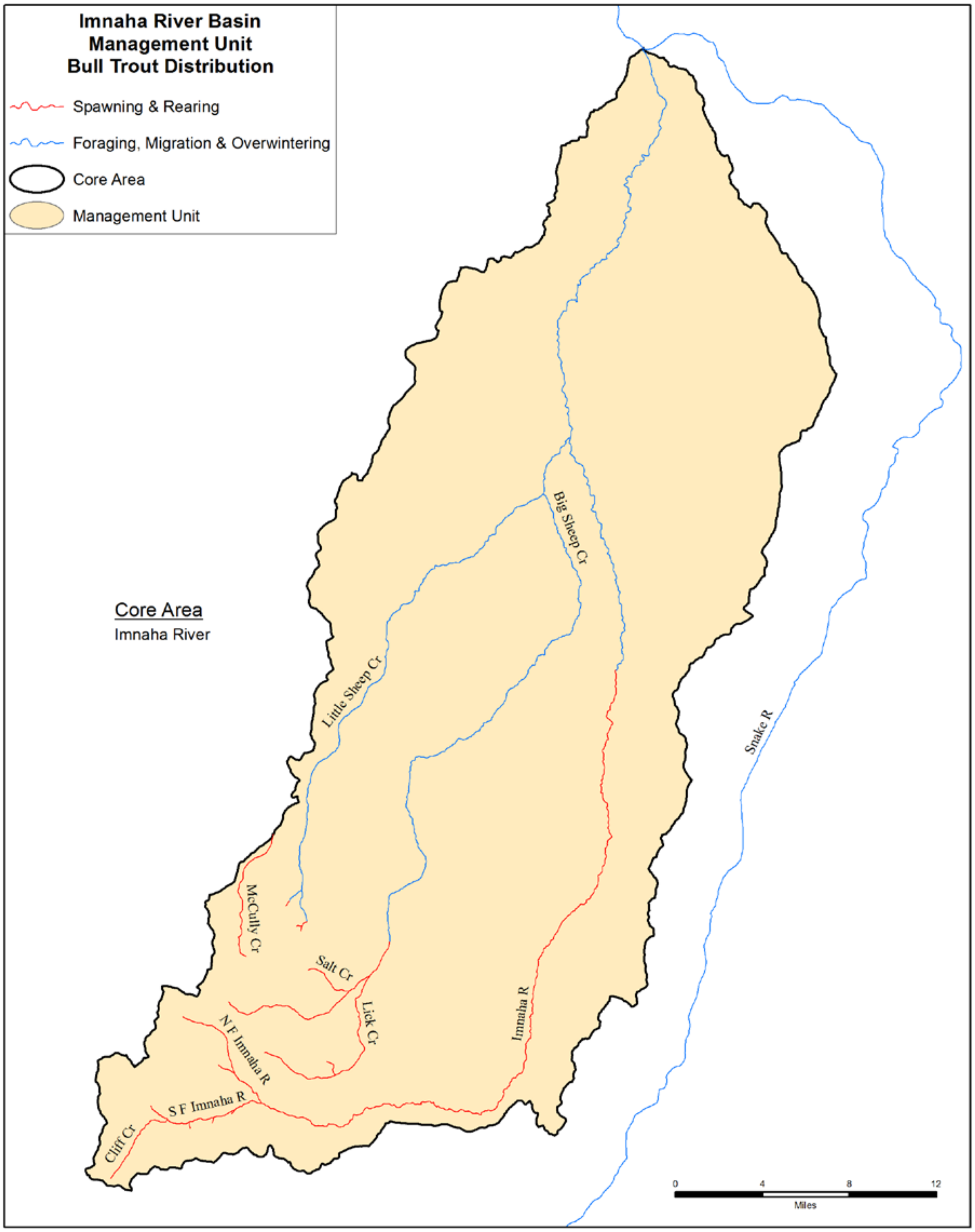
Oregon Fish and Wildlife Office



June 5, 2013
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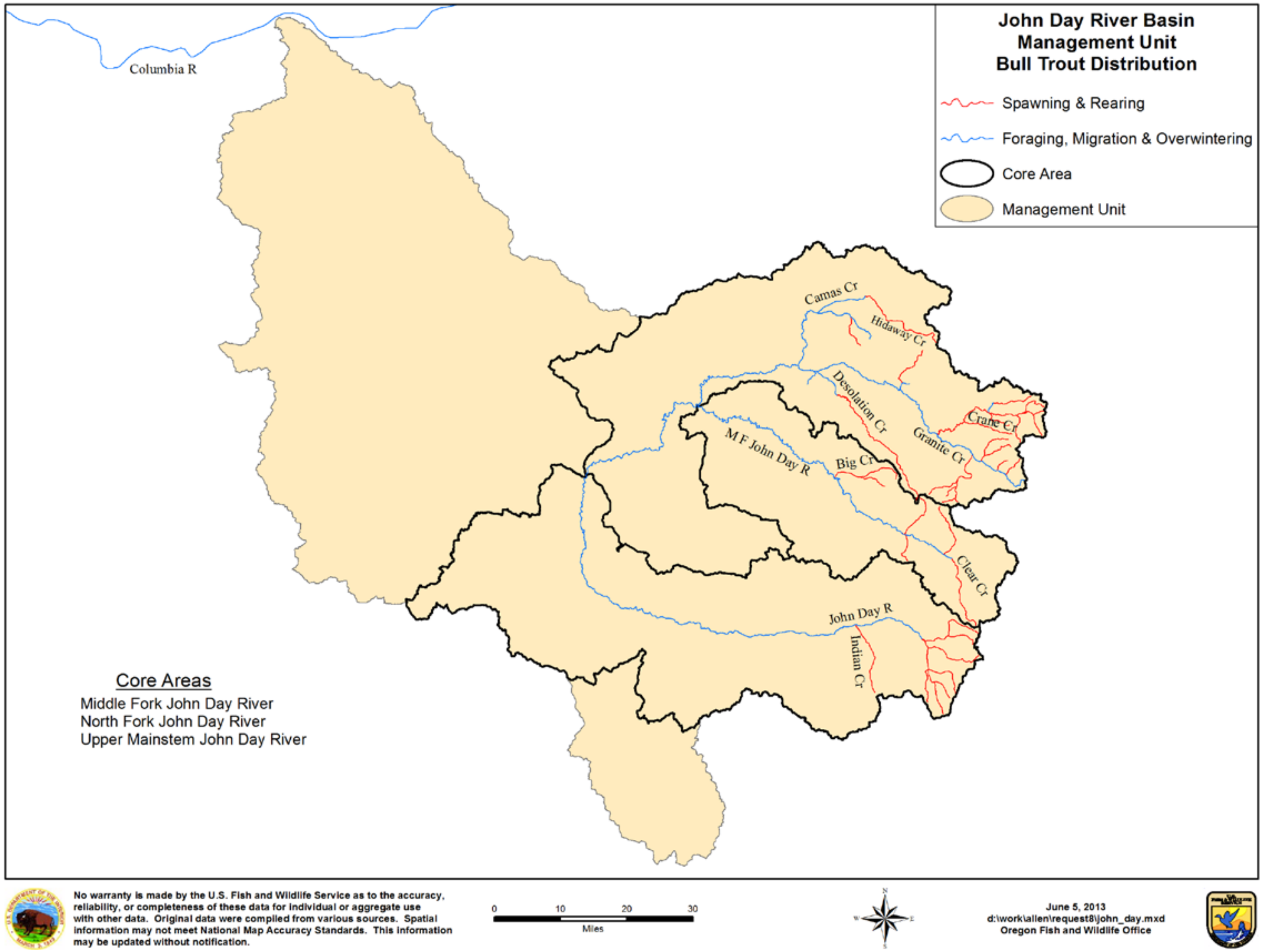
Oregon Fish and Wildlife Office


John Day River Basin
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Core Area
Management Unit
Columbia R
Camas Cr
Hidaway Cr
Desolation Cr
Granite Cr
Crane Cr
M F John Day R
Big Cr
Clear Cr
John Day R
Indian Cr
Core Areas
Middle Fork John Day River
North Fork John Day River
Upper Mainstem John Day River
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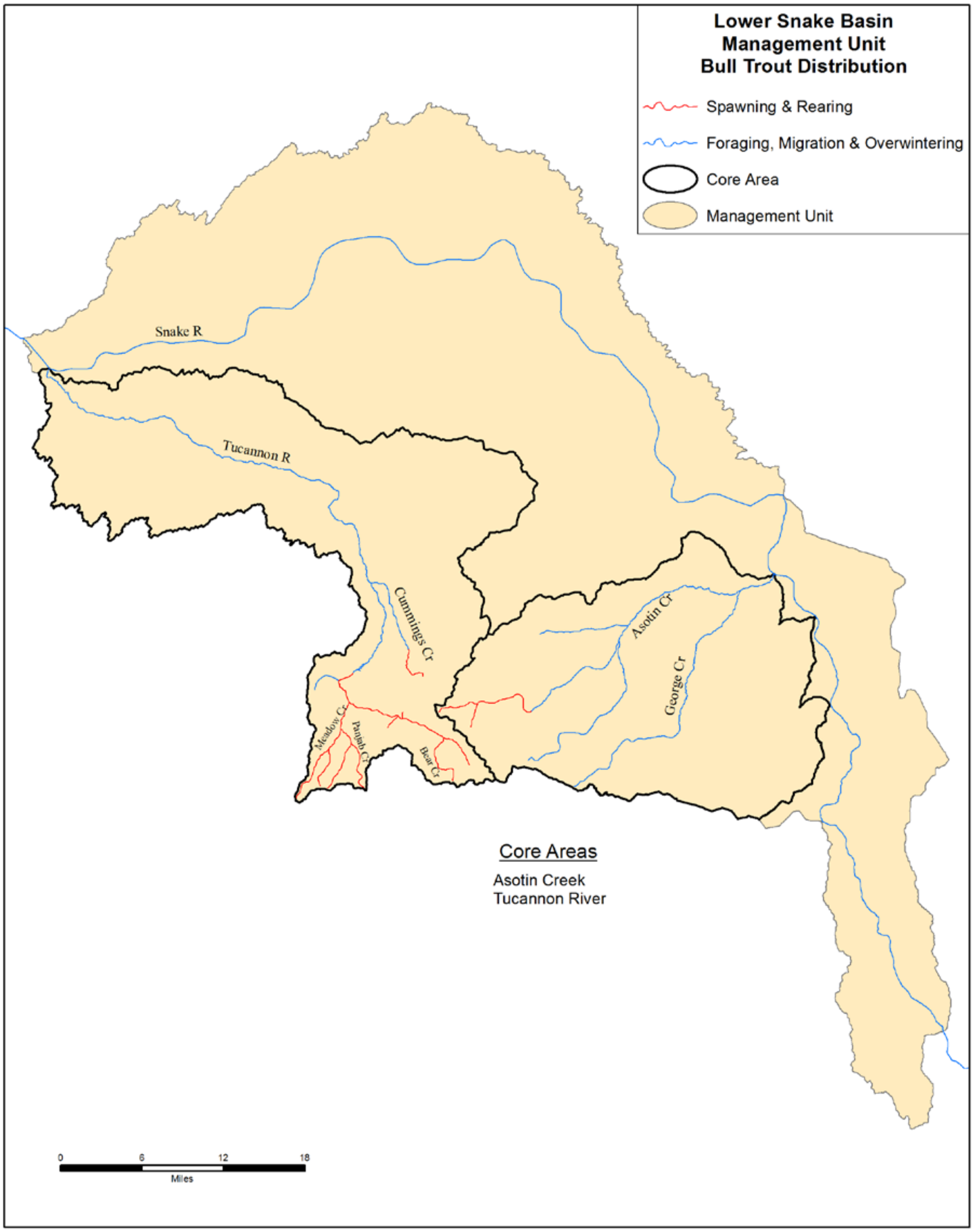
0
10
20
30
Miles
June 5, 2013
d:\work\allen\request8\john_day.mxd
Oregon Fish and Wildlife Office



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June 5, 2013
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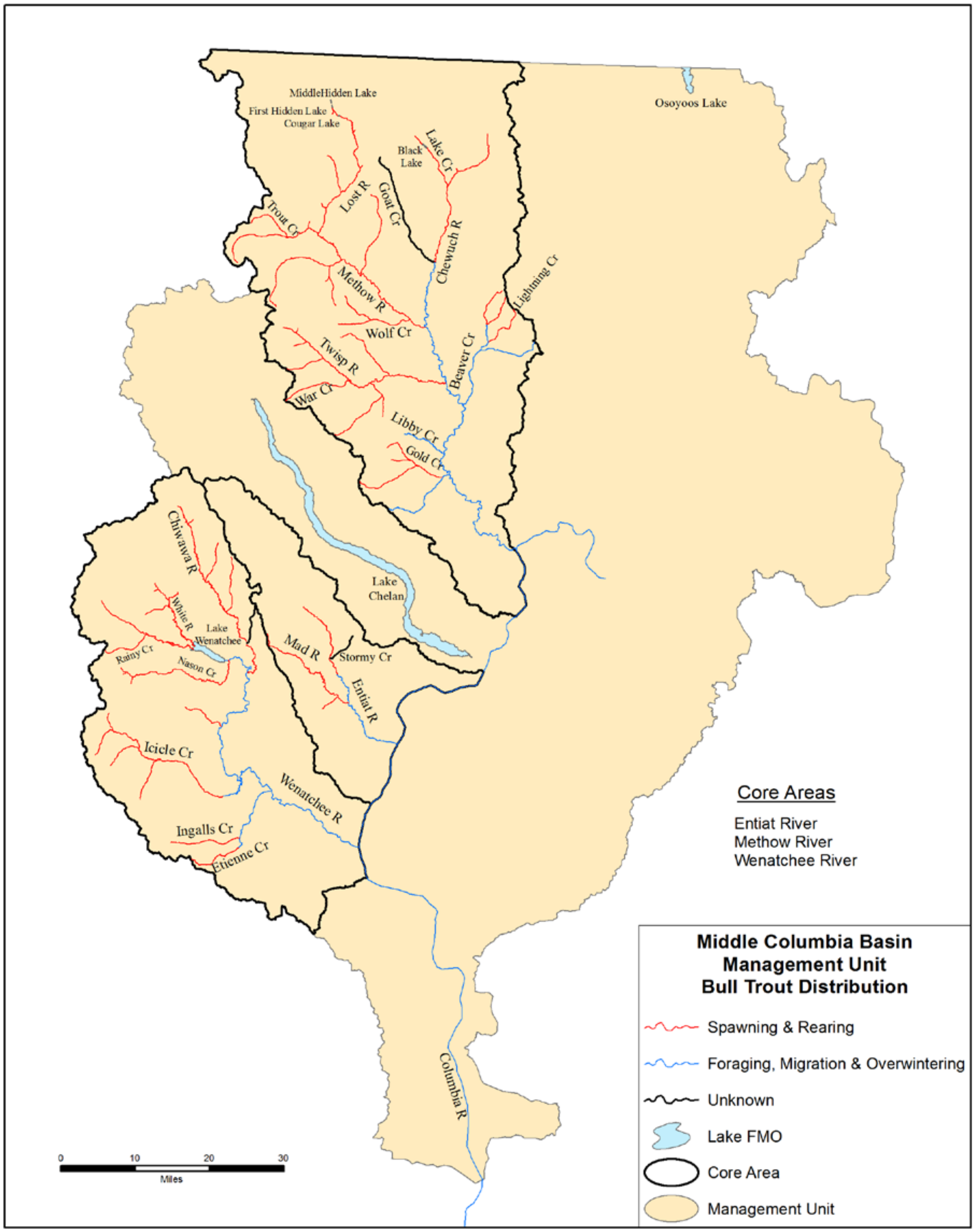
Oregon Fish and Wildlife Office



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July 1, 2013
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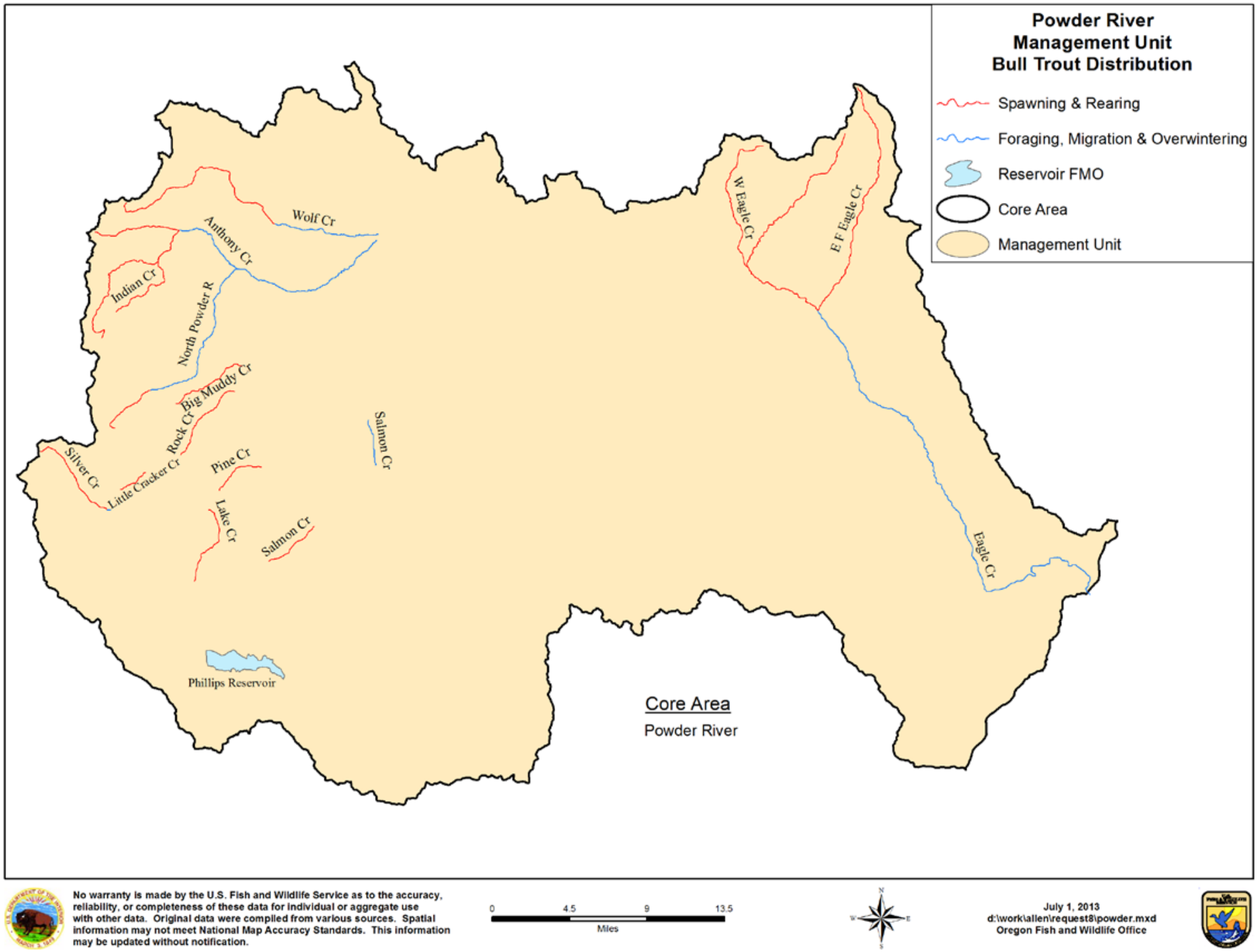
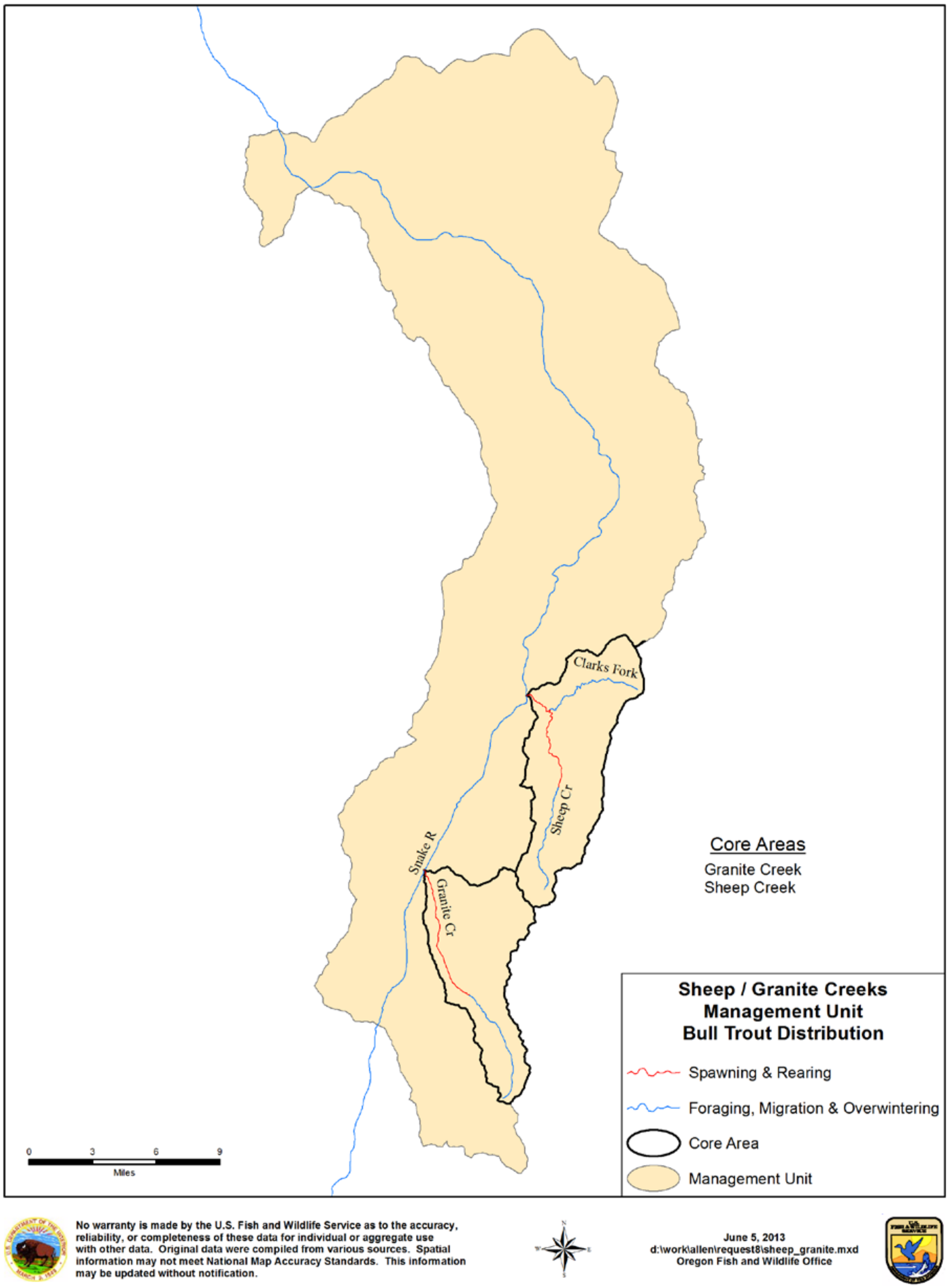
Oregon Fish and Wildlife Office


Powder River
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Reservoir FMO
Core Area
Management Unit
Wolf Cr
Anthony Cr
Indian Cr
North Powder R
Big Muddy Cr
Rock Cr
Silver Cr
Little Cracker Cr
Pine Cr
Lake Cr
Salmon Cr
Salmon Cr
Phillips Reservoir
W Eagle Cr
E F Eagle Cr
Eagle Cr
Core Area
Powder River
No warranty is made by the U.S. Fish and Wildlife Service as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.
0
4.5
9
13.5
Miles
July 1, 2013
d:\work\allen\request8\powder.mxd
Oregon Fish and Wildlife Office


Clarks Fork
Sheep Cr
Snake R
Granite Cr
Core Areas
Granite Creek
Sheep Creek
Sheep / Granite Creeks
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Core Area
Management Unit
0 3 6 9
Miles
No warranty is made by the U.S. Fish and Wildlife Service as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.
June 5, 2013
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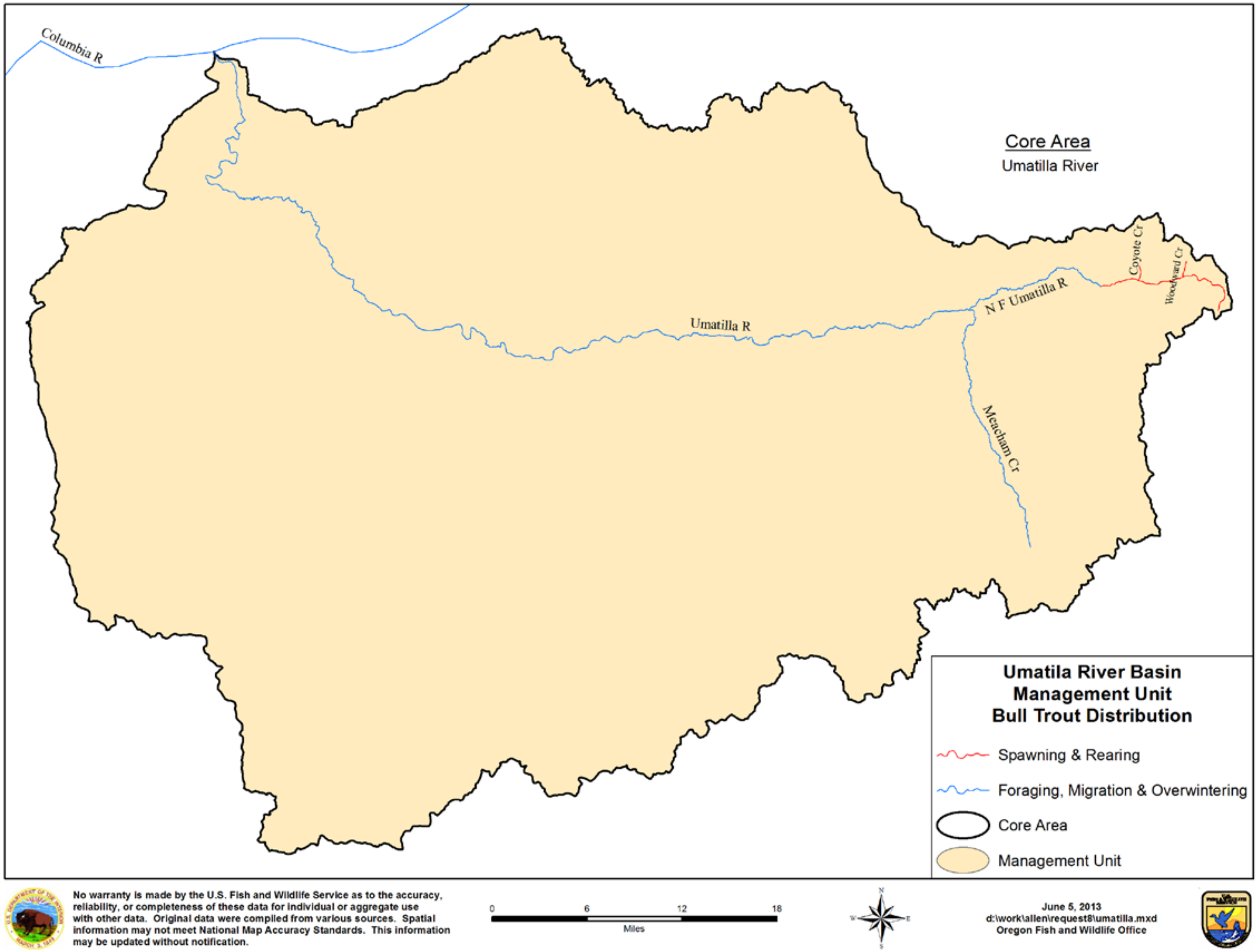
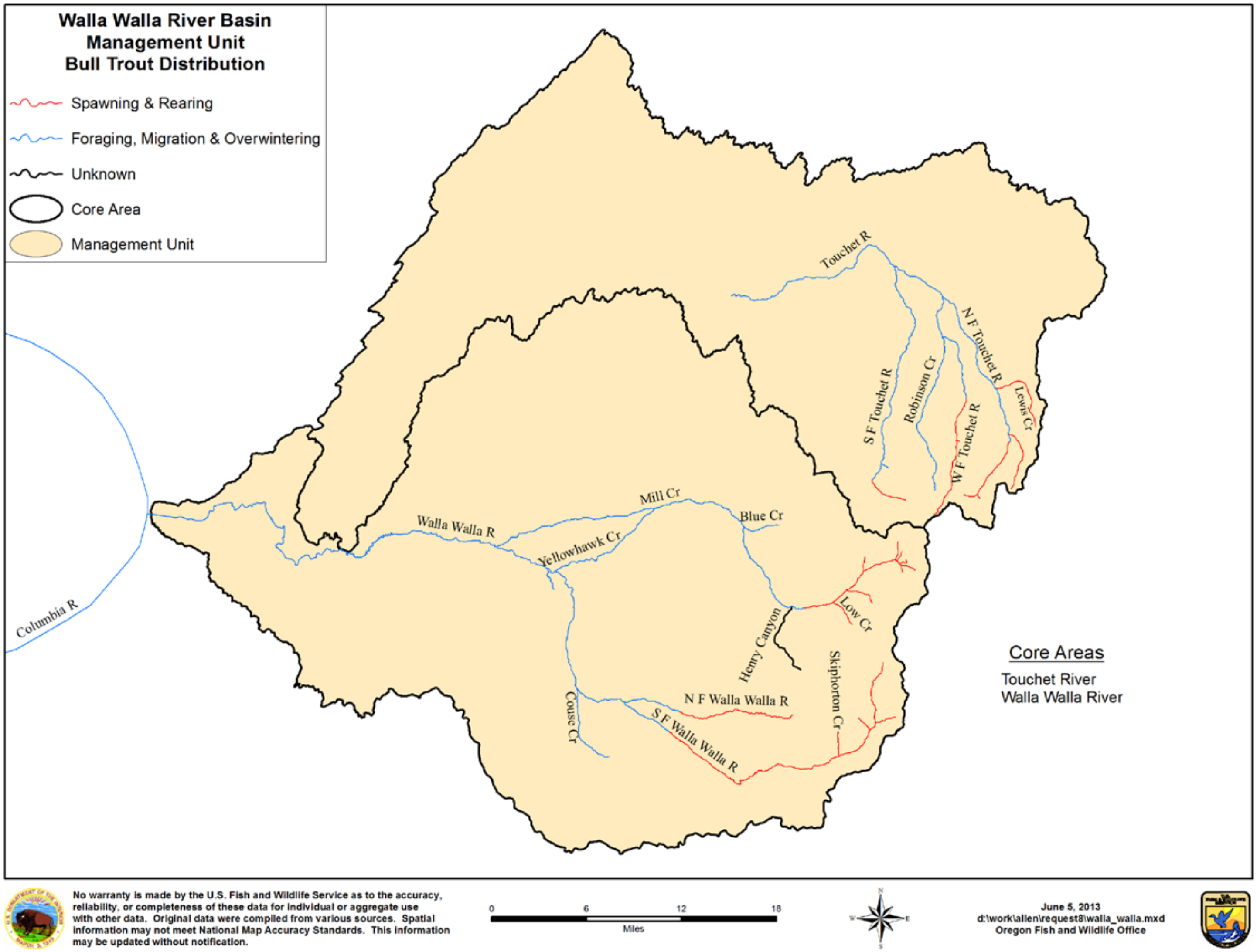
Oregon Fish and Wildlife Office


Columbia R
Core Area
Umatilla River
Coyote Cr
Woodward Cr
N F Umatilla R
Umatilla R
Meacham Cr
Umatila River Basin
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Core Area
Management Unit
No warranty is made by the U.S. Fish and Wildlife Service as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.
0
6
12
18
Miles
June 5, 2013
d:\work\allen\request8\umatilla.mxd
Oregon Fish and Wildlife Office


Walla Walla River Basin
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Unknown
Core Area
Management Unit
Touchet R
N F Touchet R
S F Touchet R
Robinson Cr
W F Touchet R
Lewis Cr
Mill Cr
Blue Cr
Walla Walla R
Yellowhawk Cr
Columbia R
Low Cr
Henry Canyon
Skiphorton Cr
N F Walla Walla R
S F Walla Walla R
Couse Cr
Core Areas
Touchet River
Walla Walla River
No warranty is made by the U.S. Fish and Wildlife Service as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.
0
6
12
18
Miles
June 5, 2013
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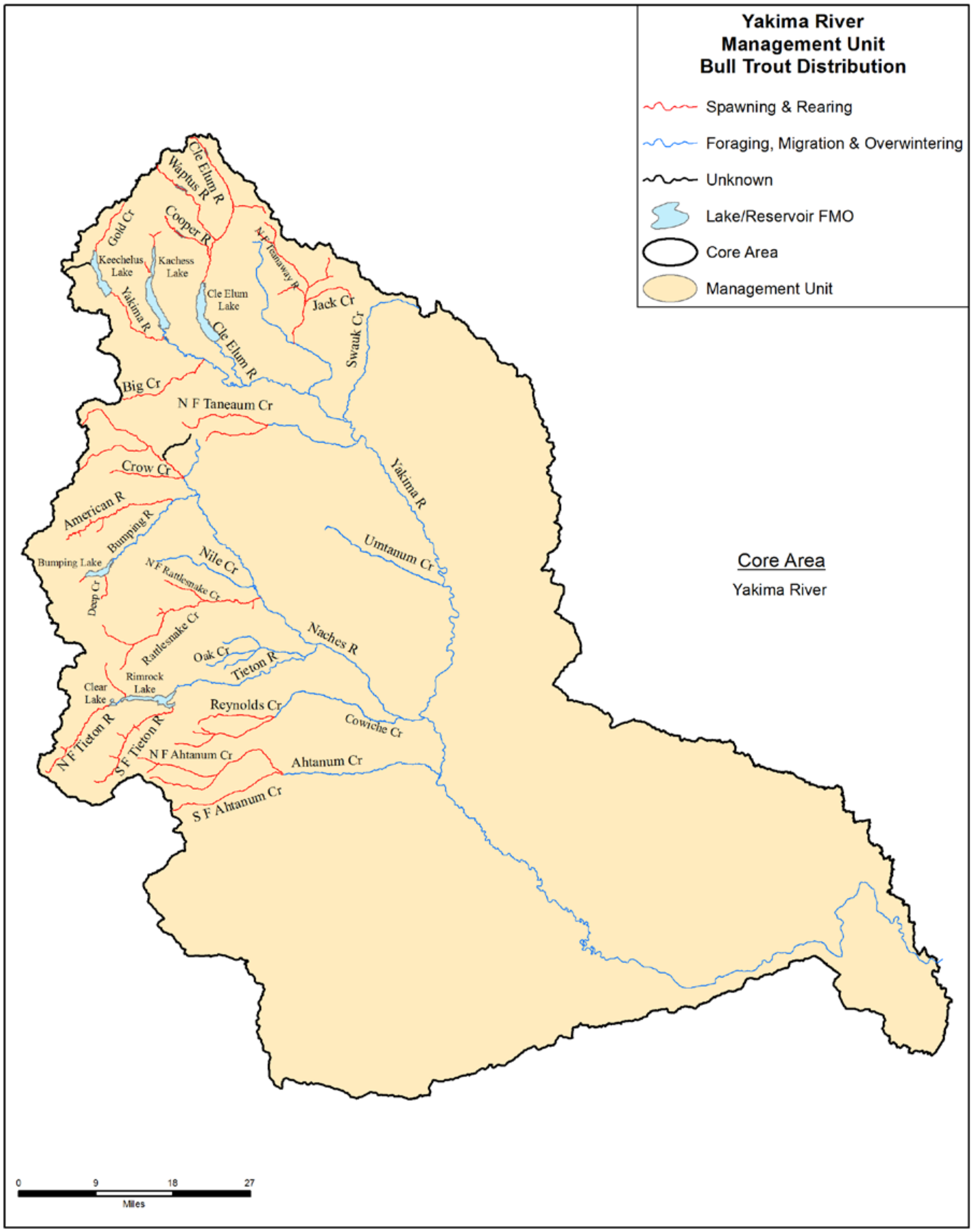
Oregon Fish and Wildlife Office



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July 1, 2013
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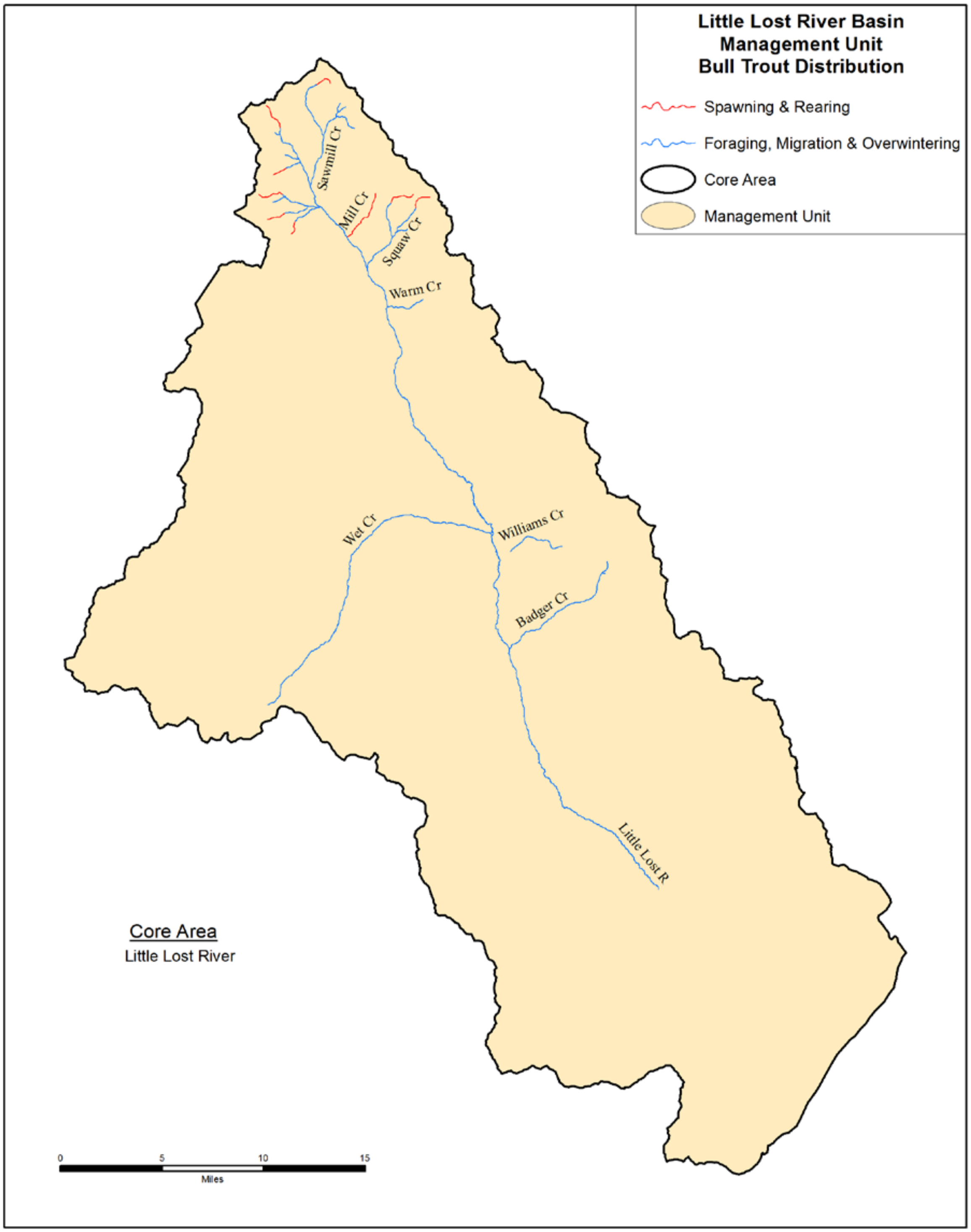
Oregon Fish and Wildlife Office



June 5, 2013
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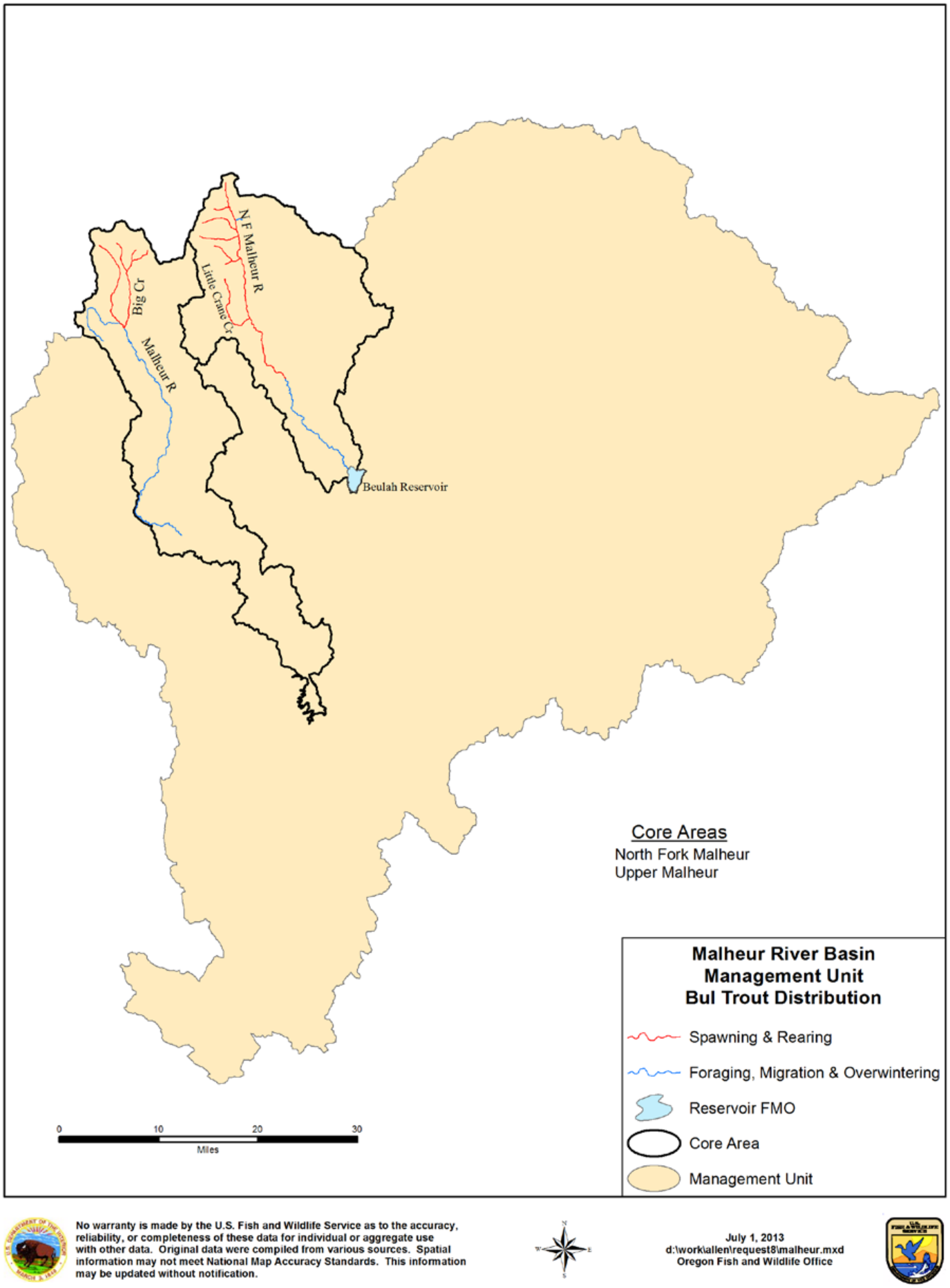
Oregon Fish and Wildlife Office


N F Malheur R
Little Crane Cr
Big Cr
Malheur R
Beulah Reservoir
Core Areas
North Fork Malheur
Upper Malheur
Malheur River Basin
Management Unit
Bul Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Reservoir FMO
Core Area
Management Unit
0
10
20
30
Miles
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July 1, 2013
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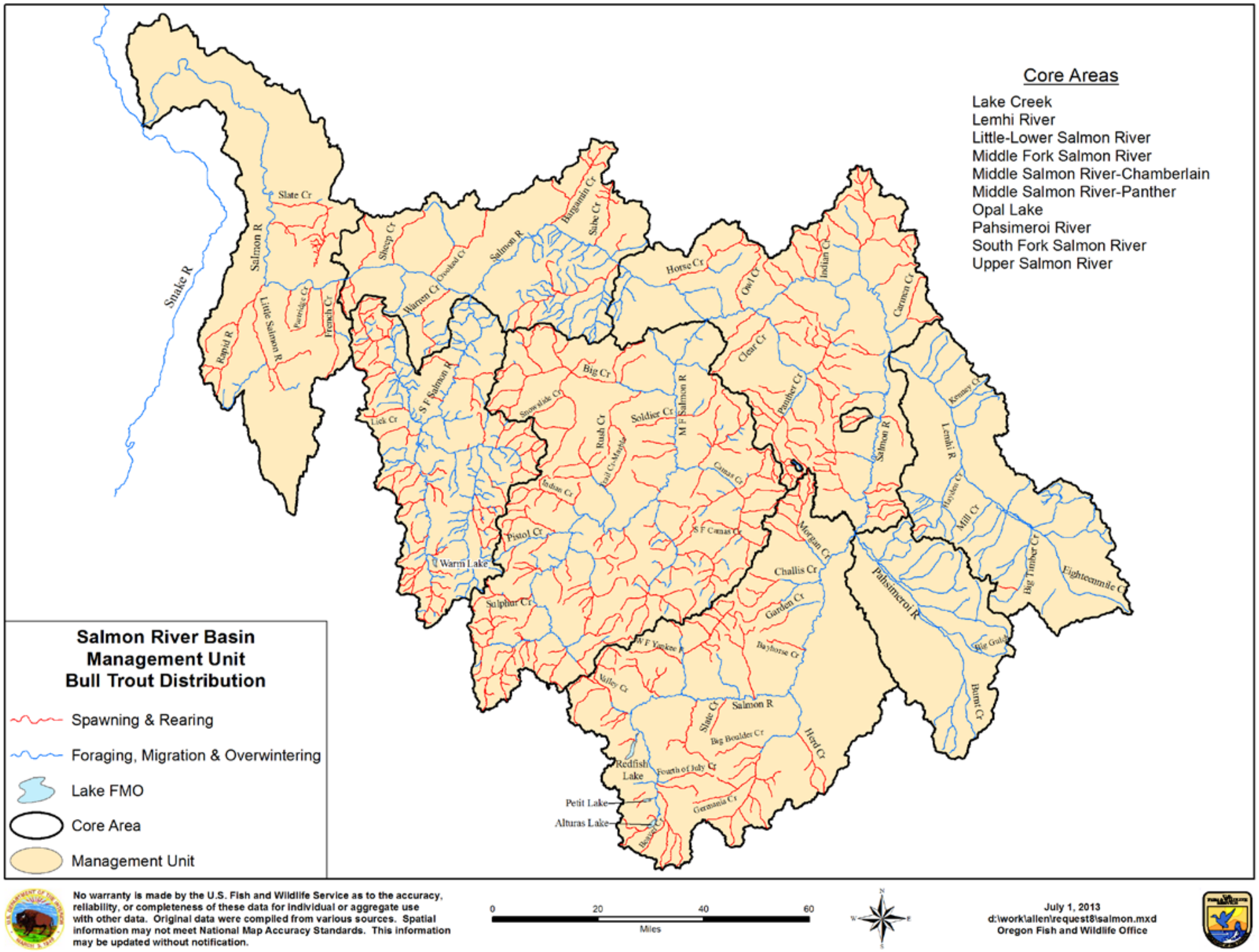
Oregon Fish and Wildlife Office


Core Areas
Lake Creek
Lemhi River
Little-Lower Salmon River
Middle Fork Salmon River
Middle Salmon River-Chamberlain
Middle Salmon River-Panther
Opal Lake
Pahsimeroi River
South Fork Salmon River
Upper Salmon River
Salmon River Basin
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Lake FMO
Core Area
Management Unit
Snake R
Salmon R
Slate Cr
Little Salmon R
Rapid R
French Cr
Sheep Cr
Warren Cr
Salmon R
Bargamin Cr
Sabe Cr
Horse Cr
Owl Cr
Indian Cr
Carmen Cr
Big Cr
Clear Cr
Panther Cr
Kenney Cr
Lemhi R
S F Salmon R
Lick Cr
Soldier Cr
M F Salmon R
Rush Cr
Salmon R
Camas Cr
Hayden Cr
Mill Cr
Indian Cr
Pistol Cr
S F Camas Cr
Morgan Cr
Big Timber Cr
Eighteenmile Cr
Warm Lake
Challis Cr
Pahsimeroi R
Sulphur Cr
Garden Cr
Bayhorse Cr
W F Yankee F
Valley Cr
Slate Cr
Salmon R
Herd Cr
Big Boulder Cr
Redfish Lake
Fourth of July Cr
Petit Lake
Alturas Lake
Germania Cr
0
20
40
60
Miles
No warranty is made by the U.S. Fish and Wildlife Service as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. Spatial information may not meet National Map Accuracy Standards. This information may be updated without notification.
July 1, 2013
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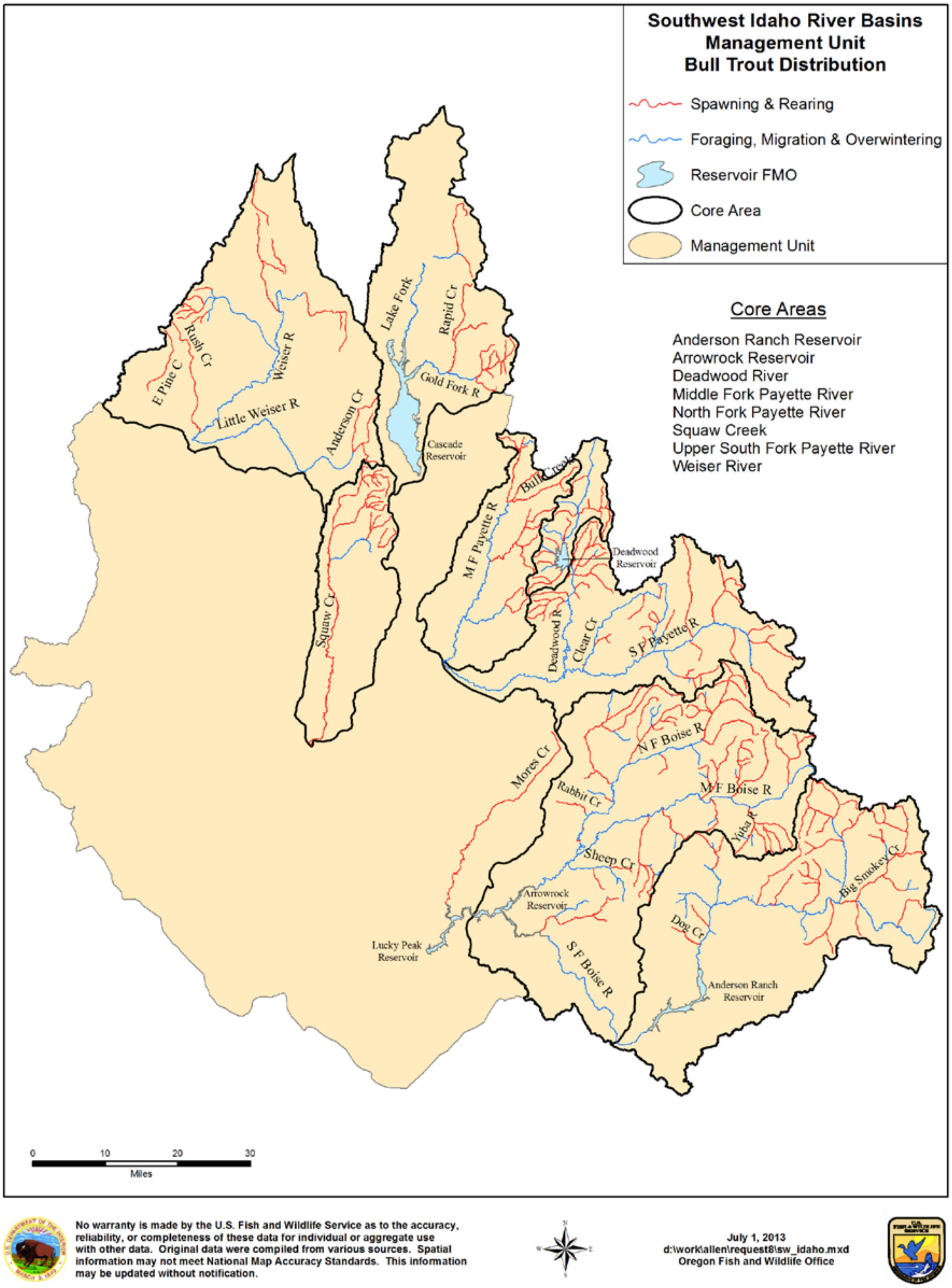
Oregon Fish and Wildlife Office



Southwest Idaho River Basins
Management Unit
Bull Trout Distribution
Spawning & Rearing
Foraging, Migration & Overwintering
Reservoir FMO
Core Area
Management Unit
Core Areas
Anderson Ranch Reservoir
Arrowrock Reservoir
Deadwood River
Middle Fork Payette River
North Fork Payette River
Squaw Creek
Upper South Fork Payette River
Weiser River
Rush Cr
E Pine C
Weiser R
Little Weiser R
Anderson Cr
Lake Fork
Rapid Cr
Gold Fork R
Cascade Reservoir
Bull Creek
M F Payette R
Deadwood Reservoir
Squaw Cr
Deadwood R
Clear Cr
S F Payette R
N F Boise R
Mores Cr
Rabbit Cr
M F Boise R
Yuba R
Sheep Cr
Big Smokey Cr
Arrowrock Reservoir
Lucky Peak Reservoir
Dog Cr
S F Boise R
Anderson Ranch Reservoir
0
10
20
30
Miles
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July 1, 2013
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Oregon Fish and Wildlife Office