United States Department of the Interior

U.S. Fish and Wildlife Service

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

Steve Freese, Assistant Regional Administrator
Sustainable Fisheries Division
National Marine Fisheries Service
7600 Sand Point Way N.E., Bldg. 1
Seattle, Washington 98115

MAY 16 2017

Subject: National Marine Fisheries Service Issuance of two Section 10(a)(1)(A) Permits for the Continued Operation of Snake River Fall Chinook Salmon Hatchery Program—Snake River and Clearwater River Basins, Washington, Oregon, and Idaho—Biological Opinion
In Reply Refer to: 01EIFW00-2012-F-0448

Dear Mr. Freese:

Enclosed is the U.S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) on the National Marine Fisheries Service's (NMFS) determinations of effect on species listed under the Endangered Species Act (Act) of 1973, as amended, for the approval of two section 10(a)(1)(A) permits for fall Chinook hatchery facilities and operations located in the Snake River basin in Idaho, Oregon, and Washington, and the Clearwater River basin in Idaho. This consultation addresses all aspects of the fall Chinook hatchery program as outlined in the Hatchery and Genetic Management Plans, and is intended to document compliance with the Act for all associated partners who authorize, fund, or carry out various components of the program. In addition to NMFS, these partners include: Bonneville Power Administration (BPA), Washington Department of Fish and Wildlife (WDFW), Idaho Department of Fish and Game (IDFG), Idaho Power Company (IPC), Oregon Department of Fish and Wildlife (ODFW), the U.S. Bureau of Indian Affairs (BIA), the Nez Perce Tribe (NPT), and the Service (the Lower Snake River Compensation Plan Office (LSRCP) and the Idaho Fisheries Resources Office (IFRO)[1]).

In a letter dated September 6, 2012, and received by the Service on September 10, NMFS requested formal consultation on the determination under section 7 of the Act that issuance of the permits is likely to adversely affect bull trout (*Salvelinus confluentus*) and bull trout critical habitat. NMFS also determined that the permits will have no effect on the Canada lynx (*Lynx canadensis*), pygmy rabbit (*Brachylagus idahoensis*), gray wolf (*Canis lupus*), Spalding's catchfly (*Silene spaldingii*), MacFarlane's four-o'clock (*Mirabilis macfarlanei*), Howells's

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[1] IFRO is now known as the Idaho Fish and Wildlife Conservation Office. In the enclosed Opinion, we will use IFRO to retain consistency with existing permits.

spectacular thelypody (*Thelypodium howellii*), or Ute ladies'-tresses (*Spiranthes diluvialis*). The Service acknowledges these determinations.

The enclosed Opinion is based primarily on our review of the proposed action, as described in your 2012 Assessment, revised 2015 Biological Assessments (Assessment), 2017 Addendum to the Assessment, and the anticipated effects of the action on listed species, and was prepared in accordance with section 7 of the Act. Our Opinion concludes that the proposed issuance of the permits will not jeopardize the continued existence of bull trout and will not destroy or adversely modify bull trout critical habitat. A complete record of this consultation is on file at this office.

Thank you for your continued interest in the conservation of threatened and endangered species. Please contact Clay Fletcher at (971) 701-1497 or Russ Holder at (208) 378-5384 if you have questions concerning this Opinion.

Sincerely,

Gregory M. Hughes
State Supervisor

Enclosure

cc: NMFS, Portland (Busak)
NMFS, Lacey (Dixon)
BPA, Portland (Grange, Peterson, Jule)
FWS-LSRCP, Boise (Collins)
FWS-EWFO, Spokane (MacRae, Eames, Kuttel)
FWS-LFO, LaGrande (Miller, Sausen)
FWS-RO, Portland (Brown)
NPT, Lapwai (Johnson)
WA DFW (Donnelly, Tribble)
ID DFG (Hassemer)
OR DFW (Eddy, Myatt)

BIOLOGICAL OPINION

FOR THE
ISSUANCE OF TWO SECTION 10(a)(1)(A) PERMITS FOR THE CONTINUED OPERATION OF SNAKE RIVER FALL CHINOOK SALMON HATCHERY PROGRAMS

01EIFW00-2012-F-0448

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

Gregory M. Hughes

Gregory M. Hughes
State Supervisor

Date MAY 1 6 2017

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1. BACKGROUND

1.1 Introduction

The U.S. Fish and Wildlife Service (Service) has prepared this Biological Opinion (Opinion) of the effects of the issuance of two section 10(a)(1)(A) permits for the continued operation and maintenance of Snake River fall Chinook salmon (*Oncorhynchus tshawytscha*) hatchery program on bull trout (*Salvelinus confluentus*) and bull trout critical habitat. In a letter dated September 6, 2012 and received on September 10, the National Marine Fisheries Service (NMFS) requested formal consultation with the Service under section 7 of the Endangered Species Act (Act) of 1973, as amended, for its proposal to implement the action. NMFS determined that the proposed action is likely to adversely affect bull trout and bull trout critical habitat. As described in this Opinion, and based on the Biological Assessment (NMFS 2015, entire) and Addendum to the Assessment (NMFS 2017, entire) developed by NMFS, and other information, the Service has concluded that the action, as proposed, is not likely to jeopardize the continued existence of bull trout and is not likely to destroy or adversely modify bull trout critical habitat

NMFS also determined that the permits will have no effect on the Canada lynx (*Lynx canadensis*), pygmy rabbit (*Brachylagus idahoensis*), gray wolf (*Canis lupus*), Spalding's catchfly (*Silene spaldingii*), MacFarlane's four-o'clock (*Mirabilis macfarlanei*), Howells's spectacular thelypody (*Thelypodium howellii*), and Ute ladies'-tresses (*Spiranthes diluvialis*). The Service acknowledges these determinations.

This consultation addresses all aspects of the fall Chinook hatchery program as outlined in the Hatchery and Genetic Management Plans (BIA 2011, entire; WDFW 2005, entire), and is intended to document Act compliance for all associated partners who authorize, fund, or carry out various components of the program. In addition to NMFS, these partners include the Bonneville Power Administration (BPA), Washington Department of Fish and Wildlife (WDFW), Idaho Department of Fish and Game (IDFG), Idaho Power Company (IPC), Oregon Department of Fish and Wildlife (ODFW), the U.S. Bureau of Indian Affairs (BIA), the Nez Perce Tribe (NPT), and the Service (the Lower Snake River Compensation Plan Office (LSRCP) and the Idaho Fisheries Resources Office (IFRO[2])).

The Snake River fall Chinook hatchery program includes research, monitoring, and evaluation (RM&E) activities that may adversely affect and result in incidental take of bull trout. Some of these activities, that have been or are currently covered by Service section 10(a)(1)(A) recovery permits, will be covered in this Opinion and the coverage will become effective when the Opinion is issued.

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[2] IFRO is now known as the Idaho Fish and Wildlife Conservation Office. In this Opinion we will use IFRO to retain consistency with existing permits.

1.2 Consultation History

The Service has had the following communication and coordination with NMFS and other partners on the proposed action.

May 3, 2012:	The Service participated in a conference call with NMFS to discuss the need to consult with the Service on the proposed action.
May 21, 2012:	The Service (Regional Office (RO) and Idaho Fish and Wildlife Office (IFWO)) participated in communications with NMFS seeking clarification on NMFS' proposed action, and whether components of the action had been addressed previously through other mechanisms.
July 13, 2012:	The Service participated in a conference call with NMFS, and with Service organizations, including RO-Ecological Services, RO-Fisheries, and the LSRCP, to discuss the section 10 permit program for Snake River fall Chinook salmon. Ultimately, it was decided that since the consultation was meant to address the entire hatchery program, separate LSRCP and NMFS section 10 assessments was not appropriate. It was originally thought to move the LSRCP consultation separately as not likely to adversely affect (NLAA) consultations for species and habitat, to ensure consultation was completed prior to an August 18 deadline. The decision was to have a single assessment covering all aspects of the hatchery management program.
July 23, 2012:	The Service received a draft Assessment from NMFS.
August 9, 2012:	The Service provided comments on the draft Assessment (NMFS and LSRCP components) to NMFS. It was noted that the Assessment needed to clarify whether bull trout would be trapped or not, as this would clarify the appropriateness of the NLAA determination contained in the original draft Assessment.
September 6, 2012:	The Service received an email from NMFS requesting formal consultation. Hard copies were received on September 10, 2012.
September 14, 2012:	The Service participated in a call with the RO and Eastern Washington Fish and Wildlife Office EWFO to discuss the adequacy of the Assessment. All agreed that although the Assessment could use additional work, given the ramifications, the Assessment was accepted as adequate for initiating consultation.
September 18, 2012:	The Service sent a letter to NMFS conditionally accepting the Assessment as adequate for initiation of formal consultation. Through this letter, it was noted that an extended time frame would be necessary to address additional information needs and to account for other Service priorities.
October 17, 2012:	The Service sent comments on the draft Assessment to NMFS by email.
November 27, 2012:	The Service participated in a coordination call with NMFS, the RO, the LSRCP, and the BPA to ensure that all action agencies involved with the proposed action provide input so all potential effects could be identified.

March 18, 2013:	The Service received a revised draft Assessment from NMFS by email.
April 9, 2013:	The Service exchanged emails with NMFS to extend the timeline for completing formal consultation.
May 2, 2013:	The Service sent comments on the draft Assessment to NMFS by email.
April 2, 2014	The Service received a revised draft Assessment from NMFS by email.
February 9, 2015:	The Service received a revised Assessment from NMFS via email. The Service responded by email on March 6, 2015 stating that the Assessment was adequate to initiate formal consultation.
August 4, 2015:	The Service sent a draft Opinion to NMFS and other action agencies for review.
October 21, 2015:	The Service participated in a conference call with NMFS, BPA, and LSRCP to discuss the review of the draft Opinion, coverage for RM&E in the Opinion, and clarification on maintenance activities.
December 14, 2015:	The Service participated in a conference call with NMFS to discuss an additional RM&E activity at Lower Granite Dam to be included in an Addendum to the Assessment (Addendum). Additional topics included routine versus non-routine maintenance and covering RM&E in the Opinion.
February 22, 2016:	The Service participated in a conference call with NMFS, BPA, LSRCP, and LaGrande and Spokane FOs to discuss the draft Opinion. NMFS and BPA began preparing the Addendum to cover maintenance and RM&E
August 22, 2016:	The Service received comments on the draft Opinion from the action agencies and received a draft Addendum from NMFS in separate emails.
September 13, 2016:	The Service sent comments on the draft Addendum to NMFS by email.
February 8, 2017:	The Service participated in a conference call with NMFS to discuss the Addendum. We also received BPA comments on the draft Opinion by email on this date (forwarded by NMFS).
March 7, 2017:	The Service received a revised Addendum from NMFS by email.
March 8, 2017:	The Service participated in a conference call with NMFS to discuss the Addendum.
March 14, 2017:	The Service received the final Addendum to the Assessment from NMFS by email.
March 15, 2017:	The Service sent, by email, the RM&E effects section and RM&E and Maintenance Best Management Practices (BMPs) section to NMFS for review.
March 21, 2017:	The Service sent, by email, the draft Incidental Take Statement (ITS) to NMFS for review.

March 24, 2017: The Service received an email from NMFS stating that both NMFS and the NPT had no comments on the draft RM&E effects section, the RM&E and Maintenance BMPs sections, and the draft ITS. NMFS and the NPT both agreed with the contents of these sections of the Opinion.

2. BIOLOGICAL OPINION

2.1 Description of the Proposed Action

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

2.1.1 Action Area

The action area for the analysis of the effects of the proposed activities will primarily focus on the lower Snake and Clearwater River basins, where the hatchery program activities are located, including the South Fork Clearwater River, Selway River, Lapwai Creek, Grande Ronde River, Imnaha River, and Tucannon River subbasins. Activities occurring in the mainstem Clearwater, Lower Snake, and mid-Columbia Rivers are also included in the action area (Figure 1). It is recognized that fish released from the program also inhabit the lower Columbia River, some of its tributaries, and the Pacific Ocean, however, this Opinion is more narrowly focused on the operational elements of the Snake River fall Chinook hatchery program.

2.1.2 Proposed Action

The following description of the proposed action is adapted from the Assessment (NMFS 2015, pp. 11-45), an Addendum to the Assessment (NMFS 2017, entire), and the two section 10(a)(1)(A) permits that are the subject of this consultation (NMFS 2012a, entire; 2012b, entire).

The proposed action is NMFS issuance of two research/enhancement permits under section 10(a)(1)(A) of the Act (permit numbers 16607 and 16615), which include the proposed actions of other agencies authorizing, funding, and carrying out proposed actions in the Hatchery and Genetic Management Plans (HGMPs). The permits authorize the continued operation and maintenance of the hatchery program for the listed Snake River fall Chinook salmon population through December 31, 2017, as described below.

Permit Number 16607: Operation, Monitoring, and Evaluation of the Lyons Ferry Hatchery fall Chinook salmon program, including the Fall Chinook Acclimation Program and Idaho Power Company (IPC) Fall Chinook Mitigation Program, issued to the Washington Department of Fish and Wildlife (WDFW), the Idaho Department of Fish and Game (IDFG), the Oregon Department of Fish and Wildlife (ODFW), and the U.S. Bureau of Indian Affairs (BIA) on behalf of Nez Perce Tribe.

Artificial production of Snake River fall Chinook salmon occurs through four hatchery programs: (1) the Lower Snake River Compensation Plan (LSRCP), which involves the Lyons Ferry Hatchery (LFH) program and (2) Fall Chinook Acclimation Program (FCAP); (3) the IPC program; and (4) Nez Perce Tribal Hatchery (NPTH). Activities occurring specifically for the NPTH programs are covered under sister permit number 16615.

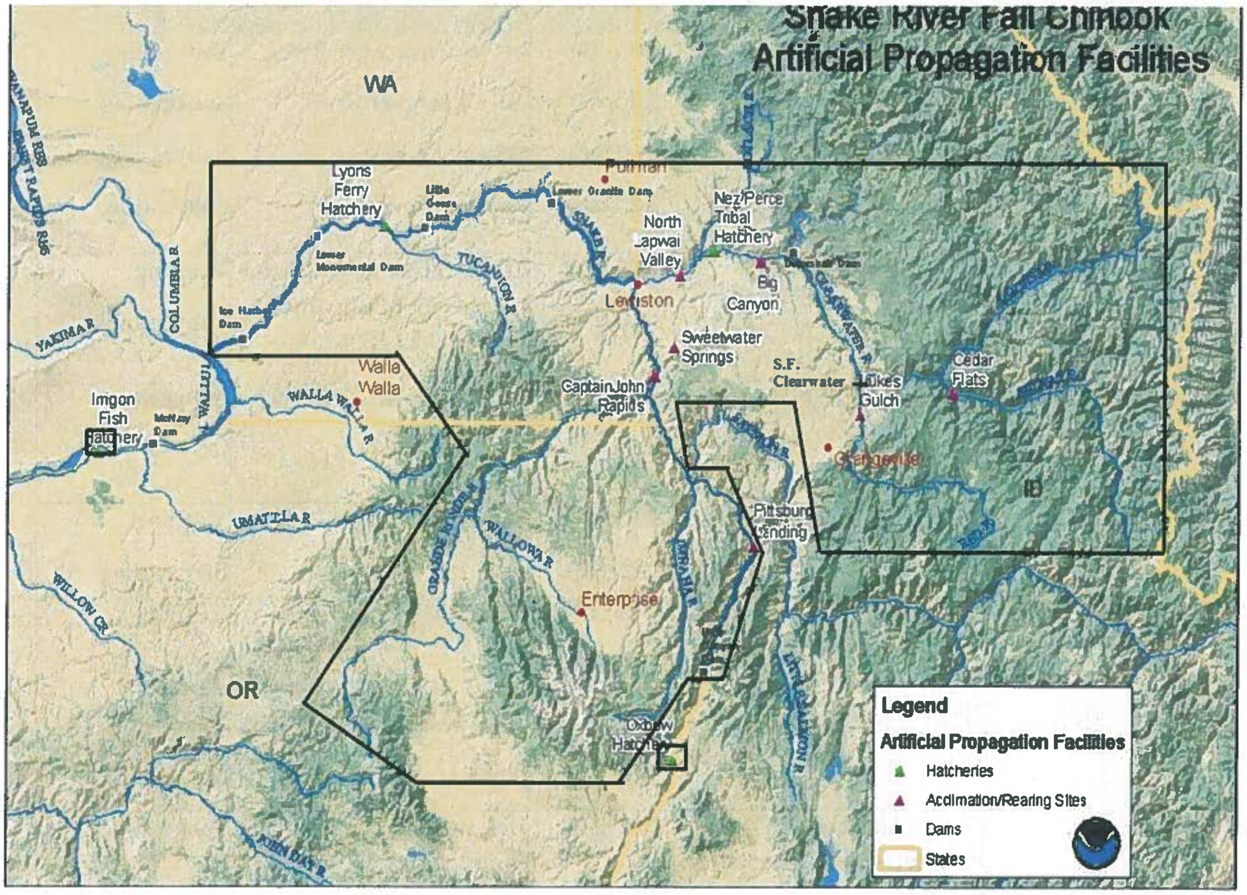

Figure 1. Snake River basin fall Chinook salmon program Action Area (black outline), with the locations of pertinent hatchery, acclimation facilities, and release sites. Irrigon Hatchery and Oxbow Hatchery are also included in the action area (from the Assessment, Figure 2).

The four programs are highly coordinated in their operations, including broodstock collection and fish transfers between facilities. In addition to the in-basin (Snake River) facilities and acclimation sites, out-of-basin hatchery facilities are utilized (Irrigon (ODFW) and Oxbow (IDFG)).

This permit covers program activities involving collection and sampling of adult fall Chinook salmon for broodstock and run reconstruction at Lower Granite Dam (LGR), LFH, and NPTH. This permit also covers all other artificial production activities and all RM&E activities associated with the LFH program, the FCAP, and the IPC program. Artificial production activities and RM&E occurring specifically for the NPTH program are covered under sister permit 16615, as described further below.

Table 1. Current Snake River fall Chinook salmon hatchery annual release goals by operator, location of release, and number of fish released (from the Assessment).

Program Operator	Funding Agency	Rearing Facility	Release Number	Release Location (RM = River Mile)	Life stage Released[1]
NPT	BPA	NPTH Luke's Gulch Cedar Flats North Lapwai	500,000 200,000 200,000 500,000	Lower Clearwater River SF Clearwater River Selway River Lapwai Creek	Subyearling Subyearling Subyearling Subyearling
WDFW	LSRCP	Lyons Ferry Hatchery	450,000 200,000	Lower Snake River (below Little Goose Dam, direct release at LFH)	Yearling Subyearling
WDFW/ODFW	LSRCP	Irrigon Hatchery	400,000	Grande Ronde (RM 31) (direct release)	Subyearling
NPT/WDFW	BPA	FCAP[2] – Pittsburg Landing	150,000 400,000	Snake River (RM 215)	Yearling Subyearling
NPT/WDFW	BPA	FCAP – Captain John Rapids	150,000 700,000	Snake River (RM 165)	Yearling Subyearling
NPT/WDFW	BPA	FCAP – Big Canyon	150,000 500,000	Clearwater River (RM 35)	Yearling Subyearling
IDFG/ODFW/ IPC	IPC	Oxbow Hatchery*(IDFG) Irrigon/Umatilla Hatcheries (ODFW)	1,000,000	Below Hells Canyon Dam (direct release)	Subyearling

* Currently, the 200,000 subyearlings previously reared at Oxbow Hatchery are now reared at Irrigon Hatchery. This practice will continue indefinitely. Effects from operation of Oxbow Hatchery are included in this Opinion in the event that the production of subyearling fall Chinook at Oxbow is reinstituted.

[1] Yearling fall Chinook are typically released in April (larger size, cooler water temperatures, and less feeding) and move seaward fastest (mean travel time from Pittsburg Landing to LGR was 10 -12 days in 1997 and 1998). Subyearlings are typically released in late May or early June (smaller size, warmer water temperatures, and higher feeding rates) and move seaward slower, may remain in the reservoirs longer, and may overwinter in the reservoirs prior to completing their seaward migration in the spring (mean travel from Pittsburg landing to LGR was 25-58 days) (Conner et. al. 2004, p. 552).

[2] Fall Chinook Acclimation Project

Adult fall Chinook salmon are collected at LGR for broodstock and run reconstruction estimates for all programs. Broodstock may also be collected at LFH and NPTH, if necessary. Annually, these programs produce up to 5,500,000 juveniles released as yearlings (900,000) and subyearlings (4,600,000) (Table 1). Releases occur at locations in the Snake, Clearwater, and Grande Ronde Rivers as agreed to by co-managers through the 2008-2017 *U.S. v Oregon* Management Agreement (*U.S. v Oregon* 2008).

The LFH program is funded under the LSRCP, and is operated by WDFW. The LSRCP was authorized by the Water Resources Development Act of 1976 (PL 94-587, section 102, 94th Congress, 22 October 1976) to "replace fish and wildlife losses caused by the construction and operation of Ice Harbor, Lower Monumental, Little Goose and Lower Granite Lock and Dam projects." The LSCRP Office owns the LFH, with partial reimbursement by BPA under the terms of a direct funding agreement (BPA reimburses the Service for BPA's power share costs of the four lower Snake River dams). The LFH program was designed to annually return 18,300 adult Chinook to the project area after a harvest of 73,200 individuals from the ocean and Columbia River mainstem fisheries.

Under the Pacific Northwest Electric Power Planning and Conservation Act of 1980, 16 U.S.C. §§ 839 *et seq.* (Northwest Power Act), BPA must protect, mitigate, and enhance fish and wildlife affected by the development, operation, and management of federal hydroelectric facilities on the Columbia River, and its tributaries, in a manner consistent with the purposes of the Northwest Power Act and the fish and wildlife program adopted by the Northwest Power and Conservation Council. The FCAP is funded by BPA under the Northwest Power Act, and operated by the NPT.

The FCAP was developed to acclimate and release fall Chinook salmon produced at LFH upstream of LGR, in order to supplement the natural population and prevent extirpation of Snake River fall Chinook salmon. Through *U.S. v Oregon,* an agreement was made between the four Columbia River Treaty Tribes, States, and Federal agencies to annually release 450,000 yearlings and 1.4 million subyearlings at the three acclimation facilities (Table 1).

The goal for the IPC program is to annually produce 1,000,000 juvenile fall Chinook salmon to mitigate for losses caused by the construction and operation of the three Hells Canyon Complex (HCC) dams, as per the Hells Canyon Settlement Agreement (HCSA). This program is funded by IPC, with hatchery rearing activities taking place at the Irrigon (ODFW) and Oxbow (IDFG) hatcheries (Table 1).

Permit Number 16615: Operation, Monitoring, and Evaluation of the Nez Perce Tribal Hatchery Fall Chinook Salmon Program, issued to the U.S. Bureau of Indian Affairs

This permit covers program activities involving collection and sampling of adult fall Chinook salmon for broodstock and run reconstruction at LGR, LFH, and NPTH. This permit also covers all other artificial production activities and all RM&E activities associated with the NPTH program. Artificial production activities and RM&E occurring specifically for the LFH, FCAP, and IPC programs are covered under sister permit 16607, as described above.

The NPTH program is funded by the BPA under the Northwest Power Act. The interim total annual return target, based on current program production levels, is 3,206 adult fall Chinook, with a long-term return goal of 3,750 adults.

Activities necessary for the Snake River fall Chinook hatchery program, inclusive of all facilities and operators described above, include elements that are separated into two categories. One category includes elements related to the operation of the program; these elements are broodstock collection, release of hatchery juveniles, and RM&E. The other category includes elements that are related to the operation of program facilities; these elements are water withdrawal, hatchery effluent, fish disease management, and facility maintenance. These elements represent activities that are common among the various facilities and locations contained in this action. While not all of these elements occur at all of the locations, the likely effect of these elements, where they do occur and where listed species and/or their critical habitat occur, will be similar and vary only in magnitude, based on the particular location.

A description follows for each of these elements. Additionally, conservation measures and best management practices (BMPs) that are broadly applied to minimize effects of the program elements to bull trout and bull trout critical habitat are described in section 2.1.2.3.

2.1.2.1 Operation of the Program

2.1.2.1.1 Broodstock Collection

For this program, broodstock collection may occur annually at four locations in the Snake and Clearwater River Basins: the LGR adult fish trap, the LFH, the NPTH, and the South Fork (SF) Clearwater adult weir. The primary collection point for the program is at the LGR trap, where incremental run-at-large trapping occurs.

The LGR trap, which is operated by NMFS staff and accessed by both the NPT and WDFW for broodstock collection, functionally diverts the entire fish ladder flow (Lower Snake River) into a trapping facility for set periods of time. This allows all fish ascending the ladder to be subject to a process of anesthetization, handling, sorting, and potential tagging prior to being collected (for fall Chinook salmon hatchery broodstock), or recovered and returned to the ladder to continue upstream migration; this includes non-broodstock and other fish species.

Secondary, supplemental, collection of broodstock has also taken place at the LFH and the NPTH through volunteer traps. Each of these facilities utilizes a volitional-entry trap for their collection. There are no stream-blocking attributes to these facilities so fish are not trapped unless they volitionally enter.

Run-at-large collection at the SF Clearwater weir is not yet operational, but would occur between October 1 and December 1 (Table 2). The weir would be focus on collecting a relatively early segment of the fall Chinook return to the Clearwater Basin.

All broodstock collection activities for this program, at all locations, will apply the applicable conservation measures and BMPs presented in section 2.1.2.3.

Table 2. Snake River Fall Chinook Program Broodstock Collection (from Assessment, Table 4).

Broodstock collection Facility	Annual Operation Timeframe
LGR Trap	Mid-August through November
LFH	September 1st through November
NPTH	September 1st through early December
S.F. Clearwater River weir (not yet operational)	October 1st through December 1st

2.1.2.1.2 Release of Hatchery Juveniles

As shown in Table 1, all of the rearing facilities subject to this consultation release significant numbers of subyearling and yearling salmon. Release of hatchery-produced juvenile salmon can elevate the risk of effects from increased resource competition and predation to naturally occurring species, as described in the Effects of the Proposed Action section (2.5.1.1.2) of this Opinion.

2.1.2.1.3 Research, Monitoring, and Evaluation

Section 7 of the Act identifies agency responsibilities to further the purposes of the Act, and ensures that otherwise lawful activities do not limit the recovery or survival of listed species; RM&E can fulfill both of these requirements.

Though it is necessary to monitor and evaluate impacts on the target listed species from hatchery programs, RM&E programs are designed, in coordination with other plans, to maximize data collection while minimizing take of all listed species, particularly non-target listed fish. RM&E for the Snake River fall Chinook hatchery program is separated into two main areas of focus: "in-hatchery" RM&E and "off-station RM&E" of the program fish and the Snake River fall Chinook population in general. Refer to the Assessment for a complete description of these activities (NMFS 2015, pp. 22-30).

2.1.2.2 Operation of Program Facilities

2.1.2.2.1 Water Withdrawals

Water supply is the most important aspect of fish hatchery operations. Water supplies for most hatchery facilities come from either surface water diversions, ground water sources (wells and springs), or a combination of both. Surface water intakes, which draw from stream and river sources, typically have diversion structures associated with them to efficiently withdraw the water volume required to operate the hatchery facility. Ground water is also utilized as a primary or supplemental source of water for many hatchery facilities. Groundwater typically has the added benefit of more stable temperature throughout the year.

2.1.2.2.2 Hatchery Effluent

Hatchery operations discharge wastewater from normal operations. This water is typically discharged (returned) into the stream it was first withdrawn from, usually downstream of the facility and withdrawal diversion point. The water has typically been used throughout the facility, for all aspects of hatchery operations, including adult broodstock trapping and holding, egg incubation, juvenile rearing, fish health treatments, and pond cleaning. Many of these operations introduce substances/compounds into the water that can then be carried in the effluent back into the stream. Hatchery facility waste products include uneaten food, fecal matter, soluble metabolites (e.g., ammonia), algae, parasitic microorganisms, drugs, and other chemicals (Kendra 1991, p. 43). The substances/compounds that can be added to the hatchery effluent, in addition to the hatchery's open pond structures and high biomass densities, can raise water temperatures, reduce dissolved-oxygen levels, and affect the pH of the stream. These changes to the water can affect aquatic species living in the streams adjacent to and downstream of the facilities, as further described in section 2.5.1.1.2 of this Opinion.

The Federal Clean Water Act regulates discharges of dredged or fill material into waters of the United States. The purpose of the Clean Water Act is to restore the physical, biological, and chemical integrity of the waters of the United States using two basic mechanisms: (1) direct regulation of discharges pursuant to permits issued under the National Pollution Discharge Elimination System (NPDES) and section 404 (discharge of dredge or fill materials); and (2) the Title III water quality program. The states of Washington and Oregon are responsible for issuing and reporting on NPDES permits. The Environmental Protection Agency (EPA) monitors the NPDES standards for the state of Idaho. Under the Clean Water Act, any facility that rears 20,000 lbs of fish, or more, and discharges effluent into navigable waters must obtain a permit; facilities that meet this threshold include the LFH and the NPTH.

2.1.2.2.3 Fish Disease Management

Because of the physical and operational structure of hatchery facilities and the high biomass densities typically found in artificial fish culture, fish diseases that occur in the natural environment can be amplified in the hatchery. The Snake River fall Chinook Hatchery program operates under coordinated fish health policies by all parties to the action. The primary objective of the fish health management of any production program is to produce healthy juveniles that contribute to the program goals of the particular stock. Another equally important objective is to prevent the introduction, amplification, or spread of certain fish pathogens that might negatively affect the health of both hatchery and naturally producing stocks. A Fish Health Specialist visits each program facility approximately once per month to examine juvenile fish. Juvenile fish are sampled to ascertain general health on each stock and brood year. Based on any exhibited pathological signs, age of fish, and concerns of fish hatchery personnel, the examining Fish Health Specialist determines any appropriate tests to manage fish disease.

Periodically, the hatchery fish are treated for a variety of fish diseases, both internally and externally. For external treatments, the fish are provided a mild concentration of formalin or hydrogen peroxide for 15 to 60 minutes, depending on the situation. For internal treatments, the fish are fed fish approved antibiotics incorporated in their feed for 3 to 10 days. It is possible that hatcheries can transmit fish diseases back into the natural environment, at high concentrations, through contaminated wastes. Free-living fish exposed to increased levels of pathogens may contract diseases as a result.

2.1.2.2.4 Hatchery Maintenance

Normal and preventative maintenance of hatchery structures, facility grounds, and equipment is necessary for facility upkeep, safety, and proper functionality.

Routine Maintenance activities include: Hatchery structure maintenance such as pond cleaning, pump maintenance, and light debris removal from intake and outfall structures (no heavy equipment needed), ladders, and traps; building maintenance, such as painting, roofing, and other repairs; grounds maintenance on already established grounds such as mowing, weed trimming and herbicide application; road (driveway) maintenance; equipment maintenance such as auto and tractor/equipment maintenance; and generator maintenance.

Routine maintenance activities occur within and around existing facilities and established properties and implement BMPs to reduce the potential for affects to adjacent terrestrial habitats and waterbodies (see section 2.1.2.3).

Semi-routine Maintenance activities are not yearly occurrences, but may occur with frequency over a period of 5 to 10 years. Such examples include: in-stream (below the Ordinary High Water Mark (OHWM)) work like clearing gravel and major debris blockages from water intakes and outfalls after larger flood events; minor bridge repairs; equipment failures such as intake pumps and screening structures (screen media); and weir, ladder, and trap maintenance. All facilities are expected to have some element of semi-routine maintenance activities necessary on an infrequent basis.

Semi-routine maintenance activities occur within and around existing facilities and established properties and implement BMPs to reduce the potential for effects to adjacent terrestrial habitats and waterbodies (see section 2.1.2.3).

Non-routine Maintenance activities include major repairs or re-construction of in-river hatchery structures (below the OHWM), such as re-construction of hatchery intake or outfall structures, ladders, permanent weirs, or traps; major bridge repairs/replacements; and bank-armoring projects around existing facility structures. Non-routine maintenance activities usually include significant in-stream work that could result in additional effects to listed species and/or their critical habitat, and as such, are not considered in this Opinion. These types of work would require a separate, site-specific consultation with the Service, as appropriate.

2.1.2.3 Conservation Measures and Best Management Practices (BMPs)

Specific conservation measures and BMPs to minimize impacts to bull trout and bull trout critical habitat, from the proposed action, are described below, by program element.

General Conservation Measures

2.1.2.3.1 Broodstock Collection

The following are measures to be applied to minimize potential effects during broodstock collection activities:

- All adult collection program activities are directed and coordinated through a series of annual planning meetings between the NPT, WDFW, IDFG, CTUIR[3], IPC, ODFW, and NMFS.
- The amount of time that the LGR trap is actively run is minimized, based on forecasted fall Chinook run size and in-season adjustments.
- Operate the trap in accordance with U.S. Army Corps of Engineers' Fish Passage Plan (USCOE 2014, or most current)) to minimize risk to all fish in general and non-target species in particular.

[3] Confederated Tribes of the Umatilla Indian Reservation

- All of the collection facilities are designed and maintained to be fish-friendly, with regard to the layout and function.
- The LGR trap facility operation is limited to a daily proportion of time and closed down (ladder open for dam passage) to allow for unabated passage of all fish.
- The LFH and the NPTH traps are checked at least daily, and more often during peak Chinook return. Fish are quickly removed from the traps and all non-target fish are returned to the stream immediately in a fish-friendly manner.

2.1.2.3.2 Release of Hatchery Juveniles

Measures to be applied to minimize potential resource competition and predation effects during juvenile release activities:

- Release all hatchery fish as smolts (yearlings and subyearlings) that are physiologically ready to migrate to minimize the potential for competition with naturally produced juvenile fish in freshwater.
- Operate hatcheries such that hatchery fish are reared to sufficient size that smoltification occurs in nearly the entire population.
- Release all hatchery fish as actively migrating smolts through volitional release practices so that the fish migrate quickly seaward, limiting the duration of interaction with any co-occurring natural-origin fish downstream of the release site.

2.1.2.3.3 Research, Monitoring, and Evaluation

The following measures are to be applied to minimize potential effects of RM&E on bull trout:

- RM&E activities shall be conducted in accordance with the approved study plans.
- If sampling is done in multiple subbasins (4th field hydrologic unit code [HUC] watersheds), boots and sampling equipment intended for use in the water shall be disinfected and air-dried prior to use in each location. Water containing chemicals used in handling fish and water that was used for disinfecting equipment must not be allowed to enter the waterbody being sampled.
- Investigators may observe fish using snorkeling methods but shall avoid displacing individuals from the original encounter site during observations.
- Artificial lures with single barbless hooks shall be used during hook-and-line capture. The use of bait, live or dead, is not permitted.
- All netting used for capturing, handling, and holding of fish, including the incidental capture of bull trout, shall be composed of a fine mesh, knot-free material that minimizes injury to the fish.
- Bull trout shall not be used for rotary screw trap "trapping catch efficiency" or "containment" studies. Bull trout shall be released on the appropriate side of the trap to accommodate the apparent direction of travel of individual fish.
- All survey, capture, retention, handling, and observation activities shall be implemented at times that avoid temperature stress to fish being sampled. At locations that have

potential to contain bull trout, sampling shall not be done if water temperature exceeds 18 degrees Celsius (64 degrees Fahrenheit). The Service recommends sampling be done at water temperatures less than 15 degrees Celsius (59 degrees Fahrenheit) where possible. However, some rivers and lakes may be warmer than this, particularly on hot summer days. In these circumstances, it may be necessary to conduct the activities listed above in the morning or evening to avoid temperature stress to captured fish.

- All sampling and observation methods shall be implemented at times that will avoid disturbance of spawning fish. Any purposeful take of bull trout that are actively spawning or are near bull trout spawning sites is prohibited. Surveyors shall minimize collection, survey, and sampling activities near spawning areas and shall not physically disturb bull trout redds during these activities.
- Disturbance of or impacts to bull trout habitat shall be minimized during project activities. Since redds of resident and small fluvial bull trout may be difficult to see due to their small size, surveyors shall take precautions to avoid stepping in areas that may be potential redd locations (i.e., small gravel deposits behind boulders; under overhanging vegetation; near wood debris or logs; or areas of hydraulic influence such as confluences of tributaries, springs, seeps, pool tail crests, or edges of pools).
- If bull trout are captured or handled:
    - Authorized personnel shall ensure that their hands are free of sunscreen, lotion, or insect repellent prior to conducting activities that may involve handling bull trout.
    - Any captured bull trout that appears healthy and able to maintain itself shall be released as soon as possible, and as close as possible, to the point of capture.
    - Any captured bull trout that shows signs of stress or injury shall only be released when it is able to maintain itself. It may be necessary to nurture the fish in a holding tank until it has recovered. The holding tank water shall be conducive to bull trout health (i.e., clean, cool water with ample dissolved oxygen).
    - Because bull trout are aggressive predators and are known to be cannibalistic, investigators shall attempt to partition captured fish individually or by size class and should avoid holding numerous bull trout in the same live-well.
    - A healthy environment must be provided for bull trout held in holding tanks, and the holding time must be minimized. Water-to-water transfers, the use of shaded or dark containers, and supplemental oxygen shall all be considered in the design of fish handling operations. Bull trout may be held for up to 1 hour during electrofishing operations.
    - Bull trout shall be closely monitored in holding tanks if the ambient water temperature in these tanks is greater than 15 degrees Celsius (59 degrees Fahrenheit). All operations shall cease if fish show signs of stress, or if ambient water temperatures rise above 18 degrees Celsius (64 degrees Fahrenheit).
    - Holding tanks shall be non-toxic plastic, aluminum, or stainless steel containers. Do not use metal containers that have lead or zinc coatings.

- Fish statistics (e.g., length, weight, sex, ripeness, scale sample, mark, condition/health, angling injury) may be collected from captured bull trout. Handling and measurement of captured fish shall follow commonly accepted techniques for salmonid field sampling. If stream temperatures are greater than 15 degrees Celsius (59 degrees Fahrenheit), the collection of fish statistics shall be limited to fish length only, to avoid over-stressing captured fish.
- If a non-lethal bio-sample (i.e., fin clip or punch) is taken for genetic analyses, it shall not exceed 0.75 square centimeters in size. .
- Bull trout may be marked via a non-lethal fin clip during mark-recapture population surveys. This fin clip may be used as a bio-sample as indicated above.
- To reduce stress on captured bull trout, handling of the same individual multiple times during permitted activities shall be avoided, to the extent possible.
- A colored fish key with all char, trout, and salmon species that are known to, or may possibly be in the system, shall be on hand when identifying fish. Captured bull trout and unidentified fish that may be bull trout shall be photographed for verification in areas where bull trout occur infrequently or if identification of the fish is difficult.
- For electrofishing activities: Electrofishing shall be conducted using the methods outlined in NMFS guidelines (available at http://www.westcoast.fisheries.noaa.gov/publications/reference_documents/esa_refs/section4d/electro2000.pdf). Electrofishing equipment shall be operated at the lowest possible effective equipment settings to minimize injury or death to bull trout.
- Electrofishing shall be avoided in areas such as the mouths of rivers when adult bull trout may be staging as part of their spawning migration.
- Electrofishing shall not be conducted when the water conditions are turbid and visibility is poor (i.e., when the sampler cannot see the stream bottom in 1 foot of water).
- Any electrofishing conducted during the bull trout spawning season (typically August 15 to December 1) shall only be performed in areas where adult bull trout (305 millimeters total length or larger for fluvial bull trout or 160 millimeters total length or larger for resident bull trout) or their redds have not been observed.
- Outside the bull trout spawning season, visual or snorkel surveys for bull trout shall be conducted prior to electrofishing, where conditions allow. If bull trout are documented in visual surveys, moving to a new sample location should be considered if possible. However, electrofishing is permitted in areas where bull trout are present if there is no alternative that is consistent with the study plan.
- Because electrofishing during the spring in bull trout habitat runs the risk of injuring or killing alevins or fry that remain in or near the gravels, if salmonid alevins or fry are seen during spring electrofishing, the electrofishing activity shall immediately cease until the alevins or fry can be identified. If they are

determined to be bull trout, electrofishing shall be terminated at the site until after fry have fully emerged.

- PIT tagging bull trout:
  - Before inserting a PIT tag into a captured bull trout, the fish must be scanned for the presence of an existing functional PIT tag. If a PIT tag is detected, the fish shall not be tagged with an additional tag.
  - All PIT tagging activities shall cease when stream water temperature exceeds 18 degrees (64 degrees Fahrenheit) Celsius.
  - Any captured bull trout showing signs of injury or considerable stress prior to tagging shall not be tagged with a PIT tag. The fish shall be placed in a holding tank and released upon showing signs of adequate recovery.
  - Overcrowding of fish in holding and recovery tanks must not occur during PIT tagging operations. Additional tanks shall be set up as needed, or tagging operations shall cease until the fish can be safely released back to the stream and overcrowding conditions are no longer a concern.
  - If PIT tag injectors are used, the needles and pushrods shall be disinfected between fish in a 70 to 80 percent ethyl alcohol or 60 to 80 percent isopropyl alcohol solution for a minimum of 10 minutes. All PIT tags shall also be disinfected in this same manner before insertion into bull trout.
- If bull trout are anesthetized during PIT tag insertions:
  - Tricaine methanesulfonate (MS-222) or another anesthetic approved for use on fish (e.g., electronarcosis) may be used to anesthetize bull trout during PIT tag insertions.
  - Bull trout shall only be anesthetized if they can be processed within several minutes of capture. The period of time bull trout are anesthetized shall be minimized to the extent possible, and shall not exceed 5 minutes.
  - It is advisable to monitor the effect of anesthesia on a few fish to determine how individual fish will react under local ambient conditions (e.g., water temperature, water pH, etc.). Use the lowest dose/level needed to affect the level of anesthesia required to complete tagging.
  - All fish placed under anesthesia must have recovered sufficiently from the anesthesia to avoid predation once they are released back to the stream at the point of capture. Anesthetized fish shall be allowed to recover in a recovery tank for a time sufficient to ensure full recovery based on observations in the recovery tank. If electronarcosis is used, fish may be released immediately and not held longer than necessary.
  - Surgical equipment shall be sanitized with a betadine solution (or appropriate substitute) between each surgery.

- For gillnetting activities:
  - Gillnet sampling shall be implemented using standard, non-lethal methods that avoid mortality to salmonids, including the use of appropriate mesh size for target species, and net set duration of no longer than one hour. If the net set duration needs to be increased, the investigator shall document via an internal memorandum within the action agency files the justification as to why an increased duration is necessary, and the rationale as to why it is not expected to harm or kill bull trout.
  - If gillnetting is to occur in lake settings during summer months when water temperatures may be above 18 degrees Celsius (64 degrees Fahrenheit) in the sampling location, and adult bull trout are suspected to be in the area, gillnetting should be suspended or moved to an alternate location to avoid harming or killing bull trout.
- When conducting macroinvertebrate, water, and sediment sampling, investigators shall take precautions in known or potential bull trout spawning areas. If salmonid alevins or fry are seen or captured, the activity shall cease immediately until the alevins or fry can be identified. If they are determined to be bull trout, the activity shall be moved to an alternate site or suspended until alevins and fry are no longer present.
- Investigators may collect fish statistics (length, weight, sex, ripeness, scale sample, mark, condition/health, angling injury, etc.) from captured bull trout, consistent with above identified measures.
- All in-river spawner surveys are conducted in known target species' spawning reaches.
- Fish trapping, trap maintenance, fish handling, fish anesthesia, and fish PIT tagging protocols are followed explicitly and all staff are trained in their use and application before working under field conditions.
- Active weirs and traps shall be monitored at least once daily. Traps shall be checked more frequently when crowding produced by an increasing catch rate or high debris loading results in a higher probability of injury or mortality to bull trout being held in a weir or trap
  - Field-staff conduct regular checks of the traps and live boxes to ensure that traps are maintained and that no mortalities occur. Trap check intervals are determined by the stream conditions and numbers of fish being trapped.
  - Smolt trap cones and debris drums are also regularly checked to ensure that traps are not causing fish impingement or descaling and that fine debris is removed from the traps.
  - Water temperatures and stream discharge are regularly monitored to ensure safe capture and handling of all fish.

2.1.2.3.4 Water Withdrawals

The following measures are to be applied to minimize potential effects of water withdrawals:

- Facilities operate within their water right with respect to maximum withdrawal from surface and/or ground water sources.
- All surface water intakes are designed to meet NMFS fish screening criteria to reduce and/or eliminate the risk of fish impingement and entrainment across the range of expected flow conditions.
- All withdrawal structures are sited, designed, and operated to prevent barriers to fish passage.

2.1.2.3.5 Hatchery Effluent

The following measures are to be applied to minimize potential effects of hatchery effluent:

- Where required, all facilities operate under an applicable EPA NPDES permit, which includes periodic water quality sampling for compliance.
- Proper feeding volume and application is performed to reduce non-utilized feed.
- All pond-cleaning activities (LFH and NPTH) use pollution abatement structures to reduce the suspended sediment from these activities.
- All hatchery maintenance performed on "watered" or "in-water" facilities will be performed to minimize potential effects to hatchery effluent, i.e., sediment disturbance, water temperature, and chemical composition.
- While EPA NPDES standards have not been adequately assessed for potential impacts to bull trout, fall Chinook programs will continue to monitor requirements under the permits and adjust as new data/criteria becomes available.

2.1.2.3.6 Fish Disease Management

The following measures are to be applied to minimize disease introduction, amplification, and transmission:

- Administration of therapeutic drugs and chemicals to fish and eggs reared at program facilities is performed only when necessary to effectively prevent, control, or treat disease conditions.
- All treatments are administered according to label directions in compliance with the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA) regulations for the use of aquatic animal drugs and chemicals. EPA and FDA consider the environmental effects acceptable when the therapeutic compounds are used according to the label.
- Pre-release/Transfer Examination: Program staff notifies program Fish Health staff at least 6 weeks prior to a release or transfer of fish from the hatchery. Tissue samples are collected on 60 fish of the stock being transferred or released. The pathogens screened for include: infectious hematopoietic necrosis virus (IHNV); infectious pancreatic necrosis virus (IPNV); viral hemorrhagic septicemia virus (VHSV); *Renibacterium salmoninarum, Aeromonas salmonicida, Yersinia ruckeri*, and under certain circumstances other pathogens such as *Myxobolus cerebralis* and *Ceratomyxa shasta*.

2.1.2.3.7 Hatchery Maintenance

The following measures are to be applied to avoid, minimize, or mitigate effects from hatchery maintenance (Routine and Semi-routine):

- Except for emergency instances, all normal maintenance activities will occur in the daytime, during normal working hours.
- Continue cataloging and prioritizing those structures that do not meet Anadromous Salmonid Passage Facility Design criteria and guidelines (NMFS 2011, or most current, entire) for upgrades as funding becomes available.
- Herbicide application, to control noxious weeds, is small in scale, follows manufacturer's label guidelines, and occurs only during dry weather conditions (i.e., not raining) to prevent runoff into surface waters. Roundup® may be used around buildings and landscapes that are more than 300 feet from the river. Rodeo®, or a similar aquatic-approved herbicide, may be used around rearing ponds, adult collection ponds, and surface water intakes, which are in closer proximity to the water. All application of herbicides utilize the following risk reduction measures:
    - Only selective spot treatment of aquatic-approved formulations of glyphosate or imazapyr will be made within 15 feet of live waters (e.g., flowing ditches, streams, ponds, springs, etc., and will only be applied when wind speeds are less than or equal to 5 mph. No live water will be directly sprayed with herbicides, although some limited drift may occur when spot spraying.
    - Only ground based spot/selective applications of herbicides rated as having a low level of concern for aquatic species will be authorized from 15 to 100 feet from live waters and within riparian areas (whichever is greater), and will only be applied when wind speeds are less than or equal to 8 mph.
    - A spill cleanup kit will be available whenever herbicides are transported or stored.
    - A spill contingency plan will be developed prior to all herbicide applications. Individuals involved in herbicide handling or application will be instructed on the spill contingency plan and spill control, containment, and cleanup procedures.
    - Herbicide applications will only treat the minimum area necessary for the control of noxious weeds.
    - No herbicide mixing will be authorized within 100 feet of any live waters. Mixing and loading operations must take place in an area where an accidental spill would not contaminate a stream or body of water before it could be contained.
    - Authorized spray equipment will include pick-up- and 4-wheeler-mounted spray rigs (hand spot-gun only), backpack sprayers, hand pump sprayers, hand-spreading granular formulations, and wicking (e.g., also includes wiping, dipping, painting, or injecting target species).
    - Equipment used for transportation, storage, or application of chemicals shall be maintained in a leak-proof condition.

    - Only the quantity of herbicides needed for one day's operation will be transported from the storage area.

- Minimize impacts to riparian vegetation at the work sites, and upon completion of the work, grade and replant disturbed areas to match the landscape and existing vegetation at the site.
- Install silt barriers at the site during ground disturbing work to prevent/reduce sediment from entering the river.
- All normal hatchery maintenance (Section 2.1.2.2.4) performed on "watered" or "in-water" facilities will be performed at times and with methods to minimize potential effects to hatchery effluent, i.e., sediment disturbance, water temperature, and chemical composition.
- Non-routine maintenance that includes significant in-stream work that could result in additional effects to listed species and/or their critical habitat, including major repair, construction, or reconstruction of in-river hatchery structures(i.e., surface water diversion and hatchery outfall structures), are not considered in this Opinion. These types of work would require a separate consultation with the Service.
- Complete all work during the allowable freshwater work times established for each location unless otherwise approved, in writing, by the appropriate state agency (WDFW, IDFG, or ODFW), NMFS, and the Service.
- Prepare and implement a pollution and erosion control plan to prevent pollution related to maintenance activities. The plan will be made available for inspection on request by the BPA, NMFS, and the Service. The pollution and erosion control plan will address equipment and materials storage sites, fueling operations, staging areas, cement mortars and bonding agents, hazardous materials, spill containment and notification, and debris management.
- Select equipment that will have the least adverse effects on the environment (e.g., minimally sized rubber tires, etc.) when heavy equipment must be used.
- Have the proper approved oils/lubricants when working below the OHWM.
- Operate all equipment above the OHWM, or in the dry, whenever possible to reduce impacts.
- Clean all materials used prior to placement below the OHWM.
- Make absorbent material available on site to collect any lubricants in the case of a pressurized line failure. Dispose of all used materials in the proper manner.
- Stage and fuel all equipment in appropriate areas above the OHWM.
- Cease operations if, at any time, fish are observed in distress as a result of action activities.
- Clean all equipment to ensure it is free of vegetation, external oil, grease, dirt, and mud before equipment is brought to the site and prior to removal from the project area.

- Involve local habitat entities with the maintenance actions and notify them prior to and following the completion of all activities.
- Ensure that all work meets state and federal fish passage requirements.
- Dispose of all discharge water created by maintenance tasks (e.g., debris removal operations, vehicle wash water) at an adjacent upland location. No discharge water will be allowed to return to the adjacent waterbodies unless specifically approved by the Services.
- Obtain all appropriate state and Federal permits before work is initiated.
- Install straw bales and/or geo-textile filtration traps to outlet channel when dredging to catch any sediment exiting the subject waterbody.
- Filter pumped water through straw bale sediment traps to remove any sediment prior to re-entering waterbodies.

2.2 Analytical Framework for the Jeopardy and Adverse Modification Determinations

2.2.1 Jeopardy Determination

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

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

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

Recovery Units (RUs) for the bull trout were defined in the final *Recovery Plan for the Coterminous United States Population of [the] Bull Trout* (USFWS 2015a, entire). Pursuant to Service policy, when a proposed Federal action impairs or precludes the capacity of a RU 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, the biological opinion describes how the proposed action affects not only the capability of the RU, but the relationship of the RU to both the survival and recovery of the listed species as a whole.

The jeopardy analysis for the bull trout in this biological opinion considers the relationship of the action area and affected core areas (discussed below under the *Status of the Species* section) to the RU and the relationship of the RU to both the survival and recovery of the bull trout as a whole 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.

Within the above context, the Service also considers how the effects of the proposed Federal action and any cumulative effects impact bull trout local and core area populations in determining the aggregate effect to the RU(s). Generally, if the effects of a proposed Federal action, taken together with cumulative effects, are likely to impair the viability of a core area population(s), such an effect is likely to impair the survival and recovery function assigned to a RU(s) and may represent jeopardy to the species (USFWS 2005a, 70 FR 56258).

2.2.2 Adverse Modification Determination

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of "destruction or adverse modification of critical habitat" was published on February 11, 2016 (USFWS and NMFS 2016, 81 FR 7214). The final rule became effective on March 14, 2016. The revised definition states: "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features."

The destruction or adverse modification analysis in this biological opinion relies on four components:

1. The *Status of Critical Habitat*, which describes the range-wide condition of designated critical habitat for the bull trout in terms of the key components of the critical habitat that provide for the conservation of the bull trout, the factors responsible for that condition, and the intended value of the critical habitat overall for the conservation/recovery of the bull trout.
2. The *Environmental Baseline*, which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation/recovery of the listed species.
3. The *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the value of the affected critical habitat units for the conservation/recovery of the listed species; and,
4. The *Cumulative Effects*, which evaluate the effects of future non-Federal activities that are reasonably certain to occur in the action area on the key components of critical habitat that

provide for the conservation of the listed species and how those impacts are likely to influence the value of the affected critical habitat units for the conservation/recovery of the listed species.

For purposes of making the destruction or adverse modification determination, the effects of the proposed Federal action, together with any cumulative effects, are evaluated to determine if the value of the critical habitat rangewide for the conservation/recovery of the listed species would remain functional or would retain the current ability for the key components of the critical habitat that provide for the conservation of the listed species to be functionally re-established in areas of currently unsuitable but capable habitat.

Note: Past designations of critical habitat have used the terms "primary constituent elements" (PCEs), "physical or biological features" (PBFs) or "essential features" to characterize the key components of critical habitat that provide for the conservation of the listed species. The new critical habitat regulations (USFWS and NMFS 2016, 81 FR 7214) discontinue use of the terms "PCEs" or "essential features" and rely exclusively on use of the term PBFs for that purpose because that term is contained in the statute. To be consistent with that shift in terminology and in recognition that the terms PBFs, PCEs, and essential habit features are synonymous in meaning, we are only referring to PBFs herein. Therefore, if a past critical habitat designation defined essential habitat features or PCEs, they will be referred to as PBFs in this document. This does not change the approach outlined above for conducting the "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs or essential features.

2.3 Status of the Species and Critical Habitat

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

2.3.1 Bull Trout

2.3.1.1 Listing Status

The coterminous United States population of the bull trout was listed as threatened on November 1, 1999 (USFWS 1999, 64 FR 58910-58933). The threatened bull trout 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. 2; Brewin and Brewin 1997, p. 215; Cavender 1978, pp. 165-166; Howell and Buchanan 1992, entire; Leary and Allendorf 1997, pp. 716-719; USFWS 1999, 64 FR 58910).

The final listing rule for the United States coterminous population of the bull trout discusses the consolidation of five Distinct Population Segments (DPSs) into one listed taxon and the application of the jeopardy standard under section 7 of the Endangered Species Act (Act) relative to this species, and established five interim recovery units for each of these DPSs for the purposes of Consultation and Recovery (USFWS 1999, 64 FR 58930).

The 2010 final bull trout critical habitat rule (USFWS 2010b, 75 FR 63898-64070) identified six draft recovery units based on new information that confirmed they were needed to ensure a resilient, redundant, and representative distribution of bull trout populations throughout the range of the listed entity. The final bull trout recovery plan (RP) (USFWS 2015a, pp. 36-43) formalized these six recovery units: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake. The final recovery units replace the previous five interim recovery units and will be used in the application of the jeopardy standard for section 7 consultation procedures.

2.3.1.2 Reasons for Listing and Emerging Threats

Throughout its range, the bull trout is 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; incidental angler harvest; entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels; and introduced non-native species (USFWS 1999, 64 FR 58910). Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats.

Since the time of coterminous listing the species (64 FR 58910) and designation of its critical habitat (USFWS 2004a, 69 FR 59996;USFWS 2005a, 70 FR 56212; USFWS 2010b, 75 FR 63898) a great deal of new information has been collected on the status of bull trout. The Service's Science Team Report (Whitesel et al 2004, entire), the bull trout core areas templates (USFWS 2005b, entire; 2009, entire), Conservation Status Assessment (USFWS 2005c, entire), and 5-year Reviews (USFWS 2008, entire; 2015h, entire) have provided additional information about threats and status. The final RP lists many other documents and meetings that compiled information about the status of bull trout (USFWS 2015a, p. 3). As did the prior 5-year review (2008), the 2015 5-year status review maintains the listing status as threatened based on the information compiled in the final bull trout RP (USFWS 2015a, entire) and the Recovery Unit Implementation Plans (RUIPs) (USFWS 2015b-g, entire).

When first listed, the status of bull trout and its threats were reported by the Service at subpopulation scales. In 2002 and 2004, the draft recovery plans (USFWS 2002, entire; 2004a, entire; 2004b, entire) included detailed information on threats at the recovery unit scale (i.e. similar to subbasin or regional watersheds), thus incorporating the metapopulation concept with core areas and local populations. In the 5-year Reviews, the Service established threats categories (i.e. dams, forest management, grazing, agricultural practices, transportation networks, mining, development and urbanization, fisheries management, small populations, limited habitat, and wild fire) (USFWS 2008, pp. 39-42; USFWS 2015h, p. 3). In the final RP, threats and recovery actions are described for 109 core areas, forage/migration and overwintering areas, historical core areas, and research needs areas in each of the six recovery units (USFWS 2015a, p 10). Primary threats are described in three broad categories: Habitat, Demographic, and Nonnative Fish for all recovery areas within the coterminously listed range of the species.

The 2015 5-year status review references the final RP and the RUIPs and incorporates by reference the threats described therein (USFWS 2015h, pp. 2-3). Although significant recovery actions have been implemented since the time of listing, the 5-year review concluded that the listing status should remain as "threatened" (USFWS 2015h, p. 3).

New or Emerging Threats

The 2015 RP (USFWS 2015a) describes new or emerging threats such as climate change and other threats. Climate change was not addressed as a known threat when bull trout was listed. The 2015 bull trout RP and RUIPs summarize the threat of climate change and acknowledge that some bull trout local populations and core areas may not persist into the future due to anthropogenic effects such as climate change. The RP further states that use of best available information will ensure future conservation efforts that offer the greatest long-term benefit to sustain bull trout and their required coldwater habitats (USFWS 2015a, pp. vii, 17-20).

Mote et al. (2014, pp. 487-513) summarized climate change effects in the Pacific Northwest to include rising air temperature, changes in the timing of streamflow related to changing snowmelt, increases in extreme precipitation events, lower summer stream flows, and other changes. A warming trend in the mountains of western North America is expected to decrease snowpack, hasten spring runoff, reduce summer stream flows, and increase summer water temperatures (Poff et al. 2002, p. 34; Koopman et al. 2009, entire; Point Reyes Bird Observatory (PRBO) Conservation Science 2011, p. 13). Lower flows as a result of smaller snowpack could reduce habitat, which might adversely affect bull trout reproduction and survival. Warmer water temperatures could lead to physiological stress and could also benefit nonnative fishes that prey on or compete with bull trout. Increases in the number and size of forest fires could also result from climate change (Westerling et al. 2006, p. 940) and could adversely affect watershed function by resulting in faster runoff, lower base flows during the summer and fall, and increased sedimentation rates. Lower flows also may result in increased groundwater withdrawal for agricultural purposes and resultant reduced water availability in certain stream reaches occupied by bull trout (USFWS 2015c, p. B-10).

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 (Rieman et al. 2007, p. 1552). Climate change is expected to reduce the extent of coldwater habitat (Isaak et al. 2015, p. 2549, Figure 7), and increase competition with other fish species (lake trout, brown trout, brook trout, and northern pike) for resources in remaining suitable habitat. Several authors project that brook trout, a fish species that competes for resources with and predates on the bull trout, will continue increasing their range in several areas (an upward shift in elevation) due to the effects from climate change (e.g., warmer water temperatures) (Wenger et al. 2011, p. 998, Figure 2a, Isaak et al. 2014, p. 114).

2.3.1.3 Species Description

Bull trout (*Salvelinus confluentus*), member of the family Salmonidae, are char native to the Pacific Northwest and western Canada. The bull trout and the closely related Dolly Varden (*Salvelinus malma*) were not officially recognized as separate species until 1980 (Robins et al. 1980, p. 19). Bull trout historically occurred in major river drainages in the Pacific Northwest from the southern limits in the McCloud River in northern California (now extirpated), Klamath River basin of south central Oregon, and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, pp. 165-169; Bond 1992, pp.

2-3). To the west, the bull trout's current range includes Puget Sound, coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992, p. 2-3). East of the Continental Divide bull trout are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and British Columbia (Cavender 1978, p. 165-169; Brewin and Brewin 1997, pp. 209-216). Bull trout are wide spread throughout the Columbia River basin, including its headwaters in Montana and Canada.

2.3.1.4 Life History

Bull trout exhibit resident and migratory life history strategies throughout much of the current range (Rieman and McIntyre 1993, p. 2). Resident bull trout complete their entire life cycle in the streams where they spawn and rear. Migratory bull trout spawn and rear in streams for 1 to 4 years before migrating to either a lake (adfluvial), river (fluvial), or, in certain coastal areas, to saltwater (anadromous) where they reach maturity (Fraley and Shepard 1989, p. 1; Goetz 1989, pp. 15-16). Resident and migratory forms often occur together and it is suspected that individual bull trout may give rise to offspring exhibiting both resident and migratory behavior (Rieman and McIntyre 1993, p. 2).

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

Bull trout are found primarily in colder streams, although individual fish are migratory in larger, warmer river systems throughout the range (Fraley and Shepard 1989, pp. 135-137; Rieman and McIntyre 1993, p. 2 and 1995, p. 288; Buchanan and Gregory 1997, pp. 121-122; Rieman et al. 1997, p. 1114). Water temperature above 15°C (59°F) is believed to limit bull trout distribution, which may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989, p. 133; Rieman and McIntyre 1995, pp. 255-296). Spawning areas are often associated with cold water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, p. 6; Rieman and McIntyre 1993, p. 7; Rieman et al. 1997, p. 1117). Goetz (1989, pp. 22, 24) suggested optimum water temperatures for rearing of less than 10°C (50°F) and optimum water temperatures for egg incubation of 2 to 4°C (35 to 39°F).

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

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

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

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

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

2.3.1.5 Population Dynamics

Population Structure

As indicated above, 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, p. 2). 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 (Goetz 1989, p. 15). 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, p. 138; Goetz 1989, p. 24), or saltwater (anadromous form) to rear as subadults and to live as adults (Brenkman and Corbett 2005, entire; McPhail and Baxter 1996, p. i). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Fraley and Shepard 1989, p. 135; Leathe and Graham 1982, p. 95; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Bull trout are naturally migratory, which allows them to capitalize on temporally abundant food resources and larger downstream habitats. Resident forms may develop where barriers (either natural or manmade) occur or where foraging, migrating, or overwintering habitats for migratory fish are minimized (Brenkman and Corbett 2005, pp. 1075-1076; Goetz et al. 2004, p. 105; Starcevich et al. 2012, p. 10; Barrows et al. 2016, p. 98). 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, pp. 96, 98-106) and Wenatchee River (Ringel et al. 2014, pp. 61-64). Parts of these river systems have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem rivers. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes.

Benefits of connected habitat 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, pp. 861-863; MBTSG 1998, p. 13; Rieman and McIntyre 1993, pp. 2-3). 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, p. 2).

Whitesel et al. (2004, p. 2) noted that although there are multiple resources that contribute to the subject, Spruell et al. (2003, entire) best summarized genetic information on bull trout population structure. Spruell et al. (2003, entire) 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, p. 17). 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, p. 25) of the Saskatchewan River drainage populations (east of the continental divide), grouping them with the upper Columbia River group.

Spruell et al. (2003, p. 17) noted that within the major assemblages, populations were further subdivided, primarily at the level of major river basins. Taylor et al. (1999, entire) surveyed bull trout populations, primarily from Canada, and found a major divergence between inland and coastal populations. Costello et al. (2003, p. 328) suggested the patterns reflected the existence of two glacial refugia, consistent with the conclusions of Spruell et al. (2003, p. 26) and the biogeographic analysis of Haas and McPhail (2001, entire). Both Taylor et al. (1999, p. 1166) and Spruell et al. (2003, p. 21) concluded that the Deschutes River represented the most upstream limit of the coastal lineage in the Columbia River Basin.

More recently, the USFWS identified additional genetic units within the coastal and interior lineages (Ardren et al. 2011, pp. 519-523). Based on a recommendation in the USFWS's 5-year review of the species' status (USFWS 2008, p. 45), the USFWS reanalyzed the 27 recovery units identified in the 2002 draft bull trout recovery plan (USFWS 2002, p. 48) by utilizing, in part, information from previous genetic studies and new information from additional analysis (Ardren et al. 2011, entire). In this examination, the USFWS applied relevant factors from the joint USFWS and NMFS Distinct Population Segment (DPS) policy (USFWS and NMFS 1996, 61 FR 4722-4725) and subsequently identified six draft recovery units that contain assemblages of core areas that retain genetic and ecological integrity across the range of bull trout in the coterminous United States. These six recovery units were used to inform designation of critical habitat for bull trout by providing a context for deciding what habitats are essential for recovery (USFWS 2010b, p. 63898). These six recovery units, which were identified in the final bull trout recovery plan (USFWS 2015a) and described further in the RUIPs (USFWS 2015b-g) include: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake.

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, p. 4). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991, entire). Burkey (1989, entire) 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, entire).

A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meefe and Carroll 1994, pp. 189-190). 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, entire). 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 1997, pp. 10-12; Dunham and Rieman 1999, p. 645; Spruell et al. 1999, pp. 118-120; Rieman and Dunham 2000, p. 55).

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, entire). 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, entire) 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, pp. 56-57). Research does, however, provide genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River Basin of Idaho (Whiteley et al. 2003, entire). Whitesel et al. (2004 pp. 14-23) summarizes metapopulation models and their applicability to bull trout).

2.3.1.6 Status and Distribution

The following is a summary of the description and current status of the bull trout within the six recovery units (RUs) (shown in Figure 2, below). A comprehensive discussion is found in the Service's 2015 RP for the bull trout (USFWS 2015a, entire) and the 2015 RUIPs (USFWS 2015b-g, entire). Each of these RUs 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.

Coastal Recovery Unit

The Coastal RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015b, entire). The Coastal RU is located within western Oregon and Washington. The RU is divided into three regions: Puget Sound, Olympic Peninsula, and the Lower Columbia River Regions. This RU contains 20 core areas comprising 84 local populations and a single potential local population in the historic Clackamas River core area where bull trout had been extirpated and were reintroduced in 2011, and identified four historically occupied core areas that could be re-established (USFWS 2015a, p. 47; USFWS 2015b, p. A-2). Core areas within Puget Sound and the Olympic Peninsula currently support the only anadromous local populations of bull trout. This RU also contains ten shared FMO habitats which are outside core areas and allows for the continued natural population dynamics in which the core areas have evolved (USFWS 2015b, p. A-5).

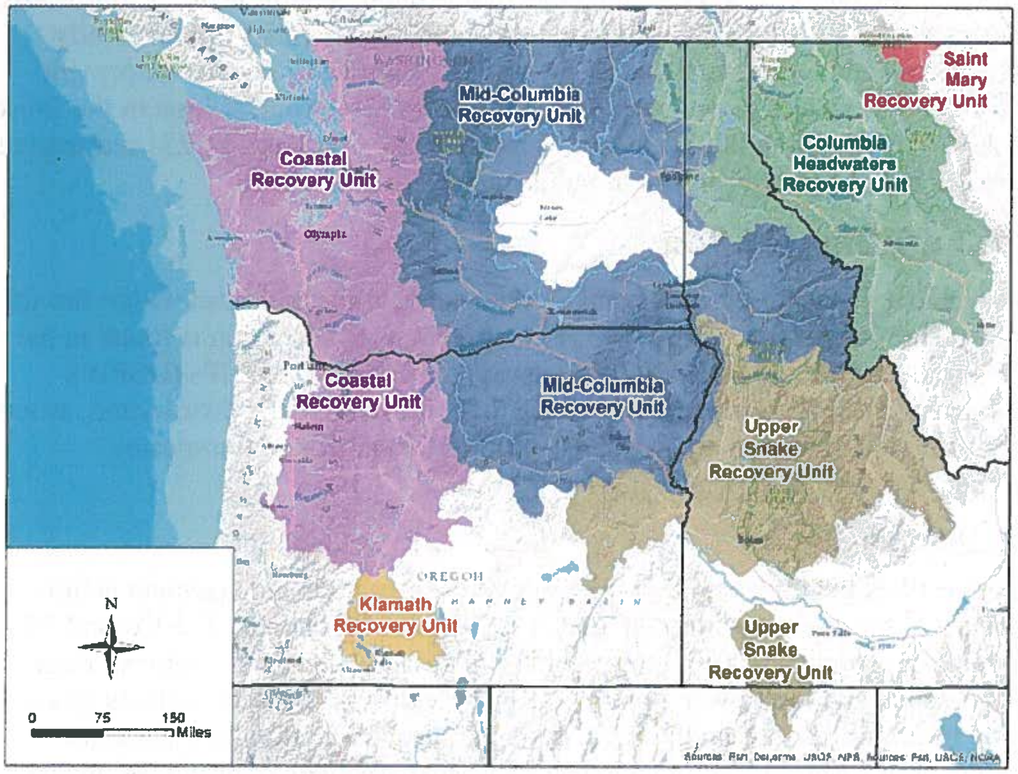

Figure 2. Map showing the location of the six bull trout Recovery Units.

There are four core areas within the Coastal RU that have been identified as current population strongholds: Lower Skagit, Upper Skagit, Quinault River, and Lower Deschutes River (USFWS 2015a, p.79). These are the most stable and abundant bull trout populations in the RU.

Most core areas in the Puget Sound region support a mix of anadromous and fluvial life history forms, with at least two core areas containing a natural adfluvial life history (Chilliwack River core area (Chilliwack Lake) and Chester Morse Lake core area). Overall demographic status of core areas generally improves as you move from south Puget Sound to north Puget Sound. Although comprehensive trend data are lacking, the current condition of core areas within the Puget Sound region are likely stable overall, although some at depressed abundances. Most core areas in this region still have significant amounts of headwater habitat within protected and relatively pristine areas (e.g., North Cascades National Park, Mount Rainier National Park, Skagit Valley Provincial Park, Manning Provincial Park, and various wilderness or recreation areas).

Within the Olympic Peninsula region, demographic status of core areas is poorest in Hood Canal and Strait of Juan de Fuca, while core areas along the Pacific Coast of Washington likely have the best demographic status in this region. The connectivity between core areas in these disjunct regions is believed to be naturally low due to the geographic distance between them. Internal connectivity is currently poor within the Skokomish River core area (Hood Canal) and is being restored in the Elwha River core area (Strait of Juan de Fuca). Most core areas in this region still have their headwater habitats within relatively protected areas (Olympic National Park and wilderness areas).

Across the Lower Columbia River region, status is highly variable, with one relative stronghold (Lower Deschutes core area) existing on the Oregon side of the Columbia River. The Lower Columbia River region also contains three watersheds (North Santiam River, Upper Deschutes River, and White Salmon River) that could potentially become re-established core areas within the Coastal Recovery Unit. Adult abundances within the majority of core areas in this region are relatively low, generally 300 or fewer individuals.

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, loss of functioning estuarine and nearshore marine habitats, development and related impacts (e.g., flood control, floodplain disconnection, bank armoring, channel straightening, loss of in-stream habitat complexity), agriculture (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation, livestock grazing), fish passage (e.g., dams, culverts, in-stream flows) residential development, urbanization, forest management practices (e.g., timber harvest and associated road building activities), connectivity impairment, mining, and the introduction of non-native species.

The RP identifies three categories of primary threats[4]: Habitat (upland/riparian land management, in-stream impacts, water quality), demographic (connectivity impairment, fisheries management, small population size), and nonnatives (nonnative fishes). Of the 20 core areas in the Coastal RU, only one (5 percent), the Lower Deschutes River, has no primary threats identified (USFWS 2015b, Table A-1).

Conservation measures or recovery actions implemented in this RU include relicensing of major hydropower facilities that have provided upstream and downstream fish passage or complete removal of dams, land acquisition to conserve bull trout habitat, floodplain restoration, culvert removal, riparian revegetation, levee setbacks, road removal, and projects to protect and restore important nearshore marine habitats. For more information on conservation actions see section 2.3.1.7 below.

Klamath Recovery Unit

The Klamath RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015c, entire). This RU is located in southern Oregon and northwestern California. The Klamath RU is the most significantly imperiled RU, having experienced considerable extirpation and geographic contraction of local populations and declining demographic condition, and natural re-colonization is constrained by dispersal barriers and presence of nonnative brook trout (USFWS 2015a, p. 39). This RU currently contains three core areas and eight local populations (USFWS 2015a, p. 47; USFWS

[4] Primary Threats are factors known or likely (i.e., non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future (4 to 10 bull trout generations, approximately 50 years).

2015c, p. B-1). Nine historic local populations of bull trout have become extirpated (USFWS 2015c, p. B-1). All three core areas have been isolated from other bull trout populations for the past 10,000 years (USFWS 2015c, p. B-3).

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, habitat degradation and fragmentation, past and present land use practices, agricultural water diversions, nonnative species, and past fisheries management practices. Identified primary threats for all three core areas include upland/ riparian land management, connectivity impairment, small population size, and nonnative fishes (USFWS 2015c, Table B-1).

Conservation measures or recovery actions implemented include removal of nonnative fish (e.g., brook trout, brown trout, and hybrids), acquiring water rights for in-stream flows, replacing diversion structures, installing fish screens, constructing bypass channels, installing riparian fencing, culvert replacement, and habitat restoration. For more information on conservation actions see section 2.3.1.7 below.

Mid-Columbia Recovery Unit

The Mid-Columbia RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015d, entire). The Mid-Columbia RU is located within eastern Washington, eastern Oregon, and portions of central Idaho. The Mid-Columbia RU is divided into four geographic regions: Lower Mid-Columbia, Upper Mid-Columbia, Lower Snake, and Mid-Snake Geographic Regions. This RU contains 24 occupied core areas comprising 142 local populations, two historically occupied core areas, one research needs area, and seven FMO habitats (USFWS 2015a, p. 47; USFWS 2015d, p. C-1 – C4).

The current demographic status of bull trout in the Mid-Columbia Recovery Unit is highly variable at both the RU and geographic region scale. Some core areas, such as the Umatilla, Asotin, and Powder Rivers, contain populations so depressed they are likely suffering from the deleterious effects of small population size. Conversely, strongholds do exist within the RU, predominantly in the Lower Snake geographic area. Populations in the Imnaha, Little Minam, Clearwater, and Wenaha Rivers are likely some of the most abundant. These populations are all completely or partially within the bounds of protected wilderness areas and have some of the most intact habitat in the recovery unit. Status in some core areas is relatively unknown, but all indications in these core areas suggest population trends are declining, particularly in the core areas of the John Day Basin. More detailed description of bull trout distribution, trends, and survey data within individual core areas is provided in Appendix II of the RUIP (USFWS 2015d).

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, agricultural practices (e.g., irrigation, water withdrawals, livestock grazing), fish passage (e.g., dams, culverts), nonnative species, forest management practices, and mining. Of the 24 occupied core areas, six (25 percent) have no identified primary threats (USFWS 2015d, Table C-2).

Conservation measures or recovery actions implemented include road removal, channel restoration, mine reclamation, improved grazing management, removal of fish barriers, and in-stream flow requirements. For more information on conservation actions see section 2.3.1.7 below.

Columbia Headwaters Recovery Unit

The Columbia Headwaters RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015e, entire). The Columbia Headwaters RU is located in western Montana, northern Idaho, and the northeastern corner of Washington. The RU is divided into five geographic regions: Upper Clark Fork, Lower Clark Fork, Flathead, Kootenai, and Coeur d'Alene Geographic Regions (USFWS 2015e, pp. D-2 – D-4). This RU contains 35 bull trout core areas; 15 of which are complex core areas as they represent larger interconnected habitats and 20 simple core areas as they are isolated headwater lakes with single local populations. The 20 simple core areas are each represented by a single local population, many of which may have persisted for thousands of years despite small populations and isolated existence (USFWS 2015e, p. D-1). Fish passage improvements within the RU have reconnected some previously fragmented habitats (USFWS 2015e, p. D-1), while others remain fragmented. Unlike the other RUs in Washington, Idaho and Oregon, the Columbia Headwaters RU does not have any anadromous fish overlap. Therefore, bull trout within the Columbia Headwaters RU do not benefit from the recovery actions for salmon (USFWS 2015e, p. D-41).

Conclusions from the 2008 5-year review (USFWS 2008, Table 1) were that 13 of the Columbia Headwaters RU core areas were at High Risk (37.1 percent), 12 were considered At Risk (34.3 percent), 9 were considered at Potential Risk (25.7 percent), and only 1 core area (Lake Koocanusa; 2.9 percent) was considered at Low Risk. Simple core areas, due to limited demographic capacity and single local populations were generally more inherently at risk than complex core areas under the model. While this assessment was conducted nearly a decade ago, little has changed in regard to individual core area status in the interim (USFWS 2015e, p. D-7).

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, mostly historical mining and contamination by heavy metals, expanding populations of nonnative fish predators and competitors, modified in-stream flows, migratory barriers (e.g., dams), habitat fragmentation, forest practices (e.g., logging, roads), agriculture practices (e.g., irrigation, livestock grazing), and residential development. Of the 34 occupied core areas, nine (26 percent) have no identified primary threats (USFWS 2015e, Table D-2).

Conservation measures or recovery actions implemented include habitat improvement, fish passage, and removal of nonnative species. For more information on conservation actions see section 2.3.1.7 below.

Upper Snake Recovery Unit

The Upper Snake RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015f, entire). The Upper Snake RU is located in central Idaho, northern Nevada, and eastern Oregon. The Upper Snake RU is divided into seven geographic regions: Salmon River, Boise River, Payette River, Little Lost River, Malheur River, Jarbidge River, and Weiser River. This RU contains 22 core areas and 207 local populations (USFWS 2015a, p. 47), with almost 60 percent being present in the Salmon River Region.

The population trends for the 22 core areas in the Upper Snake RU are summarized in Table E-2 of the Upper Snake RUIP (USFWS 2015f, pp. E-5 – E-7): six are classified as increasing, two are stable; two are likely stable; three are unknown, but likely stable; two are unknown, but likely decreasing; and, seven are unknown.

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, dams, mining, forest management practices, nonnative species, and agriculture (e.g., water diversions, grazing). Of the 22 occupied core areas, 13 (59 percent) have no identified primary threats (USFWS 2015f, Table E-3).

Conservation measures or recovery actions implemented include in-stream habitat restoration, in-stream flow requirements, screening of irrigation diversions, and riparian restoration. For more details on conservation actions in this unit see section 2.3.1.7 below.

St. Mary Recovery Unit

The St. Mary RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015g). The Saint Mary RU is located in Montana but is heavily linked to downstream resources in southern Alberta, Canada. Most of the Saskatchewan River watershed which the St. Mary flows into is located in Canada. The United States portion includes headwater spawning and rearing habitat and the upper reaches of FMO habitat. This RU contains four core areas (St. Mary River, Slide Lake, Cracker Lake, and Red Eagle Lake), and seven local populations (USFWS 2015g, p. F-1) in the U.S. headwaters.

Current status of bull trout in the Saint Mary River complex core area (U.S.) is considered strong. The three simple core areas (Slide Lake, Cracker Lake, and Red Eagle Lake) appear to be self-sustaining and fluctuating within known historical population demographic bounds. Note: the NatureServe status assessment tool ranks this RU as imperiled (Figure 3).

The current condition of the bull trout in this RU is attributed primarily to the outdated design and operations of the Saint Mary Diversion operated by the Bureau of Reclamation (e.g., entrainment, fish passage, in-stream flows), and, to a lesser extent habitat impacts from development and nonnative species. Of the four core areas, the three simple core areas (all lakes) have no identified primary threats (USFWS 2015g, Table F-1).

For more information on conservation actions see section 2.3.1.7 below.

Status Summary

The Service applied the NatureServe status assessment tool[5] to evaluate the tentative status of the six RUs. The tool rated the Klamath RU as the least robust, most vulnerable RU and the Upper Snake RU the most robust and least vulnerable recovery unit, with others at intermediate values (Figure 3).

[5] This tool consists of a spreadsheet that generates conservation status rank scores for species or other biodiversity elements (e.g., bull trout Recovery Units) based on various user inputs of status and threats (see USFWS 2015, p. 8 and Faber-Langendoen et al. 2012, entire, for more details on this status assessment tool).

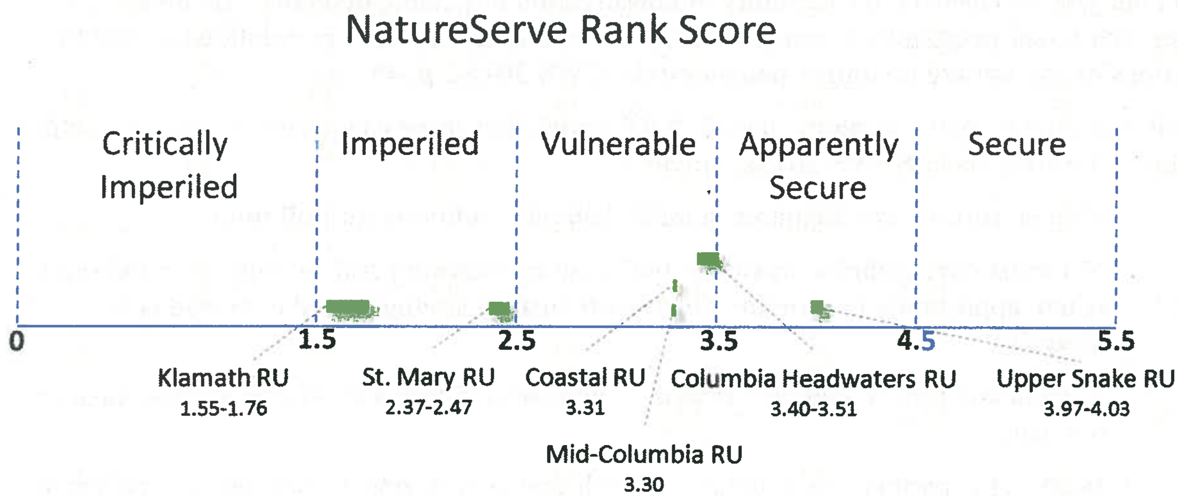

Figure 3. NatureServe status assessment tool scores for each of the six bull trout recovery units. The Klamath RU is considered the least robust and most vulnerable, and the Upper Snake RU the most robust and least vulnerable (from USFWS 2015a, Figure 2).

2.3.1.7 Conservation Needs

The 2015 RP for bull trout established the primary strategy for recovery of bull trout in the coterminous United States: (1) conserve bull trout so that they are geographically widespread across representative habitats and demographically stable in six RUs; (2) effectively manage and ameliorate the primary threats in each of six RUs at the core area scale such that bull trout are not likely to become endangered in the foreseeable future; (3) build upon the numerous and ongoing conservation actions implemented on behalf of bull trout since their listing in 1999, and improve our understanding of how various threat factors potentially affect the species; (4) use that information to work cooperatively with our partners to design, fund, prioritize, and implement effective conservation actions in those areas that offer the greatest long-term benefit to sustain bull trout and where recovery can be achieved; and (5) apply adaptive management principles to implementing the bull trout recovery program to account for new information (USFWS 2015a, p. 24.).

Information presented in prior draft recovery plans published in 2002 and 2004 (USFWS 2002a, entire; 2004b, entire; 2004c, entire) provided information that identified recovery actions across the range of the species and to provide a framework for implementing numerous recovery actions by our partner agencies, local working groups, and others with an interest in bull trout conservation. Many recovery actions were completed prior to finalizing the RP in 2015.

The 2015 RP (USFWS 2015a, entire) integrates new information collected since the 1999 listing regarding bull trout life history, distribution, demographics, conservation successes, etc., and integrates and updates previous bull trout recovery planning efforts across the coterminous range of the bull trout.

The Service has developed a recovery approach that: (1) focuses on the identification of and effective management of known and remaining threat factors to bull trout in each core area; (2) acknowledges that some extant bull trout core area habitats will likely change (and may be lost) over time; and (3) identifies and focuses recovery actions in those areas where success is likely to meet our goal of ensuring the certainty of conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations so that the protections of the Act are no longer necessary (USFWS 2015a, p. 45-46).

To implement the recovery strategy, the 2015 RP establishes three categories of recovery actions for each of the six RUs (USFWS 2015a, pp. 50-51):

1. Protect, restore, and maintain suitable habitat conditions for bull trout.
2. Minimize demographic threats to bull trout by restoring connectivity or populations where appropriate to promote diverse life history strategies and conserve genetic diversity.
3. Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.
4. Work with partners to conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks, and considering the effects of climate change.

Bull trout recovery is based on a geographical hierarchical approach. Bull trout are listed as a single DPS within the five-state area of the coterminous United States. The single DPS is subdivided into six biological-based recovery units: (1) Coastal Recovery Unit; (2) Klamath Recovery Unit; (3) Mid-Columbia Recovery Unit; (4) Columbia Headwaters Recovery Unit (5) Upper Snake Recovery Unit; and (6) Saint Mary Recovery Unit (USFWS 2015a, p. 23). A viable recovery unit should demonstrate that the three primary principles of biodiversity have been met: representation (conserving the genetic makeup of the species); resiliency (ensuring that each population is sufficiently large to withstand stochastic events); and redundancy (ensuring a sufficient number of populations to withstand catastrophic events) (USFWS 2015a, p. 33).

Each of the six recovery units contain multiple bull trout core areas, 109 total, which are non-overlapping watershed-based polygons, and each core area includes one or more local populations. Currently there are 109 occupied core areas, which comprise 611 local populations (USFWS 2015a, pp. 3, 47, Appendix F). There are also six core areas where bull trout historically occurred but are now extirpated, and one research needs area where bull trout were known to occur historically, but their current presence and use of the area are uncertain (USFWS 2015a, p. 3). Core areas can be further described as complex or simple (USFWS 2015a, p. 3-4). Complex core areas contain multiple local bull trout populations, are found in large watersheds, have multiple life history forms, and have migratory connectivity between spawning and rearing habitat and foraging, migration, and overwintering habitats (FMO). Simple core areas are those that contain one bull trout local population. Simple core areas are small in scope, isolated from other core areas by natural barriers, and may contain unique genetic or life history adaptations.

A core area is a combination of core habitat (i.e., habitat that could supply all elements for the long-term security of bull trout) and a core population (a group of one or more local bull trout populations that exist within core habitat) and constitutes the basic unit on which to gauge recovery within a recovery unit. Core areas require both habitat and bull trout to function, and the number (replication) and characteristics of local populations inhabiting a core area provide a relative indication of the core area's likelihood to persist. A core area represents the closest approximation of a biologically functioning unit for bull trout. Core areas are presumed to reflect the metapopulation structure of bull trout.

A local population is a group of bull trout that spawn within a particular stream or portion of a stream system (USFWS 2015a, p. 73). 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 population), but is assumed to be infrequent compared with that among individuals within a local population.

2.3.1.8 Federal, State, and Tribal Conservation Actions Since Listing

Since our listing of bull trout in 1999, numerous conservation measures that contribute to the conservation and recovery of bull trout have been and continue to be implemented across its range in the coterminous United States. These measures are being undertaken by a wide variety of local and regional partnerships, including State fish and game agencies, State and Federal land management and water resource agencies, Tribal governments, power companies, watershed working groups, water users, ranchers, and landowners.

In many cases, these bull trout conservation measures incorporate or are closely interrelated with work being done for recovery of salmon and steelhead, which are limited by many of the same threats. These include removal of migration barriers (culvert removal or redesign at stream crossings, fish ladder construction, dam removal, etc.) to allow access to spawning or FMO habitat; screening of water diversions to prevent entrainment into unsuitable habitat in irrigation systems; habitat improvement (riparian revegetation or fencing, placement of coarse woody debris in streams) to improve spawning suitability, habitat complexity, and water temperature; in-stream flow enhancement to allow effective passage at appropriate seasonal times and prevent channel dewatering; and water quality improvement (decommissioning roads, implementing best management practices for grazing or logging, setting pesticide use guidelines) to minimize impacts from sedimentation, agricultural chemicals, or warm temperatures.

At sites that are vulnerable to development, protection of land through fee title acquisition or conservation easements is important to prevent adverse impacts or allow conservation actions to be implemented. In several bull trout core areas, fisheries management to manage or suppress non-native species (particularly brown trout, brook trout, lake trout, and northern pike) is ongoing and has been identified as important in addressing effects of non-native fish competition, predation, or hybridization.

A more comprehensive overview of conservation successes since 1999, described for each recovery unit, is found in the Summary of Bull Trout Conservation Successes and Actions since 1999 (Available at http://www.fws.gov/pacific/ecoservices/endangered/recovery/documents/USFWS_2013_summary_of_conservation_successes.pdf).

2.3.1.9 Contemporaneous Federal Actions

Projects subject to section 7 consultation under the Act have occurred throughout the range of bull trout. Singly or in aggregate, these projects could affect the species' status. The Service reviewed 137 opinions produced by the Service from the time of listing in June 1998 until August 2003 (Nuss 2003, entire). The Service analyzed 24 different activity types (e.g., grazing, road maintenance, habitat restoration, timber sales, hydropower, etc.). Twenty opinions involved multiple projects, including restorative actions for bull trout.

The geographic scale of projects analyzed in these opinions varied from individual actions (e.g., construction of a bridge or pipeline) within one basin, to multiple-project actions, occurring across several basins. Some large-scale projects affected more than one recovery unit.

The Service's assessment of opinions from the time of listing until August 2003 (137 opinions), confirmed that no actions that had undergone Section 7 consultation during this period, considered either singly or cumulatively, would appreciably reduce the likelihood of survival and recovery of the bull trout or result in the loss of any (sub) populations (USFWS 2006, pp. B-36 – B-37).

2.3.2 Bull Trout Critical Habitat

2.3.2.1 Legal Status

Ongoing litigation resulted in the U.S. District Court for the District of Oregon granting the Service a voluntary remand of the 2005 critical habitat designation. Subsequently the Service published a proposed critical habitat rule on January 14, 2010 (USFWS 2010c, 75 FR 2270) and a final rule on October 18, 2010 (USFWS 2010b, 75 FR 63898). The rule became effective on November 17, 2010. A justification document was also developed to support the rule and is available on our website (http://www.fws.gov/pacific/bulltrout). The scope of the designation involved the species' coterminous range within the Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Upper Snake, and St. Mary recovery units[6].

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

[6] Note: the adverse modification analysis does not rely on recovery units.

Table 3. Stream/shoreline distance and reservoir/lake area designated as bull trout critical habitat by state.

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

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

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

The final rule continues to exclude some critical habitat segments based on a careful balancing of the benefits of inclusion versus the benefits of exclusion. Critical habitat does not include: (1) waters adjacent to non-Federal lands covered by legally operative incidental take permits for habitat conservation plans (HCPs) issued under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended, in which bull trout is a covered species on or before the publication of this final rule; (2) waters within or adjacent to Tribal lands subject to certain commitments to conserve bull trout or a conservation program that provides aquatic resource protection and restoration through collaborative efforts, and where the Tribes indicated that inclusion would impair their relationship with the Service; or (3) waters where impacts to national security have been identified (USFWS 2010b, 75 FR 63898). Excluded areas are approximately 10 percent of the stream/shoreline miles and 4 percent of the lakes and reservoir acreage of designated critical habitat. Each excluded area is identified in the relevant CHU text, as identified in paragraphs (e)(8) through (e)(41) of the final rule. It is important to note that the exclusion of waterbodies from designated critical habitat does not negate or diminish their importance for bull trout conservation. Because exclusions reflect the often complex pattern of land ownership, designated critical habitat is often fragmented and interspersed with excluded stream segments.

2.3.2.2 Conservation Role and Description of Critical Habitat

The conservation role of bull trout critical habitat is to support viable core area populations (USFWS 2010b, 75 FR 63943). The core areas reflect the metapopulation structure of bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. CHUs generally encompass one or more core areas and may include FMO areas, outside of core areas, that are important to the survival and recovery of bull trout.

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

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

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

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

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.
2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including, but not limited to, permanent, partial, intermittent, or seasonal barriers.
3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes that establish and maintain these aquatic environments, with features such as

large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

5. Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.
6. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.
7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departures from a natural hydrograph.
8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
9. Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

2.3.2.3 Current Rangewide Condition of Bull Trout Critical Habitat

The condition of bull trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (USFWS 2002b, 67 FR 71240). This condition reflects the condition of bull trout habitat.

The primary land and water management activities impacting the physical and biological features essential to the conservation of bull trout include timber harvest and road building, agriculture and agricultural diversions, livestock grazing, dams, mining, urbanization and residential development, and nonnative species presence or introduction (USFWS 2010c, 75 FR 2282).

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

1. Fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Dunham and Rieman 1999, p. 652; Rieman and McIntyre 1993, p. 7).
2. Degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and

rangeland practices and intensive development of roads (Fraley and Shepard 1989, p. 141; MBTSG 1998, pp. ii - v, 20-45).

3. The introduction and spread of nonnative fish species, particularly brook trout and lake trout, as a result of fish stocking and degraded habitat conditions, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary et al. 1993, p. 857; Rieman et al. 2006, pp. 73-76).
4. In the Coastal-Puget Sound region where amphidromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine nearshore foraging and migration habitat due to urban and residential development.
5. Degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

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

2.4 Environmental Baseline of the Action Area

This section assesses the effects of past and ongoing human and natural factors that have led to the current status of the species, its habitat and ecosystem in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have already undergone section 7 consultations, and the impacts of state and private actions which are contemporaneous with this consultation.

2.4.1 Bull Trout

2.4.1.1 Status of the Bull Trout in the Action Area

Within the action area, bull trout use FMO habitat in the Columbia River, Snake River, Clearwater River, Salmon River, South Fork Clearwater River, Selway River, Grande Ronde River, Asotin Creek, Imnaha River, and Tucannon River. No hatchery activities are known to occur in bull trout spawning and early rearing areas, and bull trout are not known to occur in Lapwai Creek (where NPT smolt releases occur).

Ten bull trout core areas are located within the action area as shown in Table 4, along with the status of each core area.

Table 4. Status of bull trout core areas within the action area.

Core Area	Number of Local Populations	Trends	Primary Threats Identified (and number of threats)[2,3]
Imnaha River	8	Stable[1]	No
Pine-Indian-Wildhorse Creeks	3	Decreasing[1]	Yes (3)
Little-Lower Salmon River	6	Stable[2]	No
Middle Salmon-Chamberlain River	9	Increasing[2]	No
South Fork Clearwater River	5	Decreasing[3]	Yes (2)
Selway River	10	Unknown[1]	No
Lookingglass/Wenaha Rivers	4	Stable[1]	No
Wallowa/Minam Rivers	6	Stable[1]	Yes (2)
Asotin Creek	1	Unknown[1]	Yes (2)
Tucannon River	5	Stable[1]	Yes (3)

[1]USFWS 2008, Table 1
[2]USFWS 2015f, Table E-2;
[3]USFWS 2015d, pp. C-322, Table C-2

In summary, Table 4 shows that trend for one core area is increasing (Middle Salmon-Chamberlain), the trend for five core areas is stable (Imnaha, Little-Lower Salmon, Lookingglass/Wehaha, Wallowa/Minam, and Tucannon), the trend for two core areas is decreasing (Pine-Indian-Wildhorse and South Fork Clearwater), and the trend for two core areas is unknown (Selway and Asotin), however the Service (USFWS 2015d, p. C-327) states that the Selway core area status is "strong".

2.4.1.2 Factors Affecting the Bull Trout in the Action Area

A survey conducted by Al-Chokhachy et al. (2008, p. 18) concluded that nonnative species, forest management practices, and fish passage issues were the top factors limiting bull trout populations at the range-wide level, both currently and historically. Most of the factors affecting bull trout fall into the category of destruction, modification, or curtailment of habitat (USFWS 2014, p. 12). Most of these impacts (e.g., dewatering, sedimentation, thermal modification, water quality degradation) are human-caused and are a consequence of specific land and water management activities. Today, these types of impacts are frequently mitigated or moderated, especially on Federal lands and with a greater conservation emphasis in headwater areas where suitable bull trout spawning and rearing habitat occurs. It is the legacy effect of poor past land use management that continues to degrade bull trout habitat where habitat restoration has not yet occurred. Table 5 summarizes primary threats to bull trout core areas in the action area.

Table 5. Primary threats to bull trout in core areas located within the action area (from USFWS 2015d, Table C-2; 2015f, Table E-3).

Core Area – Complex ***Core Area - Simple***	**PRIMARY THREATS***		
	Habitat	**Demographic**	**Nonnative**
Imnaha River	**None**	**None**	**None**
Pine, Indian, and Wildhorse Creeks	**In-stream Impacts** Dewatering caused by numerous diversions has resulted in significantly reduced stream flow and elevated stream temperatures directly impacting the migratory life history.	**Connectivity Impairment** Dewatering, entrainment, and passage barriers caused by water diversions and impeded connectivity. Oxbow and Hells Canyon Dams isolate Wildhorse Creek from other populations in the core area and prevent connection to other core areas.	**Nonnative Fishes** Hybridization and competition with brook trout are serious threats to bull trout. Brook trout are widespread throughout the core area.
Little-Lower Salmon River	**None**	**None**	**None**
Middle Salmon River – Chamberlain	**None**	**None**	**None**
South Fork Clearwater River	**Upland/Riparian Land Management** Legacy impacts from forest practices, roads, and mining, as well as transportation corridors (historical and current) contribute to degradation in some SF tributaries and mainstem FMO habitat. Agricultural practices and improper grazing degrade habitat primarily in lower mainstem FMO habitat. **In-stream Impacts** Activities such as forest practices, mining, roads, and grazing in upland and riparian areas have contributed to in-stream degradation, loss of LWD, pool reduction, and sedimentation.	**None**	**Nonnative Fishes** Brook trout in some SF tributaries (*e.g.*, upper Crooked and Red Rivers), and mainstem FMO habitats contributing to competition, predation, range reduction, and possible hybridization.

Core Area – Complex ***Core Area - Simple***	**PRIMARY THREATS***		
	Habitat	**Demographic**	**Nonnative**
Selway River	**None**	**None**	**None**
Lookingglass/ Wenaha Rivers	**None**	**None**	**None**
Wallowa/Minam Rivers	**Water Quality** Agricultural Practices and other land use activities resulted in high water temperatures and low flows that degrade habitat quality and impede connectivity, particularly in FMO habitats.	**None**	**Nonnative Fishes** Brook trout are present in all populations except Deer Creek and negatively impact bull trout through hybridization and competition.
Asotin Creek	**Upland/Riparian Land Management** Legacy impacts from residential development, agricultural practices, grazing, and recreation that reduce or limit habitat complexity, increase water temperatures and sediment loading, and reduce wood recruitment. **In-stream Impacts** Impacts from flood control and repairs, especially in lower stream reaches. Intermittent flows and dewatering throughout basin in tributaries impacting migration. Naturally low in-stream flows and high temperatures accentuated by climate change.	**Connectivity Impairment** Seasonal manmade and temperature barriers to migration in Snake River and lower Asotin Creek prevent or hinder migratory life history. **Small Population Size** Low population size and loss of fluvial migratory life history form have reduced genetic diversity and demographic stability.	**None**
Tucannon River	**Upland/Riparian Land Management** Agricultural and forest practices, transportation networks, rural and urban development have eliminated or reduced riparian cover and protective buffers,	**Connectivity Impairment** Thermal and manmade barriers prevent or limit free movement and connectivity between FMO and spawning/rearing areas.	**Nonnative Fishes** Predatory species such as small mouth bass and walleye in FMO areas of the lower Tucannon River and mainstem Snake River. Competitive/ interbreeding species including hatchery origin

Core Area – Complex *Core Area - Simple*	**PRIMARY THREATS***		
	Habitat	**Demographic**	**Nonnative**
	resulting in the loss of habitat complexity, and increased water temperatures. **In-stream Impacts** Flood control and transportation networks that have led to channelization, loss of floodplain connectivity, levee installation and loss of habitat complexity and diversity throughout entire core area. **Water Quality** Contaminants, sedimentation, and temperature impairments both from current and legacy agricultural, recreational, forestry, and transportation practices in the watershed have reduced habitat availability and suitability. Reduction of habitat suitability due to climate change is predicted as high risk in the core area.	Hydropower facilities on the mainstem Snake River delay migration or hinder free movement of bull trout between core areas.	rainbow, and brook trout in FMO and spawning/rearing areas. Changes in habitat and water temperatures as a result of climate change will likely exacerbate this threat in some areas.

***Primary Threat**: *Factors known or likely (i.e., non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require management actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future (50 years).*

In summary, Table 6 shows that the main threats for bull trout in the action area are connectivity impairment (e.g., dams, passage barriers, water temperature), non-native fish (e.g., brook trout), upland/riparian land management (e.g., legacy timber harvest and roads, residential development, agriculture, grazing, recreation impacts) and in-stream impacts (e.g., low in-stream flows, loss of habitat complexity, sedimentation, water temperature). The following sections provide more information on these threats.

Connectivity Impairment

Connectivity between spawning/rearing habitat and downstream FMO habitat sufficient for bull trout to move freely and with minimal risk is necessary for the expression of migratory life history patterns. In core areas where multiple local populations exist, interaction among local populations through movement of migratory individuals is critical to maintaining genetic diversity and recolonizing local populations that become extirpated. Thus, when connectivity with FMO habitat is impaired or blocked, bull trout populations tend to become restricted to isolated local populations of small resident fish, which may be genetically depauperate, vulnerable to extirpation, and cannot be readily recolonized. Barriers to connectivity may consist of natural physical features such as waterfalls; river reaches that create mortality risks or prevent movement of adult fish because of entrainment, excessively warm water, or poor water quality; in-stream structures such as culverts or weirs; or dams. The severity of passage barriers is generally affected by the volume of streamflow, which can vary with seasonal precipitation, and dam operations that may limit passage at certain times of year (USFWS 2014, p. 27)

Non-native Fish

Nonnative fish of primary concern include both lake trout and brook trout. Lake trout, a congeneric species whose niche has strong overlap with bull trout, can outcompete and prey upon bull trout in lake environments where they co-occur (USFWS 2015a, p. 14)

Brook trout represent another threat to bull trout populations. Brook trout is a congeneric species that competes with, and can hybridize with, bull trout (USFWS 2015a, p. 15). Brook trout are the only species known to commonly hybridize with bull trout throughout their range. There are numerous examples where bull trout hybridization with brook trout has been documented resulting in bull trout declines or even local extirpations (Leary et al. 1983, p. 369; Ardren et al. 2011, p. 521).

Upland and Riparian Management

Forest management activities, including timber extraction and road construction, affect bull trout habitat by altering recruitment of large woody debris, erosion and sedimentation rates, runoff patterns, the magnitude of peak and low flows, water temperature, and annual water yield resulting in degradation of suitable habitat (USFWS 2002a, p. 17).

Improperly managed livestock grazing degrades bull trout habitat by removing riparian vegetation, destabilizing stream banks, widening stream channels, promoting incised channels, lowering water tables, reducing pool frequency, increasing soil erosion, and altering water quality (USFWS 2002a, p. 18).

Residential development is rapidly increasing within portions of the action area. Residential development alters stream and riparian habitats through contaminant inputs, stormwater runoff, changes in flow regimes, stream bank modification and destabilization, increased nutrient loads, and increased water temperatures. Indirectly, urbanization within floodplains alters groundwater recharge by rapidly routing water into streams through drains rather than through more gradual subsurface flow (USFWS 2002a, p. 21).

Mining degrades aquatic habitats used by bull trout by altering water chemistry (e.g., pH); altering stream morphology and flow; and causing sediment, fuel, and heavy metals to enter streams (USFWS 2002a, p. 20).

Agricultural practices, such as cultivation, irrigation diversions, and chemical application, contribute to nonpoint source pollution in some areas within the range of bull trout. These practices can release sediment, nutrients, pesticides, and herbicides into streams; increase water temperature; reduce riparian vegetation; and alter hydrologic regimes, typically by reducing flows in spring and summer. Irrigation diversions also affect bull trout by altering stream flow and allowing entrainment. The effects of the myriad of small irrigation diversion and hydropower projects throughout the range of bull trout are likely of even greater significance than the large hydropower and flood control projects. Many of these are located further up in watersheds and either physically block fish passage by means of a structure (i.e., a dam), or effectively block passage by periodically dewatering a downstream reach (e.g., diversion of flows through a penstock to a powerhouse; diversion of flows for the purposes of irrigation). Even if diversions are not so severe as to dewater downstream reaches, reduced flows can result in structural and thermal passage barriers. Other effects include water quality degradation resulting from irrigation return flows and runoff from fields and entrainment of bull trout into canals and fields. Some irrigation diversion structures are reconstituted annually with a bulldozer as "push up" berms and not only affect passage, but also significantly degrade the stream channel. The prevalence of these structures throughout the range of bull trout has resulted in the isolation of bull trout populations in the upper watersheds in many areas (USFWS 2002a, p. 19).

In-stream Impacts

In-stream impacts can result from forest management, grazing, residential development, mining, and agriculture, and can impact bull trout habitat through the pathways described above in *Upland and Riparian Management.*

Water Quality

Impacts to water quality can negatively affect bull trout, including but not limited to: sedimentation, pH changes and heavy metal contamination from mines; runoff of pesticides, fecal coliform, or nutrients from agricultural activities or urban development; associated low dissolved oxygen concentrations; and oil from roads. Fish exposed to contaminants such as heavy metals and pesticides can suffer direct mortality at high levels, or at lower levels, can experience chronic sublethal impacts to performance (such as to swimming ability, migratory behavior, reproductive success, and survival). Therefore, water quality in bull trout habitat should be maintained at high levels by implementing BMPs and enforcing water quality standards (USFWS 2015a, p. 26).

Climate Change

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

Isaak et al's 2010 (p. 1350) study of changing stream temperatures over a 13 year period in the Boise River basin estimated an 11 to 20 percent loss of suitable coldwater bull trout spawning and early juvenile rearing habitats. These results suggest that a warming climate is already affecting suitable bull trout in-stream habitats. This is consistent with Rieman et al. (2007, p. 1552) and Wenger et al. (2011, p. 988) conclusions that bull trout distribution is strongly influenced by climate, and predicted warming effects could result in substantial loss of suitable bull trout habitats over the next several decades. Bull trout already seem to inhabit the coldest available streams in study areas (Wenger et al. 2011, p. 1002), and in several watersheds bull trout do not have the potential to shift upstream with warming stream temperatures at lower elevations.

2.4.2 Bull Trout Critical Habitat

2.4.2.1 Status of Bull Trout Critical Habitat in the Action Area

The action area is encompassed by Critical Habitat Units (CHUs) in the Mid-Columbia and Upper Snake Recovery Units (defined in USFWS 2010a, pp. 4-7). The CHUs are Mainstem Upper Columbia River, Mainstem Snake River, Lower Snake River, Grande Ronde River, Imnaha River, Clearwater River, and the Salmon River. These CHUs and applicable Critical Habitat Subunits (CHSU) are described in the following sections.

Mainstem Upper Columbia River CHU

The Mainstem Upper Columbia River CHU is essential for maintaining bull trout distribution and genetic contributions to the Lower Columbia and Snake River mainstems and 13 other CHUs. Its location between Chief Joseph Dam, in the most northern geographical area, and John Day Dam, in the most southern area, provides key connectivity for the Mid-Columbia River RU. Bull trout are known to reside year-round in the mainstem rivers as sub-adults and adults, but spawning adults may utilize the mainstem Columbia River for up to at least nine months as well. Several studies in the upper Columbia and lower Snake Rivers indicate migration between the Mainstem Upper Columbia River CHU and core areas, generally during periods of cooler water temperatures. FMO habitat provided by the mainstem Columbia River is essential for bull trout conservation because it supports the expression of the fluvial migratory life history forms for multiple core areas (USFWS 2010a, p. 577).

The Irrigon Hatchery is located on the mainstem Columbia River within this CHU.

Mainstem Snake River CHU

The Snake River Mainstem CHU is located from the confluence of the Snake River with the Columbia River upstream to Brownlee Reservoir. The Snake River is within Franklin, Walla Walla, Columbia, Whitman, Garfield, and Asotin Counties in Washington; Wallowa, Whitman, Baker, and Malheur Counties in Oregon; and Nez Perce, Idaho, Adams, and Washington Counties in Idaho.

The mainstem Snake River plays an important role in the recovery of bull trout populations by providing essential FMO habitat necessary for populations found in the Tucannon River, Asotin Creek, Grande Ronde River, Imnaha River, Clearwater River, Salmon River, Sheep Creek, Granite Creek, Powder River, Pine Creek, Indian Creek, and Wildhorse Creek. Brownlee Reservoir contains potential FMO habitat for fluvial bull trout in the Powder River and Eagle Creek.

In the lower section of the Snake River are a series of dams and locks built by the U.S. Army Corps of Engineers. The Lower Granite, Little Goose, Lower Monumental, and Ice Harbor Dams serve as hydroelectric power sources and provide a navigable route for barge traffic to

Lewiston, Idaho. The major features in the Hells Canyon Hydroelectric Complex reach of the Snake River are Hells Canyon, Oxbow, and Brownlee Dams and their reservoirs.

Downstream from Hells Canyon Dam to the Oregon–Washington border, the Snake River is designated a Wild and Scenic River. It also lies within the Hells Canyon National Recreation Area and the Hells Canyon Wilderness, which are administered by the U.S. Forest Service. The Snake River, from its mouth to Brownlee Dam, is occupied by bull trout in most of its reaches and is essential to the long-term conservation of the species by conserving the opportunity for expressing life history, facilitating genetic exchange, and ensuring connectivity among populations and core areas.

The Snake River and its reservoirs provide an abundant food source for migratory bull trout during the fall, winter, and spring. Forage fish such as juvenile salmon and steelhead, whitefish, sculpins (family Cottidae), suckers (family Catostomidae), and minnows (family Cyprinidae) are present throughout the Lower Snake River (USFWS 2010a, pp. 583-584).

Snake River fall Chinook hatchery facilities located on the mainstem Snake River include Oxbow, Pittsburg Landing, Lyons Ferry, Captain John Landing, and Lower Granite Dam, as well as the location used for direct release of juvenile salmon below Hells Canyon Dam.

<u>Lower Snake River CHU</u>

The Lower Snake River CHU is essential to the conservation of bull trout because both fluvial and resident bull trout life history forms occur in Asotin Creek and Tucannon River, and these basins are the only suitable bull trout refugia with adequate spawning, rearing, and FMO habitat in the lower Snake River basin.

Asotin Creek CHSU

The Asotin Creek mainstem, from the confluence with the Snake River upstream 24.0 km (14.9 mi) to the confluence with the North Fork and the South Fork of Asotin Creek, provides FMO habitat and is an important migratory connection to Snake River FMO habitat. Observed redd sizes in the upper watershed of this core area suggest that most bull trout in the basin are resident. However, trap data near the mouth of Asotin Creek indicate that both juvenile and adult migrant bull trout have been captured annually in recent years in both upstream and downstream traps (Mayer et al. 2007, p. 26). It is unknown if the adult fish originated in Asotin Creek or if they utilize Asotin Creek seasonally for cold water refuge and for forage.

Spawning ground surveys occur in Asotin Creek as part of the fall Chinook salmon hatchery program.

Tucannon River CHSU

The Tucannon River is a tributary to the Snake River located in Columbia and Garfield Counties, Washington. There are five local populations of bull trout in the Tucannon River subbasin (USFWS 2014, p. 86).

The Tucannon River mainstem includes the lower 71 km (44 mi) of the Tucannon River. The mainstem is primarily FMO habitat, but bull trout may occur either seasonally or year-round. The upper 22.9 km (14.2 mi) from Cow Camp Bridge to the uppermost headwaters of the Tucannon River above Bear Creek serves primarily as spawning, rearing, and foraging habitat. Bull trout spawn in tributaries to the Tucannon River, but most spawning takes place in a 13.2

km (8.2 mi) reach of the mainstem between Panjab Creek and Bear Creek (USFWS 2010a, p. 429).

The lower Tucannon River is an important migratory corridor to spawning areas upstream in the watershed. Each spring, a varying number of adult bull trout (range of 20-286 from 1998-2014) up to 650 mm (25.6 in) in length enter the Tucannon River anadromous fish trap (located at river kilometer 59) and are released upstream of the facility. Movement of bull trout upstream into the trap coincides with the spring chinook return to the Tucannon River. Some of these captured bull trout are believed to be migrating into the Tucannon River from the Snake River to prepare for spawning in upper reaches of the Tucannon River and its tributaries in September and October (Underwood et al. 1995, pp. 77-81), but many have reared in the lower Tucannon River during the winter months following spawning in the fall (Faler 2008, p. 2).

Smolt trapping and spawning ground surveys occur in the lower Tucannon River as components of the fall Chinook salmon hatchery program.

Grande Ronde River CHU

The Grande Ronde River CHU is located in northeast Oregon and southeast Washington and includes the mainstem Grande Ronde River from its headwaters to the confluence with the Snake River. The Wenaha and Wallowa Rivers are included in this CHU, but hatchery program activities are only conducted in the Wenaha River.

Wenaha River

The Wenaha River is bull trout critical habitat from its confluence with the Grande Ronde River upstream 35 km (21.7 mi) to the junction of the North Fork and South Fork. Collectively, the Wenaha River and its tributaries support three bull trout populations, which is about one-third of the populations within in the Grande Ronde basin. The Wenaha River system is the basin's stronghold for bull trout. The lower 16 km (10 mi) of the Wenaha River, near the confluence with Beaver Creek, provide FMO habitat for fluvial bull trout and a migratory connection to the Grande Ronde River. Spawning and rearing have been documented in the upper Wenaha, the North Fork Wenaha, the South Fork Wenaha, Milk Creek, Beaver Creek, Butte Creek, and West Fork Butte Creek. All other tributaries named are documented FMO habitat for bull trout (Buchanan et al. 1997, pp.107, 111).

Imnaha River CHU

The Imnaha River CHU is located in northeastern Oregon in Wallowa County and very small portions of Baker and Union Counties. Although much of the mainstem Imnaha River watershed is federally owned, the river corridor is mostly privately owned below approximately river km 83 (mi 51.5).

The Imnaha River from its confluence with the Snake River upstream approximately 66.6 km (41.4 mi) is utilized by fluvial bull trout in fall, winter, and spring as essential FMO habitat (USFWS 2010a, p. 482).

Spawning ground surveys are the only fall Chinook salmon hatchery activities that occur in the Imnaha River.

Clearwater River CHU

The Clearwater River CHU is located east of Lewiston, Idaho, and extends from the Snake River confluence at Lewiston, on the west to headwaters in the Bitterroot Mountains along the Idaho–Montana border on the east in Nez Perce, Latah, Lewis, Clearwater, Idaho, and Shoshone Counties, Idaho. This unit includes five CHSUs with three encompassing the action area: the Lower-Middle Fork Clearwater River, South Fork Clearwater River, and the Selway River (USFWS 2010a, p. 527).

Lower-Middle Fork Clearwater River CHSU

Located within Idaho's Nez Perce, Latah, Lewis, Clearwater, and Idaho Counties, the Lower-Middle Fork Clearwater River CHSU includes the mainstem Clearwater River, Middle Fork Clearwater River, and all tributary watersheds. The North Fork Clearwater River above Dworshak Dam, South Fork Clearwater River, Lochsa River, and Selway River drainages are separate CHSUs. A total of 159.5 km (99.1 mi) of rivers are designated as bull trout critical habitat.

The Clearwater River, from its confluence with the Snake River upstream 119.6 km (74.3 mi) to its confluence with the South Fork Clearwater River and the Middle Fork Clearwater River from its confluence with the South Fork upstream 36.8 km (22.9 mi) to the confluence of the Lochsa and Selway Rivers provide FMO habitat. The North Fork Clearwater River from its confluence with the Clearwater River upstream 3.1 km (2.0 mi) to the base of Dworshak Dam provides FMO habitat.

The Lower-Middle Fork Clearwater River CHSU is essential to bull trout conservation because the Clearwater River and Middle Fork Clearwater River primarily serve as migratory corridors, connecting bull trout local populations within the Clearwater River CHU as well as maintaining connectivity to other Mid-Columbia River bull trout populations. These mainstem river reaches also provide important foraging and overwintering areas for subadult and adult bull trout that originate in upstream CHSUs.

Subadult and adult bull trout have been documented in both the Clearwater and the Middle Fork Clearwater Rivers (CBBTTAT 1998, p. 24). Subadult bull trout have been captured in the mainstem Clearwater River near the confluence with the Snake River (USFWS 2010a, p. 529).

The NPTH and the Big Canyon facility are located on the mainstem Clearwater River.

South Fork Clearwater River CHSU

Located within Idaho and Nez Perce Counties, the South Fork Clearwater River CHSU includes the entire stream network of the South Fork Clearwater River. A total of 508.0 km (315.6 mi) of streams and rivers are designated as bull trout critical habitat.

The South Fork Clearwater River CHSU is essential to bull trout conservation because both migratory and resident life histories are known to occur within the CHSU. Although the overall core area population level is considered to be moderate, bull trout are distributed among most of the major watersheds within the CHSU. Located downstream of the Lochsa River CHSU and Selway River CHSU, and upstream of the North Fork Clearwater CHSU, the South Fork Clearwater River CHSU provides additional habitat for foraging and thermal refuge for bull trout that disperse from these other CHSUs. Furthermore, for bull trout originating in the North Fork Clearwater CHSU that are entrained past Dworshak Dam and unable to return to their natal streams, the South Fork Clearwater River CHSU is the first major drainage below the dam supporting known local populations and suitable habitat that they can utilize to fulfill their life cycle.

The South Fork Clearwater River, from its confluence with the Clearwater River upstream 100.3 km (62.3 mi) to the confluence of the Red River and the American River, provides bull trout FMO habitat.

Radio-tracking studies and creel surveys have documented bull trout subadult and adult use of rearing and overwintering habitat in the mainstem South Fork.

Luke's Gulch satellite facility and the proposed NPT weir, included in this consultation, are located on the South Fork Clearwater River.

Selway River CHSU

Located within Idaho County, the Selway River CHSU includes the entire stream network of the Selway River. A total of 735.6 km (457.1 mi) of streams are designated as critical habitat.

The Selway River CHSU is essential to bull trout conservation because the Selway River core area has many individuals and local populations that are distributed throughout much of the CHSU. The Selway River CHSU is almost entirely within Wilderness areas and has much habitat with few threats. Bull trout within the Selway River CHSU are one of the more secure and stable bull trout core area populations within the Clearwater River CHU and provide a very important stronghold against potential extinction.

The Selway River from its confluence with the Lochsa River upstream 130.0 km (80.7 mi) to Deep Creek provides FMO habitat; spawning and rearing habitat occurs upstream an additional 29.0 km (18.0 mi).

The NPT's Cedar Flats satellite facility, included in this consultation, is located at RM 5.3 on the mainstem Selway River. Spawning ground surveys are also conducted in the Selway River.

Salmon River CHU (Upper Snake River Recovery Unit)

The Salmon River Basin CHU is essential for maintaining bull trout distribution within this unique geographic region of the Upper Snake RU. This CHU extends from the Idaho–Montana border to the Oregon–Idaho border before entering the Snake River, and represents the most northern and eastern extents of the Upper Snake RU. This CHU is the largest CHU of the Upper Snake RU and contains the largest populations of bull trout in this RU. It supports bull trout populations that express adfluvial, fluvial, and resident life history expression. Migratory life history expression is needed for the long-term conservation of the species, and some resident populations may also contain unique genes that promote persistence from specific threats.

Little-Lower Salmon River CHSU

Located within Nez Perce, Lewis, Idaho, Adams, and Valley counties in west-central Idaho immediately southeast of the town of Riggins, Idaho, this CHSU includes 472.7 km (293.7 mi) of streams that are designated as bull trout critical habitat.

The Little-Lower Salmon River, from its confluence with the Snake River 167.6 km (104.1 mi) upstream, contains bull trout FMO habitat.

The Little-Lower Salmon River CHSU is essential to bull trout conservation because it is in the northwesternmost extent of the Salmon River CHU and contains many individuals, a large amount of habitat, and few threats. Bull trout populations in this CHSU express fluvial life history forms that are important to the long-term recovery of the species. The Little-Lower Salmon River CHSU also provides access to the Snake River, which promotes the migratory life history form needed for the conservation of the species.

As part of the Snake River fall Chinook salmon hatchery program, spawning ground surveys are conducted in the lower Salmon River.

Middle Salmon River-Chamberlain River CHSU

The Middle Salmon River-Chamberlain River CHSU is located within Idaho and Valley Counties in east-central Idaho, 80 km (50 mi) east of the town of Riggins, Idaho, and includes 793.7 km (493.2 mi) of streams that are designated bull trout critical habitat.

The portion of the Salmon River that lies within this CHSU, from approximately 2.1 km (1.3 mi) upstream from its confluence with French Creek upstream 110.0 km (68.3 mi) to its confluence with Chamberlain Creek, contains bull trout FMO habitat.

The Middle Salmon River-Chamberlain River CHSU is essential to bull trout conservation because it contains many individuals, a large amount of habitat, and few threats. This CHSU contains fluvial life history forms that are important in the long-term recovery of the species. It also provides a migratory corridor between multiple CHSUs, which promotes the migratory life history expression within the Salmon River basin.

As part of the Snake River fall Chinook salmon hatchery program, spawning ground surveys are conducted in the Middle Salmon River-Chamberlain River CHSU.

2.4.2.2 Factors Affecting Bull Trout Critical Habitat in the Action Area

The same threats described above for bull trout in section 2.4.1 also apply to bull trout critical habitat, including climate change.

With a warming climate, thermally suitable bull trout spawning and rearing areas are predicted to shrink during warm seasons, in some cases very dramatically, becoming even more isolated from one another under moderate climate change scenarios (Rieman et al. 2007, pp. 1558–1562; Porter and Nelitz 2009, pp. 5–7). Climate change will likely interact with other stressors, such as habitat loss and fragmentation (Rieman et al. 2007, pp. 1558–1560; Porter and Nelitz 2009, p. 3); invasions of nonnative fish (Rahel et al. 2008, pp. 552–553); diseases and parasites (McCullough et al. 2009, p. 104); predators and competitors (McMahon et al. 2007, pp. 1313–1323; Rahel et al. 2008, pp. 552–553); and flow alteration (McCullough et al. 2009, pp. 106–108), rendering some current spawning, rearing, and migratory habitats marginal or wholly unsuitable. Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features described in section 2.3.2.2 (PBFs 1, 2, 3, 5, 7, 8 and 9).

2.5 Effects of the Proposed Action

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

2.5.1 Bull Trout

2.5.1.1 Direct and Indirect Effects of the Proposed Action

Effects to bull trout (and its critical habitat, section 2.5.2) will be analyzed relative to the operational elements of the proposed action previously discussed in sections 2.1.2.1 and 2.1.2.2.

2.5.1.1.1 Broodstock Collection

Broodstock collection (the collection of returning adult salmon for spawning in the hatcheries) can be accomplished in several ways, but in most hatchery operations it occurs by trapping. There are two main categories of traps: run-at-large trapping with a weir or dam and associated trap that blocks the entire stream, either on a temporary or permanent basis; and volunteer traps associated with facilities. In run-at-large trapping, non-target fish (e.g., bull trout) may be trapped inadvertently and held for some time before being returned to the stream, causing migration delay and possibly injury. Even if the fish are not trapped, presence of the structure may slow migration (Recovery Implementation Science Team (RIST) 2009, p. 7). Non-target fish are much less likely to be affected by volunteer traps, where the target fish are enticed by attraction water and directed by homing instinct, although this depends on trap size relative to the stream. Regardless, all trapping involves risk. Installation and operation of adult traps may capture, delay, or otherwise disrupt the movements and distribution of fish in the stream. Trapping can also stress, injure, or kill fish if improperly designed and operated. Proper design and placement of ladders and traps are paramount to minimizing the negative effects that these facilities can pose. Vigilant monitoring and cleaning of facilities is also necessary.

The primary broodstock collection location for the Snake River fall Chinook hatchery program is the adult trap at LGR. Supplemental collection can take place at the LFH and the NPT hatchery. This supplemental collection is annually dependent on the progress in attaining full program broodstock goals at LGR. Broodstock collection for the Snake River fall Chinook program at LGR starts as early as August 18th and can run through the end of November.

There have been no documented or reported instances of bull trout trapped at any of these three locations during the fall Chinook broodstock collection timeframe (mid-August through November) since broodstock collection operations began (1984 at the LFH, 2003 at the NPTH, and 2006 at LGR). However, bull trout have been detected/observed in fish ladders in the mainstem dams and are known to be present in the mainstem rivers near adult collection facilities. Broodstock collection at the South Fork Clearwater weir has not been initiated to date; however, because the weir will span the width of the river, bull trout are expected to be adversely affected when the weir is in operation.

All of the broodstock collection facilities are located in critical bull trout FMO habitat. As previously noted, the broodstock collections at LFH and NPTH are through volunteer adult ladders to the facilities and do not block or delay mainstem bull trout passage.

The LGR adult trap diverts all fish ascending the ladder into the adult trap at predetermined intervals (annually determined, based on run forecast). Given that there have been observations (PIT tag and telemetry work) of bull trout presence and migration through the lower mainstem Snake River during summer months, it is possible that the broodstock collection activities at the LGR adult trap could encounter migratory bull trout during their operations and adversely affect the species by delaying migratory movements and causing stress and injury through handling.

However, fall Chinook broodstock collection occurs during timeframes when bull trout are unlikely to be in mainstem FMO habitat because they are spawning or rearing in headwater tributaries. As noted above, since broodstock collection operations began, there have been no documented or reported instances of bull trout trapped at any of the three locations during the fall Chinook broodstock collection timeframe (mid-August through November). At LGR, eight bull trout were captured from 2009 through 2015; all of the captures occurred between May 28 and June 4 (Ogden 2015, *in litt.*), outside the fall Chinook broodstock collection period. For these reasons, and with conservation measures incorporated into the proposed action to minimize effects (section 2.1.2.3), broodstock collection is not likely to adversely affect bull trout; all effects are expected to be insignificant or discountable.

2.5.1.1.2 Release of Hatchery Juveniles

Release of hatchery-produced juvenile salmon can elevate the risk of effects from increased competition and predation to naturally occurring species. Naturally produced fish may be competitively displaced by hatchery fish early in life, especially when hatchery fish are more numerous, are of equal or greater size, when hatchery fish take up residency before naturally produced fry emerge from redds, and if hatchery fish residualize. Hatchery fish might alter naturally produced salmon behavioral patterns and habitat use, making them more susceptible to predators (Steward and Bjornn 1990, pp. 35-50, 57). Hatchery-origin fish may also alter naturally produced salmonid migratory responses or movement patterns, leading to a decrease in foraging success (Steward and Bjornn 1990, pp. 35-50). Actual impacts on naturally produced fish would thus depend on the degree of dietary overlap, food availability, size-related differences in prey selection, foraging tactics, and differences in microhabitat use (Steward and Bjornn 1990, pp. 35-50). The negative ecological effects of hatchery release programs are most severe when wild and hatchery fish share a limited environment for a substantial period of time (Kostow 2009, p. 17).

Direct competition for food and space between hatchery and natural fish may occur in spawning/or rearing areas and in the migration corridor (FMO habitat), but is often more intense between individuals of the same species. These resource competition impacts are assumed to be greatest in the spawning and nursery areas and at points of highest fish density (release areas) and to diminish as hatchery smolts disperse (NMFS et al. 1998, p. 33). Rearing and release strategies (i.e., release of hatchery smolts that are physiologically ready to migrate) are designed to minimize competitive interactions between hatchery and naturally produced fish because hatchery smolts should quickly migrate away from release sites (NMFS 1998, p. 33). Additionally, the release sites identified in the Assessment are all located in bull trout FMO habitat, not in headwater spawning and early rearing habitat. Juvenile bull trout remain in spawning and early rearing habitat for three to four years before emigrating to mainstem FMO habitat, so there should be minimal competitive interaction between released salmon smolts and juvenile bull trout. During downstream migrations by smolts, there may be some temporal or spatial overlap (but likely small) with bull trout in FMO habitat. However, where this may occur it is likely insignificant from a competition standpoint, and may be beneficial to bull trout who will be of larger size and would consume released smolts.

Risks to naturally produced salmonids attributable to direct predation (direct consumption) or indirect predation (increases in predation by other predator species due to enhanced attraction) can result from hatchery releases. Direct predation risks from hatchery releases are likely a combination of prey abundance, in this case naturally produced salmonid juveniles in the Snake River Basin, and the size of the prey in relation to the predator fish—predators tend to prey on food items from less than or equal to 0.33 (Parkinson et al. 1989, p. i) to 0.5 of their length (Pearsons and Busack 2012, p. 59). Juvenile bull trout and hatchery released smolts are unlikely to have spatial overlap until bull trout juveniles are three to four years old by which time they are unlikely to be predated upon because they exceed these prey to predator size ratios. Furthermore, in a study designed to look at the feeding habits of yearling Snake River Chinook salmon smolts trapped at LGR, Muir and Coley (1996, p. 298) found no fish in the stomach contents of the emigrating yearling Chinook salmon smolts. Rondorf et al. (1990, p. 18, Table 1), examining the dietary composition of mainstem Columbia River subyearling Chinook salmon in the reservoir behind McNary Dam, also showed the vast majority (greater than 91 percent) of the prey items consumed were insects and crustaceans. The remaining 9 percent was a combination of various trace species including embryonic fish not identified.

Large concentrations of migrating hatchery fish may attract predators (birds, fish, and seals) and consequently contribute indirectly to predation of emigrating naturally produced fish (Steward and Bjornn 1990, p. 57). Studies indicate that increases in the number of predators in response to juvenile releases results in higher predation of wild fish (Steward and Bjornn 1990, p. 57: Collis et al. 1995, p. 353; Nickelson 2003, p. 1054). However, as previously noted, there is unlikely to be spatial and temporal overlap between juvenile bull trout and salmon smolts, and we assume that predators targeting salmon smolts are unlikely to target larger adult and subadult bull trout. Additionally, a mass of hatchery fish migrating through an area may overwhelm established predator populations, providing a beneficial, protective effect to co-occurring listed naturally produced fish (NMFS et al 1998, p. 34).

In conclusion, the release of hatchery smolts from the Snake River fall Chinook hatchery program is not likely to adversely affect bull trout by increasing bull trout vulnerability and susceptibility to predation. The release of uniformly and actively smolting yearlings that will emigrate away from the general release area in a matter of hours to days will significantly minimize the spatial and temporal overlap of smolts with juvenile bull trout (NMFS 2015, p. 60). As noted above, releases of fall Chinook juveniles may actually provide a benefit to adult and subadult bull trout by increasing forage prey base in FMO habitat.

2.5.1.1.3 Research, Monitoring, and Evaluation

The program RM&E includes activities associated with monitoring the success of the hatchery program in the restoration of the natural Snake River fall Chinook salmon population and the production of adults for harvest. "In-hatchery" RM&E will have no effect on bull trout. Only program "off-station" (conducted in the natural system) RM&E activities have the potential to affect bull trout. As shown in the Assessment (NMFS 2015, pp. 22-30), most of the RM&E activities will have no effect on bull trout; however, the following activities have the potential to adversely affect bull trout. These activities, conducted by the NPT, IFRO, NMFS, WDFW, and LSRCP, are listed below with BPA project numbers, where applicable.

Nez Perce Tribe

BPA: 1983-350-03

Nez Perce Tribal Hatchery Monitoring and Evaluation - Monitoring and evaluation of hatchery and natural fish.

Primary monitoring activities to be conducted under the Nez Perce Tribal Hatchery Monitoring and Evaluation Program with associated evaluation products include PIT tagging, weir operation and/or spawning ground surveys, screw trapping, habitat surveys, genetic analysis, and harvest monitoring. Of these various activities, weir and screw trap operations are likely to adversely affect bull trout. The screw trap is operated in the mainstem Clearwater River from May 1 – October1 (NPT 2011, p. 42). Juvenile fall Chinook are also collected in the Clearwater River using seines, trawls, and purse seins in the same time period (NPT 2011, p. 44). These activities may adversely affect bull trout through incidental capture and handling.

South Fork Clearwater River Weir: The Nez Perce Tribal Hatchery Fall Chinook Monitoring & Evaluation Project plans on placing a temporary adult fish picket weir just above the mouth of the South Fork Clearwater River. The weir will be installed around October 1 and disassembled around December 1, with subsequent years following a similar schedule. The proposed action is expected to primarily capture adult fall Chinook, although bull trout are present during the time period the weir will be operational (NPT 2011, p. 58). Operation of this weir has not yet occurred, but has the potential to adversely affect outmigrating, post-spawning bull trout through incidental capture and handling once operations begin.

BPA: 1998-010-04

Monitor and Evaluate (M&E) Performance of Juvenile Snake River Fall Chinook salmon from the Fall Chinook Acclimation Project (NPT).

This project will evaluate the success of fall Chinook supplementation above LGR and facilitate management decisions for the future conservation and perpetuation of naturally spawning populations of fall Chinook salmon in the Snake and Clearwater Rivers above LGR.

- Fall Chinook Salmon Spawning Ground Surveys in the Snake River Basin upriver of Lower Granite Dam (USFWS, NPT, IPC).
    - Fall Chinook salmon aerial (helicopter) redd surveys will occur from the end of September through December 15, and will have an insignificant to no effect on bull trout because these surveys occur on lower mainstem rivers where the potential for encountering and disturbing bull trout is discountable.

- A systematic sampling strategy may be used to conduct underwater video searches in deep-water areas where fall Chinook salmon redds are expected. A jet boat and video camera mounted on weighted in-stream flow equipment will be used to search potential deep water spawning areas. This technique will be used only in assessable lower reaches of the Clearwater and Salmon rivers (NPT 2015, p. 5). These activities are not likely to adversely affect bull trout because these surveys occur in lower mainstem rivers where the potential for encountering and disturbing bull trout is discountable.
- Snorkeling for fall Chinook salmon will occur in the Clearwater River, Grande Ronde River, Imnaha River, and Salmon River. The studies will collect fish density (number/m^2), biomass (grams/m^2), fish size, and condition factor data per age group of juvenile anadromous salmonids. Snorkeling counts are the main sampling method used to determine density and relative abundance of juvenile Chinook salmon and steelhead of natural and hatchery origin, as well as other co-existing species (NPT 2016, p. 16). Snorkeling surveys are not likely to adversely affect bull trout because these surveys occur in lower mainstem rivers where the potential for encountering and disturbing bull trout is discountable. In the unlikely event surveyors encounter bull trout, bull trout may be momentarily disturbed but the disturbance will be very short in duration and bull trout will not be perceptibly affected; effects are expected to be insignificant.

<u>Idaho Fisheries Resource Office (IFRO)</u>

IFRO fall Chinook RM&E activities that may adversely affect bull trout are currently covered by Service subpermit FWSIFWO -15, which expires on December 31, 2021. This permit coverage will end when this Opinion is issued, at which time the coverage provided in this Opinion will become effective.

BPA: 1991-029-00

This project gathers and summarizes information on adult Chinook escapement, stock-recruitment relations, smolt production, redd counts, juvenile early life history, and predation. The study is expected to be continued to 2018, and likely longer, as part of monitoring and evaluation efforts related to hatchery operations, and other Act recovery efforts and status determinations. The following activities under this project are likely to adversely affect bull trout through incidental capture and handling.

- To describe early life history attributes of juvenile fall Chinook salmon and evaluate the influence of supplementation on those attributes, roughly 15 to 25 stations along the Snake River, from LGR to Hells Canyon Dam, are beach seined weekly from March through July. Captured fish are handled and then released from the seine. This is a field activity accompanied by data summary in the office.
- To evaluate predation on juvenile fall Chinook salmon, smallmouth bass are collected along the free-flowing Snake River from the upper end of Lower Granite Reservoir to Hells Canyon Dam using angling or boat electrofishing.

BPA: 2002-032-00

This project gathers and summarizes information on abundance, food habits, and growth of juvenile fall Chinook salmon in Lower Granite Reservoir; predation on juvenile fall Chinook salmon by smallmouth bass and catfish in the reservoir; and origin, natal locale, and overwintering history of adults returning to LGR. The study is expected to be continued to 2018, and likely longer, as part of monitoring and evaluation efforts related to hatchery operations, and other Act recovery efforts and status determinations.

- Data for evaluating the abundance, food habits, and growth of juvenile fall Chinook salmon are collected by beach seining, lampara seining, and trawling periodically throughout the year. This is a field activity accompanied by data summary in the office. Actions taken in this project may adversely affect bull trout through incidental capture and handling.
- To evaluate predation on juvenile fall Chinook salmon, smallmouth bass and catfish are collected along the Snake River from LGR to the points in the Snake and Clearwater rivers where they become free-flowing. Sampling is done by angling, boat electrofishing, and hoop nets, depending on environmental conditions during a given year. BMP restrictions allow electrofishing until water temperatures exceed 18 degrees Celsius (64 degrees Fahrenheit), at which time sampling is limited to angling and hoop nets. This is a field activity accompanied by data summary in the office. Actions taken in this project may adversely affect bull trout through incidental capture and handling.
- To determine juvenile attributes of adult fall Chinook salmon returning to Lower Granite Dam, juvenile fall Chinook salmon are collected in the Snake River, from the upper end of Lower Granite Reservoir to Hells Canyon Dam and the lower 20 kms of the Grande Ronde River, using a beach seine during May. Otoliths are removed for analysis. Otoliths are also collected from adults after spawning at the LFH and the NPTH. This is a field activity accompanied by data summary in the office. Actions taken in this project may adversely affect bull trout through incidental capture and handling.

<u>NMFS</u>

BPA: 2005-002-00

Lower Granite Dam Adult Trap Operations (NMFS)

Collection and sampling of adult salmonids at LGR is an integral part of many studies. Past operation of the adult trap has been conducted primarily by NMFS staff, in cooperation with other agencies. Use of the Lower Granite Dam adult trap has increased in recent years, and is expected to increase. Current uses of the adult trap include fall Chinook broodstock collection, run-reconstruction sampling, sampling of PIT-tagged fish from transportation studies, radio telemetry studies (both tagging and tag removal at the adult trap), and PIT tagging of adult steelhead and adult Chinook. Operation of the LGR adult trap provides significant biological benefits for the Snake River fall Chinook evolutionarily significant unit (ESU).

The LGR adult trap can divert fish ascending the ladder into the trap as determined by the separation by code (SbyC) system. Given that there have been some observations (PIT tag and telemetry work) of bull trout presence and migration through the lower mainstem Snake River during summer months, it is possible that the radio tagging study at the LGR adult trap could encounter migratory bull trout, and could adversely affect bull trout by delaying migratory movements and causing stress and injury through handling.

However, fall Chinook trapping at LGR occurs during timeframes (mid-August through November) when bull trout are unlikely to be in mainstem FMO habitat because they are spawning or rearing in headwater tributaries. As noted above, since trapping operations began at LGR for fall Chinook broodstock collections, there have been no documented bull trout trapped during the fall Chinook trapping timeframe. For these reasons, and with the conservation measures described in section 2.1.2.3 incorporated into the proposed action to minimize effects, the radio telemetry study is not likely to adversely affect bull trout; all effects are expected to be insignificant or discountable.

BPA: 2012-013-00

Snake River Fall Chinook Telemetry Study at LGR (WDFW and NPT)

In an effort to improve the estimates of the Snake River fall Chinook total run size, a telemetry tagging study of adult fall Chinook was initiated in 2013. Trapping and tagging for the study takes place at LGR, and subsequent fish movements are tracked by car, boat, and from fixed site receivers positioned in various places throughout the Snake and Clearwater River basins.

For this study, fall Chinook salmon are trapped at the LGR trap (as described above). Study fish are selected using the separation by code (SbyC) system, which can trigger the gate at the adult trap to shunt PIT-tagged fish into the trap area. The diversion of these PIT-tagged fish can occur throughout the day, and may be independent of the diversion of fall Chinook for the general program broodstock collection. These PIT-tagged study fish are then radio-tagged (stomach) and released back into the Snake River via the adult fish ladder.

The SbyC assisted trapping related to this telemetry study may increase individual trapping events (quick diversion of fish ascending the ladder into the adult trap as determined by the SbyC system), which may increase the potential for incidental encounters with bull trout ascending the ladder at LGR. However, as described above, fall Chinook trapping at LGR, including the proposed telemetry study, occurs during timeframes when bull trout are unlikely to be in mainstem FMO habitat because they are likely spawning or rearing in headwater tributaries. For these reasons the fall Chinook telemetry study is not likely to adversely affect bull trout; all effects are expected to insignificant or discountable.

<u>Lower Snake River Compensation Plan</u>

LFH evaluations (WDFW)

Program RM&E activities occur in the Tucannon River and are conducted by WDFW (USFWS LSRCP funding agreement- F12AC00091). These activities include the annual operation of a juvenile smolt trap from October through July, and annual adult spawner surveys conducted weekly on index reaches on the Tucannon mainstem between October and December.

The smolt trapping activities occur at RM 2 of the Tucannon River. The smolt trapping activities are directed at multiple species and races of anadromous salmonids (e.g., listed summer steelhead, spring Chinook salmon), including the fall Chinook salmon that this program focuses on. Bull trout have been captured during the operation of the Tucannon River smolt trap. Table 6 shows annual total numbers of bull trout that have been trapped, handled, and released from the smolt trap from the 2002 fall season through the spring of 2012. The numbers are segmented into two timeframes, October-February and March-July, to demonstrate the significant difference in occurrence of trapped bull trout seasonally. The bull trout captured are predominantly emigrating sub-adult and emigrating mature, post-spawning adult bull trout. It should be noted that the Tucannon smolt trap was utilized as a sampling and tagging station by the Service during work on bull trout distribution and movement (Faler et al. 2008, p. 12), so some of the bull trout captures (and associated take) reflected in Table 6 occurred as part of that work. Under normal conditions that do not involve focused bull trout sampling efforts, bull trout sub-adults and adults are captured during Tucannon River smolt trap activities.

Bull trout may be adversely affected by handling and delayed migration, but there have been no reports of injury or observed mortality with these captures, and all precautionary measures and handling practices (e.g., water to water transfers, hands free of lotions and sunscreens, etc.) are followed (see section 2.1.2.3 for conservation measures).

Table 6. Incidental Catch of Bull Trout in the Tucannon River Smolt Trap (RM 2) from Fall of 2002-Spring of 2015 (Assessment Table 17).

Trapping Year	# Bull Trout Captured Oct.-Feb.	# Bull Trout Captured Mar.-Jul.
2014/2015	3	0
2013/2014	3	0
2012/2013	27	3
2011/2012	2	1
2010/2011	5	1
2009/2010	8	0
2008/2009	27	2
2007/2008	26	0
2006/2007	8	1
2005/2006	5	1
2004/2005	3	0
2003/2004	17	1
2002/2003	3	1
Totals	137	11

Adult fall Chinook salmon spawner surveys are conducted in the fall of each year between October and December. They are conducted on foot (walking and wading) over several sections (index reaches) of the Tucannon River, between its mouth and RM 21. This area of the Tucannon is designated bull trout critical FMO habitat. Known bull trout spawning and rearing areas are located in the upper Tucannon (above RM 48) and its tributaries (USFWS 2002d, p. 12).

Fall Chinook reaches are surveyed on a weekly rotation (from October to December, as stream and weather conditions allow), so each index will be surveyed several times each year. The survey area (RM 0-21) may have both emigrating sub-adults and post-spawn adults present during the survey timeframe, and some of these fish may be utilizing the area as foraging and FMO habitat as well. Surveys are conducted on foot and require the walking of river bank and crossing of stream reaches. These activities may momentarily disturb minor amounts of sediment, including soil, fines, and algae, but these effects would be insignificant to any bull trout present or its critical FMO habitat. Survey activities may momentarily disturb bull trout in the immediate area that the surveyor is transitioning, but the effect will be very short and will not perceptibly affect the bull trout.

Conducting fall Chinook spawner surveys in the Tucannon River may result in insignificant momentary disruption to bull trout. Fall Chinook salmon spawner surveys are not likely to adversely affect bull trout.

2.5.1.1.4 Water Withdrawals

As previously noted, water supplies for most hatchery facilities come from either surface water diversions, ground water sources (wells and springs), or a combination of both.

Surface water withdrawal structures

Surface water intakes, which draw from stream and river sources, typically have diversion structures associated with them to efficiently withdraw the required water volume to operate the hatchery facility. In general, these diversion structures can potentially diminish stream flow, impinge fish against intake screening, impede upstream and downstream migration, and can affect the migratory behavior of listed fish, if not designed, operated, and maintained properly. Surface water withdrawals may also affect other stream-dwelling organisms that serve as food for juvenile salmonids by reducing the amount of quality habitat and through displacement and physical injury.

To prevent these physical effects from occurring to bull trout, conservation measures such as proper design and operation of the diversion structures are incorporated into the proposed action. All facilities have in-stream water intakes that are designed to meet NMFS screening standards, and are operated within the design specifications. Additionally, all intake facilities are monitored regularly (daily or more often) to confirm proper operation. Tables 7-16 in the Assessment detail the operational timeframe of surface water withdrawals, where present, for all of the Snake River fall Chinook hatchery facilities. All facilities are located in designated bull trout FMO habitat. The NPTH has year-round surface water withdrawal and has the potential to affect both juvenile and adult bull trout migrating through and utilizing FMO habitat. Seasonally (spring) operated acclimation sites have more potential to affect juvenile emigrating bull trout with a minor potential to affect emigrating (post-spawning) adult bull trout. However, there have been no documented instances or reports of entrainment or impingement of bull trout at any of the program's facilities.

Surface water withdrawal structures at Snake River fall Chinook hatchery facilities may affect bull trout, but factoring in the absence of stream blocking structures, the design and operation of each of the structures to meet current screening criteria, and the lack of observed incidents of entrainment or impingement of bull trout, these effects are expected to be insignificant.

Surface water withdrawal volume and return

Tables 7-16 in the Assessment detail the surface water withdrawal volume at the various Snake River fall Chinook hatchery facilities. These volumes are compared, in terms of percentage, to the source streams that the facilities use. In all cases, the facilities withdraw a very small (less than 0.50 percent) to extremely small (less than 0.01 percent) percentage of the stream flow over the entire range of operation time (months).

Given the very small percentage of water withdrawn for hatchery operations, effects to bull trout from surface water withdrawal and return at Snake River fall Chinook hatchery facilities are expected to be insignificant. In addition, potential impacts on temperature and the prey base in mainstem rivers are also expected to be insignificant, given the small area of river affected.

Groundwater withdrawal

Ground water sources withdrawn for hatchery facilities can impact nearby streams by potentially reducing the volume of groundwater that interacts with surface streams through springs, seeps, and sub-surface connectivity (hyporheic flows). These hydrologic features are important to bull trout, often determining the overall range and connectedness of populations of the species. These features provide essential thermal refugia for bull trout during seasonal temperature variations, can provide essential habitat for spawning and rearing, can maintain minimal seasonal flows, and can have a significant effect on water quality in these areas.

Table 8 of the Assessment details the groundwater volumes available to the Snake River fall Chinook hatchery facilities. Two of the facilities, LFH and Irrigon are solely dependent on groundwater for operations. These facilities are located on the shores of the mainstem Lower Snake River and the mainstem Mid-Columbia River, respectively and withdraw large volumes of ground water for their operation—LFH=118.1 ft^3/sec and Irrigon=46.6ft^3/sec. LFH draws its water from eight deep wells and Irrigon Hatchery draws from a Ranney well system (a type of well with a single large bore hole/caisson and horizontal collector pipes) connected directly to the Columbia River. The effect that these water withdrawals, as large as they are, have on their respective river system and bull trout FMO habitat is likely unmeasurable, given the sheer volume of water that flows by these facilities, in the mainstem rivers—46,000 ft3/sec for the Snake and 167,000 ft3/sec for the Columbia.

The other program facilities with ground water supplies are the NPTH, the Oxbow Hatchery, and the Luke's Gulch acclimation facility. These facilities have decidedly lower ground water volumes available to them (range 0.6-2.1 ft^3/sec). The volumes of groundwater that these facilities withdraw are very small, particularly when compared (less than 0.04 percent) to the surface water flows in their locations (see Tables 8, 9, 15, and 16 of the Assessment).

Given these considerations, groundwater withdrawals for the Snake River fall Chinook hatchery program are expected to have insignificant effects to bull trout.

2.5.1.1.5 Hatchery Effluent

All of the surface water used at the hatcheries, minus any leakage and evaporation, are discharged back into the stream of origin (non-consumptive use). At facilities with groundwater sources, this water, minus any leakage and evaporation, is added to the discharge water from the facility. These discharge waters have been run through facility structures, including rearing structures, and may contain hatchery wastes as a result. Hatchery facility waste products include uneaten food, fecal matter, soluble metabolites (e.g., ammonia), algae, parasitic microorganisms, drugs, and other chemicals (Kendra 1991, p. 43).

All of the Snake River fall Chinook hatchery facilities discharge effluent. Effluent water can affect the health, productivity, and quality of receiving waters. Some of the chemical and physical parameters of hatchery effluent that have the greatest potential to impact receiving waters are temperature, nitrogen, phosphorus, dissolved oxygen, pH, and sediment. These parameters may have an effect on bull trout.

The LFH, Irrigon Hatchery, and the NPTH facilities operate under the National Pollution Discharge Elimination System (NPDES) permit system and are monitored regularly to maintain standards according to the Clean Water Act. The purpose of the Clean Water Act is to restore the physical, biological, and chemical integrity of the waters of the United States using two basic mechanisms: (1) direct regulation of discharges pursuant to permits issued under the NPDES and section 404 of the Clean Water Act (discharge of dredge or fill materials); and (2) the Title III water quality program. The remaining facilities (Luke's Gulch, Cedar Flats, Big Canyon, Pittsburg Landing, Captain John Rapids, and Oxbow Hatchery) are all small, seasonal facilities that are sized below the minimum threshold of fish produced for the NPDES or EPA standards (less than 20,000 lbs of fish). Despite meeting current water quality standards, the effects of effluent produced at these facilities on bull trout is still a concern, and conservation measures identified as part of the action are thus implemented at these facilities.

Hatchery operators will continue to monitor effluent standards and employ conservation measures at these facilities to further minimize potential water quality impacts to bull trout. These measures, combined with the relatively minute volume of discharge these facilities produce relative to total volume of receiving water (less than 0.01 – 0.1 percent, see Tables 9-17 in the Assessment), should reduce the effects to bull trout from hatchery effluent to an insignificant level.

2.5.1.1.6 Fish Disease Management

Some fish diseases (bacterial, viral, fungal, or parasitic) may be transmittable through infected wastes discharged in hatchery effluent. The potential of effluent as a disease vector is not fully understood and is confounded by the natural occurrence of many of these diseases in salmonids.

Studies reviewed by the Service show that bull trout exposed to high and low doses of infectious stages of *Myxobolus cerebralis* (causative agent in whirling disease) showed no signs of infection as measured by presence of spores, clinical disease signs, or histopathology. Rainbow trout, exposed simultaneously, showed high infection prevalence and disease severity. Metolius (Deschutes) bull trout exposed to infection by *Ceratamyosis shasta* also showed no signs of infection (USFWS 2002d, p. 22). Disease studies conducted on bull trout from the Deschutes River Basin showed them to be relatively resistant to all strains of infectious hematopoietic necrosis virus tested. Bull trout had detectable levels of antigen to *Renibacterium salmoninarum* (bacterial kidney disease) but no evidence of the disease (USFWS 2000d, p. 22). The Service concluded that bull trout may be inherently resistant to some diseases that are more devastating to other salmonids (USFWS 2002d, p. 22).

Given the relatively minute volume of effluent these facilities produce relative to total volume of receiving water (NMFS 2015, Tables 9-17); implementation of program conservation measures, including pre-release/transfer pathogen screening; and the apparent resistance of bull trout to pathogens, it is likely that the effects to bull trout from pathogens in hatchery effluent will be insignificant.

2.5.1.1.7 Hatchery Maintenance

Routine and semi-routine maintenance of Snake River fall Chinook program facilities would likely affect aquatic species as a result of maintenance to in-water structures such as water diversions, outfall structures, fish ladders, and traps. These activities would likely result in short-term noise disturbances (e.g., when equipment is used for debris removal or repair work) and fine sediment suspension, resulting in minor diminishment of water quality in the localized areas directly adjacent to and downstream of the work. These effects would be infrequent, short in duration, and would quickly dissipate.

Routine Maintenance

Routine hatchery maintenance activities that do not occur near water (e.g., building and grounds maintenance, painting, minor building repairs, lighting and fence repair, weeding and mowing) are not expected to have any adverse effects to bull trout. Routine hatchery maintenance activities that may affect water quality of effluent (e.g., vacuuming and removal of accumulated sediment on the bottoms of hatchery ponds and raceways) are addressed in the effects of hatchery effluent section (2.5.1.1.5). All herbicide application will adhere to the BMPs described in section 2.1.2.3.7. Given the locations of program facilities are on mainstem rivers in bull trout FMO habitat (not spawning and early rearing habitat), where adult and subadult bull trout may or may not be present during maintenance activities, and required adherence to all applicable BMPs, we are not expecting significant effects to bull trout from routine maintenance activities.

Semi-routine Maintenance

Semi-routine hatchery maintenance activities, including maintenance of in-water equipment and structures (such as fish ladders, adult fish traps, intake, and outfall structures), occur intermittently as needed. This work may generate some short-term noise disturbance (e.g., from equipment operation) and some fine sediment suspension that are localized near the operation and will quickly dissipate.

Semi-routine hatchery maintenance activities at the Snake River Fall Chinook program hatchery facilities, have the potential to adversely affect bull trout. However, adult and subadult bull trout that may be in the vicinity of these facilities (FMO habitat) are highly mobile and able to detect and avoid areas of disturbance. Any bull trout that may be in the vicinity will likely avoid working machinery and easily move around or pass through the localized sediment plumes. For those bull trout that may pass through the sediment plume, exposure to turbidity is expected to be brief (less than 1 hour), and is not expected to reach or exceed levels that will measurably affect them. Noise from heavy equipment used during semi-routine hatchery maintenance activities is not expected to reach levels that would be harmful to, or disturb any bull trout in the vicinity. For these reasons, the effects to bull trout from semi-routine hatchery facility maintenance are expected to be insignificant.

Given the above considerations and adherence to the conservation measures and BMPs (section 2.1.2.3.7), we conclude that routine and semi-routine hatchery maintenance is not likely to adversely affect bull trout.

2.5.1.2 Effects of Interrelated or Interdependent Actions

The Service has not identified actions that are interrelated or interdependent with the proposed action.

2.5.2 Bull Trout Critical Habitat

2.5.2.1 Direct and Indirect Effects of the Proposed Action

Effects to bull trout critical habitat will be analyzed relative to the operational elements of the proposed action previously discussed in section 2.1.2.2., and reference the essential physical or biological features described in section 2.3.2.2 (PBFs 1-9). For more detailed information on the effects of each of the Operational Elements of the Hatchery Program see the bull trout effects section (section 2.5.1), above.

2.5.2.1.1 Broodstock Collection

All of the broodstock collection facilities are located in bull trout FMO critical habitat. The broodstock collections at the LFH and the NPTH are conducted with the use of volunteer adult ladders that do not block or delay mainstem bull trout passage and thus have no effect on bull trout critical habitat.

The LGR adult trap diverts all fish ascending the ladder into the trap at predetermined intervals (annually determined, based on run forecast), so bull trout critical habitat PBF 2 (migration habitats) could be affected during these times. There have been observations (PIT tag and telemetry work) of bull trout presence and migration through the lower mainstem Snake River during summer months (Barrows et al. 2016, p. 189). It is possible, however unlikely, that the broodstock collection activities at the LGR trap and at the LFH and NPTH facilities (lower Clearwater River mainstem) could encounter migratory bull trout during their operations.

However, fall Chinook broodstock collection occurs during timeframes when bull trout are unlikely to be in mainstem FMO habitat because they are spawning or rearing in headwater tributaries. Since broodstock collection operations began (1984 at LFH, 2003 at NPTH, and 2006 at LGR) there have been no documented or reported instances of bull trout trapped at any of these three locations during the fall Chinook broodstock collection timeframe (mid-August through November (Table 2)). At LGR, eight bull trout were captured from 2009 through 2015; all of the captures occurred between May 28 and June 4 (Ogden 2015, *in litt.*), outside the fall Chinook broodstock collection period. For these reasons, and with implementation of conservation measures incorporated into the proposed action to minimize effects (section 2.1.2.3), broodstock collection is not likely to adversely affect bull trout critical habitat (PBF 2); all effects are expected to be insignificant or discountable.

2.5.2.1.2 Release of Hatchery Juveniles

The release of hatchery smolts from the Snake River fall Chinook hatchery program is not anticipated to increase bull trout vulnerability or susceptibility to predation (PBF 9), and is thus not likely to adversely affect bull trout critical habitat. The release of uniformly and actively smolting hatchery yearling Chinook that will emigrate away from the general release area in a matter of hours to days will significantly minimize the spatial and temporal overlap of Chinook smolts with juvenile bull trout (NMFS 2015, p. 60). Releases of fall Chinook juveniles may actually provide a benefit to adult and subadult bull trout by increasing forage prey base (PBF 3) in FMO habitat.

2.5.2.1.3 Research, Monitoring, and Evaluation

The program RM&E includes activities associated with monitoring the success of the hatchery program in the restoration of the natural Snake River fall Chinook salmon population and the production of adults for harvest. In-hatchery RM&E will have no effect on bull trout critical habitat. Only program off-station (conducted in the natural system) RM&E activities have the potential to affect bull trout critical habitat. As shown in the Assessment (NMFS 2015, p. 22-30), most of the RM&E activities will have no effect on bull trout critical habitat; however, the following activities have the potential for adverse effects. These activities, conducted by the NPT, the IFRO, NMFS, WDFW, and LSRCP are listed below with BPA project numbers, where applicable.

__Nez Perce Tribe__

BPA: 1983-350-03

Nez Perce Tribal Hatchery Monitoring and Evaluation - Monitoring and evaluation of hatchery and natural fish.

Primary monitoring activities to be conducted under the Nez Perce Tribal Hatchery Monitoring and Evaluation Program include PIT tagging, weir operation and/or spawning ground surveys, screw trapping, habitat surveys, genetic analysis, and harvest monitoring. Of these various activities, weir and screw trap operations are likely to adversely affect bull trout critical habitat PBF 2 (migratory habitats). The screw trap is operated in the mainstem Clearwater River from May 1 – October1 (NPT 2011, p. 42). Juvenile fall Chinook are also collected in the Clearwater River using seines, trawls, and purse seins in the same time period (NPT 2011, p. 44). These activities may adversely affect bull trout critical habitat by impeding normal migratory movements (PBF 2).

South Fork Clearwater River Weir: NPT plans on placing a temporary adult fish picket weir just above the mouth of the South Fork Clearwater River. The weir will be installed around October 1 and disassembled around December 1, with subsequent years following a similar schedule. The proposed action is expected to primarily capture adult fall Chinook, although bull trout are present during the time period the weir will be operational (NPT 2011, p. 58). Operation of this weir has not yet occurred (NPT 2011, p. 58), but has the potential to adversely affect bull trout critical habitat by impeding normal migratory movements (PBF 2) when put into operation.

BPA: 1998-010-04

Monitor and Evaluate (M&E) Performance of Juvenile Snake River Fall Chinook salmon from the Fall Chinook Acclimation Project (NPT).

- Fall Chinook Salmon Spawning Ground Surveys in the Snake River Basin upriver of Lower Granite Dam (USFWS, NPT, IPC).
  - Fall Chinook salmon aerial (helicopter) redd surveys will occur from the end of September through December 15, and will have an insignificant to no effect on bull trout critical habitat because these surveys occur on lower mainstem rivers where the potential for encountering and disturbing bull trout in FMO critical habitat is unlikely; no significant effects to the PFBs of FMO critical habitat are expected.
  - A systematic sampling strategy may be used to conduct underwater video searches in deep-water areas where fall Chinook salmon redds are expected. A jet boat and video camera mounted on weighted in-stream flow equipment will be used to search potential deep water spawning areas. This technique will be used only in assessable lower reaches of the Clearwater and Salmon rivers (NPT 2015, p. 5). These activities are not likely to adversely affect bull trout critical habitat because these surveys occur in lower mainstem rivers where the potential for encountering and disturbing bull trout in FMO critical habitat is unlikely; no significant effects to the PBFs of critical habitat are expected.
  - Snorkeling for fall Chinook salmon will occur in the Clearwater River, Grande Ronde River, Imnaha River, and Salmon River. The studies will collect fish density (number/m^2), biomass (grams/m^2), fish size, and condition factor data per age group of juvenile anadromous salmonids. Snorkeling counts are the main sampling method used to determine density and relative abundance of juvenile Chinook salmon and steelhead of natural and hatchery origin, as well as other co-existing species (NPT 2016, p. 16). Snorkeling surveys are not likely to adversely affect bull trout critical habitat because these surveys occur in lower mainstem rivers where the potential for encountering and disturbing bull trout in FMO critical habitat is discountable. In the unlikely event surveyors encounter foraging, migrating, or overwintering bull trout, they may be momentarily disturbed but the disturbance will be very short in duration and bull trout will not be perceptibly affected; no significant effects to the PBFs of FMO critical habitat are expected.

<u>Idaho Fisheries Resource Office (IFRO)</u>

IFRO fall Chinook RM&E activities that may adversely affect bull trout are currently covered by Service subpermit FWSIFWO -15, which expires on December 31, 2021. This permit coverage will end when this Opinion is issued, at which time the coverage provided in this Opinion will become effective.

BPA: 1991-029-00

This project gathers and summarizes information on adult Chinook escapement, stock-recruitment relations, smolt production, redd counts, juvenile early life history, and predation. The study is expected to be continued to 2018, and likely longer, as part of monitoring and evaluation efforts related to hatchery operations, and other Act recovery efforts and status determinations. The following activities under this project are likely to adversely affect bull trout habitat by impeding normal migratory movements (PBF 2).

- To describe early life history attributes of juvenile fall Chinook salmon and evaluate the influence of hatchery supplementation on those attributes, roughly 15 to 25 stations along the Snake River from LGR to Hells Canyon Dam, are beach seined to capture juvenile salmon weekly from March through July. Fish are handled and then released from the seine. This is a field activity accompanied by data summary in the office.
- To evaluate predation on juvenile fall Chinook salmon, smallmouth bass are collected along the free-flowing Snake River from the upper end of Lower Granite Reservoir to Hells Canyon Dam using angling or boat electrofishing.

BPA: 2002-032-00

This project gathers and summarizes information on abundance, food habits, and growth of juvenile fall Chinook salmon in Lower Granite Reservoir; predation on juvenile fall Chinook salmon by smallmouth bass and catfish in the reservoir; and origin, natal locale, and overwintering history of adults returning to LGR. The study is expected to be continued to 2018, and likely longer, as part of monitoring and evaluation efforts related to hatchery operations and other Act recovery efforts and status determinations.

- Data for evaluating the abundance, food habits, and growth of juvenile fall Chinook salmon are collected by beach seining, lampara seining, and trawling periodically throughout the year. This is a field activity accompanied by data summary in the office. Because bull trout may be captured and handled, actions taken in this project may adversely affect bull trout critical habitat by impeding normal migratory movements (PBF 2).
- To evaluate predation on juvenile fall Chinook salmon, smallmouth bass and catfish are collected along the Snake River from LGR to the points in the Snake and Clearwater rivers where they become free-flowing. Sampling is done by angling, boat electrofishing, and hoop nets, depending on environmental conditions during a given year. BMPs allow electrofishing until water temperatures exceed 18 degrees Celsius (64 degrees Fahrenheit), at which time sampling is limited to angling and hoop nets. This is a field activity accompanied by data summary in the office. Because bull trout may be captured and handled, actions taken in this project may adversely affect bull trout critical habitat by impeding normal migratory movements (PBF 2).
- To determine juvenile attributes of adult fall Chinook salmon returning to Lower Granite Dam, juvenile fall Chinook salmon are collected in the Snake River, from the upper end of Lower Granite Reservoir to Hells Canyon Dam and the lower 20 kms of the Grande Ronde River, using a beach seine during May. Otoliths are removed for analysis. Otoliths are also collected from adults after spawning at the LFH and the NPTH. This is a field activity accompanied by data summary in the office. Because bull trout may be captured and handled, actions taken in this project may adversely affect bull trout critical habitat by impeding normal migratory movements (PBF 2).

NMFS

BPA: 2005-002-00

Lower Granite Dam Adult Trap Operations (NMFS)

Collection and sampling of adult salmonids at LGR is an integral part of many studies. Past operation of the adult trap has been conducted primarily by NMFS staff, in cooperation with other agencies. Use of the Lower Granite Dam adult trap has increased in recent years, and is expected to increase. Current uses of the adult trap include fall Chinook broodstock collection, run-reconstruction sampling, sampling of PIT-tagged fish from transportation studies, radio telemetry studies (both tagging and tag removal at the adult trap), and PIT tagging of adult steelhead and adult Chinook. Operation of the LGR adult trap provides significant biological benefits for the Snake River fall Chinook ESU.

The LGR adult trap can divert fish ascending the ladder into the trap as determined by the SbyC system. Given that there have been some observations (PIT tag and telemetry work) of bull trout presence and migration through the lower mainstem Snake River during summer months, it is possible that the radio tagging study at the LGR adult trap could encounter migratory bull trout, and could adversely affect bull trout through delayed migratory movements (PBF 2).

However, fall Chinook trapping at LGR occurs during timeframes (mid-August through November) when bull trout are unlikely to be in mainstem FMO habitat because they are spawning or rearing in headwater tributaries. As noted above, since trapping operations began at LGR for fall Chinook broodstock collections, there have been no documented bull trout trapped during the fall Chinook trapping timeframe. For these reasons, and with the conservation measures described in section 2.1.2.3 incorporated into the proposed action to minimize effects, the radio telemetry study is not likely to adversely affect bull trout critical habitat; no significant effects to the PBFs of bull trout critical habitat are expected.

BPA: 2012-013-00

Snake River Fall Chinook Telemetry Study at LGR (WDFW and NPT)

In an effort to improve the estimates of the Snake River fall Chinook total run size, a telemetry tagging study of adult fall Chinook was initiated in 2013. Trapping and tagging for the study takes place at LGR, and subsequent fish movements are tracked by car, boat, and from fixed site receivers positioned in various places throughout the Snake and Clearwater River basins.

For this study, fall Chinook salmon are trapped at the LGR trap (as described above). Study fish are selected using the separation by code (SbyC) system, which can trigger the gate at the adult trap to shunt PIT-tagged fish into the trap area. The diversion of these PIT-tagged fish can occur throughout the day, and may be independent of the diversion of fall Chinook for the general program broodstock collection. These PIT-tagged study fish are then radio-tagged (stomach) and released back into the Snake River via the adult fish ladder.

The trapping related to this telemetry study may increase individual trapping events (quick diversion of fish ascending the ladder into the adult trap as determined by the SbyC system), which may increase the potential for incidental encounters with bull trout ascending the ladder at LGR. However, as described above, fall Chinook trapping at LGR, including the proposed telemetry study, occurs during timeframes when bull trout are unlikely to be in mainstem FMO habitat because they are likely spawning or rearing in headwater tributaries. For these reasons the fall Chinook telemetry study is not likely to adversely affect bull trout critical habitat; no significant effects to the PBFs of bull trout critical habitat are expected.

Lower Snake River Compensation Plan –LFH evaluations (WDFW)

Program RM&E activities occur in the Tucannon River and are conducted by WDFW (USFWS LSRCP funding agreement- F12AC00091). These activities include the annual operation of a juvenile smolt trap from October through July, and annual adult spawner surveys conducted weekly on index reaches on the Tucannon mainstem between October and December.

Bull trout have been captured during the operation of the Tucannon River smolt trap. Table 6 shows total annual numbers of bull trout that have been trapped, handled, and released from the smolt trap from the 2002 fall season through the spring of 2015. The bull trout captured are predominantly emigrating sub-adult and emigrating mature, post-spawning adult bull trout (NMFS 2015, p. 74). As such, operation of the smolt trap will adversely affect bull trout critical habitat by impeding normal migratory movements (PBF 2) of subadult and adult bull trout.

Adult fall Chinook salmon spawner surveys are conducted in the fall of each year between October and December. They are conducted on foot (walking and wading) over several sections (index reaches) of the Tucannon River, between its mouth and RM 21. This area of the Tucannon is designated critical FMO habitat. Known bull trout spawning and rearing areas are located in the upper Tucannon (above RM 48) and its tributaries (USFWS 2002c, p. 12). Conducting fall Chinook spawner surveys in the Tucannon River may result in minor, momentary effects to bull trout FMO critical habitat (PBF 2). These effects will be insignificant.

2.5.2.1.4 Water Withdrawals

Surface water withdrawal structures

Surface water withdrawal structures can pose potential risks to bull trout and its critical habitat (PBF 2). The physical structures used to withdraw surface water can present physical effects to bull trout in the form of entrainment into the water system of the facility and impingement against the diversion structure. These physical effects could lead to outcomes as benign as a minor delay in migration, to as severe as injury or mortality.

To prevent these physical effects from occurring to bull trout, or any other listed or non-listed fish species, conservation measures, such as the proper design and operation of the diversion structures, are necessary. All facilities have in-stream water intakes that are designed to meet NMFS screening standards, are operated within the design specifications, and are monitored regularly (daily or more often) to confirm proper operation. Tables 7-16 of the Assessment detail the operational timeframe of surface water withdrawals, where present, for all of the Snake River fall Chinook Hatchery facilities. All facilities are located in designated bull trout FMO habitat. The NPTH, a year-round facility with surface water withdrawal, may have the potential to affect both juvenile and adult bull trout transitioning through and utilizing FMO habitat. Seasonally (spring) operated acclimation sites may have more potential to affect juvenile emigrating bull trout with a more minor potential to affect emigrating (post-spawning) adult bull trout. There have been no documented instances or reports of entrainment or impingement of bull trout at any of the program's facilities.

Surface water withdrawal structures at Snake River fall Chinook Hatchery facilities have the potential to affect bull trout FMO critical habitat (PBF 2), but factoring in the absence of stream blocking structures, the design and operation of each of the structures to meet current screening criteria, and the lack of observed incidents, these effects to the PBFs of critical habitat are expected to be insignificant.

Surface water withdrawal volume and return

Surface water withdrawal (volume) can adversely affect bull trout critical habitat as a result of the amount of water removed (PBFs 2, 7 and 8), its effect on stream temperature (PBF 5), and its effect on other aquatic organisms and potential prey base for bull trout (PBF 3) in the vicinity of the withdrawal.

Tables 7-16 in the Assessment detail the surface water withdrawal volume at the various Snake River fall Chinook hatchery facilities. These volumes are compared, in terms of percentage, to the source streams that the facilities use. In all cases, the facilities withdraw a very small (less than 0.50 percent) to extremely small (less than 0.01 percent) percentage of the stream flow over the entire range of operation time (months). Given the low volume of return flows to the river and the small area affected, potential impacts on temperature and prey base in the mainstem rivers are also expected to be insignificant..

Surface water withdrawal and return for the Snake River fall Chinook hatchery program facilities may affect bull trout critical habitat (PBFs 2, 3, 5, 7, and 8), but these effects are expected to be insignificant and not likely to adversely affect bull trout critical habitat.

Groundwater withdrawal

All of the hatchery facilities are located in bull trout FMO critical habitat, and their groundwater withdrawals may affect bull trout critical habitat (PBFs 1, 2, 5, 7 and 8). However, the volumes of groundwater that the NPTH, the Oxbow Hatchery, and Luke's Gulch facilities withdraw are very small, particularly when compared to the surface water flows in their locations (less than 0.04 percent) (see Tables 8, 9, 15, and 16 of the Assessment).

The LFH and the Irrigon Hatchery, which are solely dependent on groundwater for operations, draw much higher volumes of groundwater and could have greater effects to bull trout critical habitat. The LFH draws its water from eight deep wells connected to the Snake River, and Irrigon Hatchery draws from a Ranney well system (a type of well with a single large bore hole/caisson and horizontal collector pipes) connected directly to the Columbia River. The effects that these water withdrawals have on their respective river systems and to bull trout critical habitat is unknown but likely insignificant given the sheer volume of water that flows by these facilities in the mainstem rivers (Snake River=46,000 ft^3/sec and Columbia River=167,000 ft^3/sec)a.

Given the small amount of water withdrawn, compared to the volume of the affected rivers, the Snake River fall Chinook hatchery program water groundwater withdrawal is expected to have insignificant effects to bull trout FMO critical habitat (PBFs 1, 2, 5, 7, and 8).

2.5.2.1.5 Hatchery Effluent

All of the Snake River fall Chinook hatchery facilities discharge effluent. Effluent water may affect the health, productivity, and quality of receiving waters. Some of the chemical or physical parameters of hatchery effluent that have the greatest potential to impact receiving waters are temperature, nitrogen, phosphorus, dissolved oxygen, pH, and sediment. These parameters may have an effect on bull trout critical habitat PBFs 2, 3, 5, and 8.

The LFH, the Irrigon Hatchery, and the NPTH facilities operate under the NPDES permit system and are monitored regularly to maintain standards according to the Clean Water Act. The remaining facilities (Luke's Gulch, Cedar Flats, Big Canyon, Pittsburg Landing, Captain John Rapids, and Oxbow Hatchery) are all small, seasonal facilities that are sized below the minimum threshold of fish produced for the NPDES or EPA standards (less than 20,000lbs of fish). Despite meeting current water quality standards, the effects of effluent produced at these facilities on bull trout is still a concern, and conservation measures identified as part of the action are thus implemented at these facilities.

Hatchery operators will continue to monitor effluent standards and employ conservation measures at these facilities to further minimize potential water quality impacts to bull trout. These measures, combined with the relatively minute volume of discharge these facilities produce, relative to total volume of receiving water (less than 0.01 – 0.1 percent; see Tables 9-17 of the Assessment), should reduce the effects to bull trout critical habitat (PBFs 2,3,5, and 8) from hatchery effluent to an insignificant level.

2.5.2.1.6 Fish Disease Management

Some fish diseases (bacterial, viral, fungal, or parasitic) may be transmittable through infected wastes discharged in hatchery effluent. The potential of effluent as a disease vector is not fully understood and is confounded by the natural occurrence of many of these diseases in salmonids.

Studies reviewed by the Service show that bull trout exposed to high and low doses of infectious stages of *Myxobolus cerebralis* (causative agent in whirling disease) showed no signs of infection as measured by presence of spores, clinical disease signs, or histopathology. Rainbow trout, exposed simultaneously, showed high infection prevalence and disease severity. Metolius (Deschutes) bull trout exposed to infection by *Ceratamyosis shasta* also showed no signs of infection (USFWS 2002d, p. 22). Disease studies conducted on bull trout from the Deschutes River Basin showed them to be relatively resistant to all strains of infectious hematopoietic necrosis virus tested. Bull trout had detectable levels of antigen to *Renibacterium salmoninarum* (bacterial kidney disease) but no evidence of the disease (USFWS 2000d, p. 22). The Service concluded that bull trout may be inherently resistant to some diseases that are more devastating to other salmonids (USFWS 2002d, p. 22).

Given the relatively minute volume of effluent these facilities produce relative to total volume of receiving water (NMFS 2015, Tables 9-17), implementation of program conservation measures, including pre-release/transfer pathogen screening, and the apparent resistance of bull trout to pathogens, any pathogens in hatchery effluent are not likely to adversely affect bull trout critical habitat (PBFs 3 and 8); effects are expected to be insignificant.

2.5.2.1.7 Hatchery Maintenance

Routine Maintenance

Routine and preventative maintenance of hatchery facility structures and equipment is necessary for proper functionality. Routine maintenance activities include: pond cleaning; pump maintenance; light debris removal from intake structures, ladders, traps; building maintenance; and grounds maintenance. Routine maintenance activities occur within and around existing facility structures, and implement BMPs to reduce the potential for affects to adjacent waterbodies, including bull trout critical habitat.

Normal maintenance of facilities such as ponds, troughs, incubators, pumps, water diversions, outfalls, and plumbing at the programs hatchery facilities are activities that could affect bull trout through impacts to water quality due to the work.

Removal of minor debris accumulations from hatchery surface-water diversion structures and from discharge outfall structures, to maintain their integrity and performance, may momentarily elevate the level of debris—wood, leaves, grass, sediment—in the stream environment directly below the structure.

Semi-routine Maintenance

Semi-routine maintenance activities at the hatchery facilities are not yearly occurrences, but may occur with frequency over a period of 5 to 10 years. Such examples include: in-stream (below the ordinary high-water mark (OHWM)) work like clearing gravel and major debris blockages from water intakes and outfalls after larger flood events; minor bridge repairs; equipment failures such as pumps and screening structures; or weir, ladder, and trap maintenance. All facilities are expected to have some element of semi-routine maintenance activities necessary on an infrequent basis. These activities may cause short-term diminishment of water quality in the areas directly adjacent to and downstream of the work. All semi-routine maintenance activities implement BMPs to reduce the potential for affects to adjacent waterbodies.

Non-routine Maintenance

Non-routine maintenance includes major repairs or new construction of in-river hatchery structures (below the OHWM), such as: new construction of hatchery intake or outfall structures, ladders, weirs, or traps; major bridge repairs/replacement; and bank-armoring projects around new or existing facility structures. Non-routine maintenance activities usually include significant in-stream work that could result in additional effects to listed species and/or their critical habitat and are not considered in this Opinion. These types of work would require a separate consultation with the Service.

Conservation measures identified in section 2.1.2.3.7) are expected to minimize the potential effects from Snake River fall Chinook salmon hatchery routine and semi-routine maintenance activities to insignificant levels; routine and semi-routine hatchery maintenance are not likely to adversely affect bull trout critical habitat (PBFs 2, 3, 5, and 8).

2.5.2.2 Effects of Interrelated or Interdependent Actions

The Service has not identified actions that are interrelated or interdependent with the proposed action.

2.5.3 Effects Summary

Table 7 summarizes the effects of continued operation and maintenance of Snake River fall Chinook salmon hatchery programs to bull trout and bull trout critical habitat by project element. As shown, only the RM&E element is likely to adversely affect (LAA) bull trout and its critical habitat. The determination for all other elements is not likely to adversely affect (NLAA) bull trout or its critical habitat. Table 8 summarizes the effects determinations for bull trout and bull trout critical habitat by RM&E Activity and Method.

Table 7. Summary of the effects determinations for bull trout and bull trout critical habitat

Project Element	Effect Determinations for Bull Trout	Effect Determinations for Bull Trout Critical Habitat
Broodstock Collection	NLAA	NLAA
Release of Snake River Fall Chinook	NLAA	NLAA
Water Withdrawals	NLAA	NLAA
Hatchery Effluent	NLAA	NLAA
Facility Maintenance (Routine and Semi-routine)	NLAA	NLAA
Research, Monitoring, and Evaluation	LAA	LAA (PBF #2)

Table 8. Summary of effects to bull trout and critical habitat from RM&E activities and methods.

RM&E Activity	RM&E Methods	Facility or Waterbody	Dates of Activity	Agency Operators	Effects Determinations	
					Bull Trout	Critical Habitat
Adult Collection	Adult Traps	LGR*, NPTH, LFH	Mid Aug - November	NMFS, NPT, (LSRCP)WDFW	NLAA	NLAA
	Weirs/	SF Clearwater River**	Oct 1 – Dec 1	NPT	LAA	LAA (PBF 2)
Smolt Trapping	Screw Trap	Tucannon	Oct – July	WDFW	LAA	LAA (PBF 2)
		Clearwater	Oct – July	NPT	LAA	LAA (PBF 2)
Juvenile Sampling	Seines, fyke net, trawls, purse seines, lampara seining, hoop nets, minnow traps	Clearwater, SF Salmon	Oct-Jul	NPT	LAA	LAA (PBF 2)
		Snake (below Hells Canyon), Grande Ronde	March – July	IFRO	LAA	LAA (PBF 2)
Spawning ground surveys	Aerial	Clearwater, NF Clearwater, SF Clearwater, MF Clearwater, Selway, Potlatch, Grande Ronde, Wallowa, Wenaha, Salmon	End Sept – Dec 15	NPT	NLAA	NLAA
Spawning ground surveys	Ground	Tucannon	Oct - Dec	WDFW	NLAA	NLAA

RM&E Activity	RM&E Methods	Facility or Waterbody	Dates of Activity	Agency Operators	Effects Determinations	
					Bull Trout	Critical Habitat
Spawning ground surveys	Jet boat video camera	Clearwater, Salmon	End Sept – Dec 15	NPT	NLAA	NLAA
Juvenile sampling	Snorkeling	Clearwater, Grande Ronde, Imnaha, Salmon	--	NPT	NLAA	NLAA
Juvenile Predation Study	Angling	Snake River, lower Clearwater	Late Apr – mid-Sept	IFRO	LAA	LAA (PBF 2)
Juvenile Predation Study	Boat electrofishing	Snake River, lower Clearwater	Late Apr – mid-Sept	IFRO	LAA	LAA (PBF 2)

* Fall Chinook Salmon captured at LGR, in addition to supplying broodstock, are used for the Snake River Fall Chinook Telemetry Study (BPA:2012-013-00 (WDFW and NPT)).

** The SF Clearwater Weir is not yet operational.

2.6 Cumulative Effects

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

2.6.1 Bull Trout

Within the action area, there are numerous State, Tribal, local, and private actions that potentially affect bull trout. Many of the categories of on-going activities with potential effects to bull trout and bull trout critical habitat were identified in the Status of the Species and Environmental Baseline sections of this Opinion. These activities include timber harvest, road building, grazing, water diversion, residential development, and agriculture. The Service assumes that future private and State actions will continue within the action area, and will increase as human population density rises. As the human population in the action area continues to grow, demand for agricultural, commercial, and residential development is also likely to grow. The effects of new development caused by that demand are likely to reduce the conservation value of bull trout habitat within the action area.

City, state, and county governments have ongoing weed spraying programs, some with less-stringent measures to prevent water contamination. Unknown amounts of herbicides are sprayed annually (and sometimes several times a year) along road right-of-ways by state and county transportation departments. Private landholders also spray unknown chemicals in unknown amounts. Any private herbicide use could potentially combine with contaminants from other Federal and non-Federal activities, and could contribute to formation of chemical mixtures or concentrations that could kill or harm bull trout. In addition, fish stressed by elevated sediment and temperatures are more susceptible to toxic effects of herbicides. While the mechanisms for cumulative effects are clear, the actual effects cannot be quantified due to a lack of information about chemical types, quantity, and application methods used.

Illegal and inadvertent harvest of bull trout is also considered a cumulative effect. Harvest can occur through both misidentification and deliberate catch. Schmetterling and Long (1999, p. 1) found that only 44 percent of the anglers they interviewed in Montana could successfully identify bull trout. Being aggressive piscivores, bull trout readily take lures and bait (Ratliff and Howell 1992, pp. 15-16). IDFG reports that 400 bull trout were caught and released in the regional (Clearwater administrative region) waters of the Salmon and Snake Rivers during the 2002 salmon and steelhead fishing seasons. In the Little Salmon River, 89 bull trout were caught and released during the same fishing seasons (IDFG 2004, p. 11). Spawning bull trout are particularly vulnerable to harvest because the fish are easily observed during autumn low flow conditions. Hooking mortality rates range from 4 percent, for non-anadromous salmonids with the use of artificial lures and flies (Schill and Scarpella 1997, p. 1), to a 60 percent worst-case scenario for bull trout taken with bait (Cochnauer et al. 2001, p. 21). Thus, even in cases where bull trout are released after being caught, some mortality can be expected.

Although these factors are ongoing to some extent and likely to continue in the future, past occurrence is not a guarantee of a continuing level of activity. That will depend on whether there are economic, administrative, and legal impediments or safeguards in place. Therefore, although the Service finds it likely that the cumulative effects of these activities will have adverse effects commensurate with or greater than those of similar past activities; it is not possible to quantify these effects.

2.6.2 Bull Trout Critical Habitat

Within the action area, there are numerous State, Tribal, local, and private actions that potentially affect bull trout. Many of the categories of on-going activities with potential effects to bull trout critical habitat were identified in the Status of the Species and Environmental Baseline sections of this Opinion. These activities include timber harvest, road building, grazing, water diversion, residential development, and agriculture. The Service assumes that future private and State actions will continue within the action area, and will increase as human population density rises. As the human population in the action area continues to grow, demand for agricultural, commercial, and residential development is also likely to grow. The effects of new development caused by that demand are likely to reduce the conservation value of bull trout critical habitat within the action area.

City, state, and county governments have ongoing weed spraying programs, some with less-stringent measures to prevent water contamination. Unknown amounts of herbicides are sprayed annually (and sometimes several times a year) along road right-of-ways by state and county transportation departments. Private landholders also spray unknown chemicals in unknown amounts. Any private herbicide use could potentially combine with contaminants from other Federal and non-Federal activities, and could contribute to formation of chemical mixtures or concentrations that could impact water quality (PBF 8). While the mechanisms for cumulative effects are clear, the actual effects cannot be quantified due to a lack of information about chemical types, quantity, and application methods used.

2.7 Conclusion

2.7.1 Bull Trout

The Service has reviewed the current status of the bull trout, the environmental baseline in the action area, effects of the proposed action, and cumulative effects, and it is our conclusion that the proposed action is not likely to jeopardize the continued existence of the bull trout. The only program activities adversely affecting bull trout are RM&E activities involving weirs, seines, smolt traps, angling, and electrofishing during which bull trout are incidentally captured and handled, potentially resulting in harm or mortality. These activities are implemented by the NPT, NMFS, the Service, the IFRO, and WDFW throughout the action area in bull trout FMO habitat. Fall Chinook salmon RM&E does not occur in bull trout spawning and rearing habitat. Because adverse effects are limited to individual feeding, migrating, or overwintering bull trout, the Service does not expect adverse effects at the larger population, core area, recovery unit, or rangewide levels.

2.7.2 Bull Trout Critical Habitat

The Service has reviewed the current status of bull trout critical habitat, the environmental baseline in the action area, effects of the proposed action, and cumulative effects, and it is our conclusion that the proposed action is not likely to destroy or adversely modify designated critical habitat for bull trout. Incidentally capturing bull trout through the use of weirs, seines, smolt traps, angling, and electrofishing is likely to disrupt bull trout migratory movements and likely to adversely affect migratory corridors (PBF 2) of bull trout critical habitat. However, RM&E activity will only impact bull trout FMO habitat; not spawning and rearing habitat. Because adverse effects are limited to discrete reaches of FMO habitat, we are not expecting adverse effects to bull trout critical habitat at the larger CHSU, CHU, or rangewide designation levels.

2.8 Incidental Take Statement

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

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

NMFS, as the lead agency for consultation purposes, and BPA and LSRCP, as funding agencies, have a continuing duty to regulate the activity covered by this incidental take statement. NMFS should ensure that appropriate coordination occurs with the other action agencies and the various operators (NPT, IFRO, and WDFW) to ensure any relevant Terms and Conditions or reporting requirements occur. If NMFS fails to assume and implement the terms and conditions the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, NMFS must report, in coordination with the other agencies as described above, the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

2.8.1 Form and Amount or Extent of Take Anticipated

The Service has determined that RM&E activities involving the use of weirs, screw traps, seines, angling, and electrofishing are likely to result in the incidental take of bull trout in the form of harm (and potential mortality) from stress and injury related to handling and delayed migration (see section 2.5.1.1.3 for details). See Table 9 for incidental take limits. The low limits for lethal take shown in Table 9 are not unreasonable to expect, based on past reported capture rates (e.g., see Table 6 of this Opinion), the nature of many of the activities, and the associated stress from handling. We opted to provide some margin for unforeseen circumstances for activities where no or very low take has been reported in the past (e.g., see NPT 2016, entire) without providing for excessive take. The fact that mortality is possible in all circumstances is based on reported take for a number of the activities and the similar nature of handling and processing that occurs.

Table 9. Incidental take limits for Snake River Fall Chinook Salmon RM&E activities.

RM&E Method	Waterbody	Investigator	Timing of Operation	Annual Incidental Take Limits	
				Sub-lethal	Lethal
Weirs	SF Clearwater*	NPT	Oct 1 – Dec 1	25	3
Screw Trap	Lower Clearwater	NPT	Oct-Jul	25	3
Screw Trap	Tucannon	WDFW	Oct-Feb and Mar-Jul	50	5
Seines, hoop nets, minnow traps	Clearwater, SF Salmon	NPT	Oct-Jul	25	3

RM&E Method	Waterbody	Investigator	Timing of Operation	Annual Incidental Take Limits	
				Sub-lethal	Lethal
Seines, hoop nets, minnow traps	Snake (below Hells Canyon), Grande Ronde	IFRO**	Mar - Jul	25	3
Angling	Snake, lower Clearwater	IFRO	Apr-Sep	25	3
Boat Electrofishing	Snake, lower Clearwater	IFRO	Apr-Sep	25	3

*Because of the proposed timing of operation (Oct 1 – Dec 1) and location (near the mouth) of the SF Clearwater weir, we are expecting low numbers of out-migrating, post-spawning adult bull trout to be incidentally captured. The NPT's SF Clearwater weir is not yet operational. The incidental take limits shown in this table will become effective when the weir is put into operation.

**Incidental take of bull trout from IFRO fall Chinook RM&E activities is currently covered by Service subpermit FWSIFWO -15, which expires on December 31, 2021. This permit coverage will end when this Opinion is issued, at which time the incidental take limits and terms and conditions of this Incidental Take Statement (or revised Statement resulting from reinitiation of consultation) will become effective.

NMFS will exceed the authorized level of take if the above take limits are exceeded or if take occurs outside the waterbodies or the timeframes shown in Table 9. If the authorized level of take is exceeded, contact and coordinate with the Service immediately to assess the feasibility of adjusting the particular RM&E activity to allow for its continued operation.

This Incidental Take Statement remains valid until reinitiation of consultation for the Snake River fall Chinook hatchery program occurs and a revised Opinion for the program is issued by the Service.

2.8.2 Effect of the Take

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to jeopardize the continued existence of the bull trout across its range.

RM&E activities occur in FMO habitat in the waterbodies shown in Table 9; as such only adult, subadult, and outmigrating juvenile bull trout will be subject to incidental take. Because adverse effects are limited to individual feeding, migrating, and overwintering bull trout, we are not expecting adverse effects at the larger population, core area, recovery unit, or rangewide levels. Conservation measures and BMPs incorporated into the hatchery program are expected to reduce the level of incidental take.

2.8.3 Reasonable and Prudent Measures

The Service concludes that the following reasonable and prudent measure is necessary and appropriate to minimize the take of bull trout caused by the proposed action.

- Minimize the potential for harm and mortality to bull trout from trapping related stress and injury and migration delays.

2.8.4 Terms and Conditions

- Implement the Snake River fall Chinook salmon hatchery program as described in the Assessment and this Opinion, including implementation of all applicable conservation measures and BMPs, especially the measures described in section 2.1.2.3.5 of this Opinion.

2.8.5 Reporting and Monitoring Requirement

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

1. Annually by December 31, NMFS shall provide, as supplied by the NPT, WDFW, LSRCP, and IFRO, a report to the Service documenting the number of bull trout captured and handled during implementation of the activities shown in Table 9. The report shall include the date each bull trout was captured and released, as well as general information on life history stage and condition at capture (e.g., presence of injuries). Submit all reports to: U.S. Fish and Wildlife Service, Idaho Fish and Wildlife Office, 1387 S. Vinnell Way, Suite 368, Boise, Idaho 83709.
2. In the event that the number of bull trout incidentally killed by RM&E activities exceeds the limits set forth in Table 9, immediately cease the activity resulting in death, and notify the Service's Idaho Fish and Wildlife Office (IFWO) (208-378-5253). Such notification must be followed up in writing to the IFWO within three working days, at which time the RM&E operator must provide a report of the circumstances that led to the mortality, including: date, time, and precise location; disposition of the dead or injured bull trout[7]; and a description of the changes in activity protocols that will be implemented to reduce the likelihood of such injury or mortality from reoccurring. The incident should also be discussed in the annual report that is subsequently submitted.

2.9 Conservation Recommendations

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

1. Collaborate with partners on research needs associated with hatchery effluent and disease

[7] Designated depository: The Idaho Museum of Natural History, Dr. C. R. Peterson, Curator of Fish, Campus Box 8007, Idaho State University, Pocatello, Idaho 83209.

effects on bull trout. Review annual fish stocking programs to assure those programs for anadromous fish are not contributing fish diseases, exotic invertebrates or other problems such as increased competition, which could interfere with bull trout recovery.

2. Work with partners to provide additional monitoring, education, and enforcement to prevent the summer or fall construction of barrier dams by recreationists that inhibit bull trout migration to and from spawning areas in the Tucannon River watershed (Faler et al. 2008, p. 27).
3. Work with partners to continue PIT tagging and monitoring PIT-tag detections of bull trout in the Tucannon River at the Tucannon Fish Hatchery, the PIT-tag antenna arrays in the lower river, as well as elsewhere. The information from these efforts can provide valuable growth, relative survival, and movement data (especially for bull trout moving upstream or downstream of the PIT-tag antennas in the lower river) (Faler et al. 2008, p. 26).
4. Work with partners to conduct presence and absence surveys to fully describe the distribution of juvenile, subadult, and adult bull trout in the upper mainstem of the Tucannon River and Asotin Creek. Repeat surveys every five to six years to facilitate assessment of effectiveness of recovery efforts through time, and evaluate progress towards recovery goals (USFWS 2015d, pp. C-146, C-153).
5. In the Wallowa/Minam core area, work with partners to assess current status and distribution of resident and migratory bull trout. Monitoring efforts in this core area are inconsistent. The status of bull trout in some populations, such as in the Minam River, is unknown (USFWS 2015d, p. C-161).
6. In the Clearwater River subbasin core areas (e.g., South Fork Clearwater and Selway Rivers), work with partners to evaluate the potential for release of excess hatchery stock of anadromous fish into occupied bull trout habitat. Evaluate the positive and potential negative impacts of anadromous fish stocking programs currently operating in the Clearwater River subbasin. Release of excess hatchery stock in areas where bull trout and anadromous fish historically coexisted, and where anadromous populations are currently depressed, may aid bull trout recovery. Such streams include Crooked Fork and Colt Killed Creeks, and the Lochsa, Selway, and South Fork Clearwater Rivers (USFWS 2015d, p. C-135).
7. Collaborate with partners to coordinate bull trout recovery with listed anadromous fish species recovery in the Salmon River Geographic Region (USFWS 2015f, p. E-24).

2.10 Reinitiation Notice

This concludes formal consultation on NMFS' issuance of two section 10(a)(1)(A) permits for the continued operation of the Snake River fall Chinook salmon hatchery program. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if:

1. The amount or extent of incidental take is exceeded.

2. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion.

3. The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this Opinion.

4. A new species is listed or critical habitat designated that may be affected by the action.

In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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