United States Department of the Interior

FISH AND WILDLIFE SERVICE
911 NE 11th Avenue
Portland, Oregon 97232-4181

In Reply Refer to:
FWS/R1/2025-0033182

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Subject: Programmatic Biological Opinion for the Phase 2 Implementation Plan

Dear Mr. Hoefer, Mr. Kennedy, Ms. Coffey, Mr. MacMillan:

This letter transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) on the proposal from the Bureau of Reclamation (Reclamation), Bonneville Power Administration (BPA), U.S. Army Corps of Engineers (Corps), and Service to implement the Phase 2 Implementation Plan Testing Feasibility of Salmon Reintroduction in the Upper Columbia River Basin (P2IP) and its effects on bull trout (*Salvelinus confluentus*) and its designated critical habitat. This letter also transmits a Concurrence section that addresses effects to Ute ladies'-tresses (*Spiranthes diluvialis*). The P2IP will be implemented by the project proponents, which consist of the Confederated Tribes of the Colville Reservation, Spokane Tribe of Indians, and the Coeur d'Alene Tribe, through and with the assistance of the Upper Columbia United Tribes. Additionally, Reclamation, BPA, Corps, and the Service, as well as any other federal agency providing funding to activities described in the Proposed Action, are included as Action Agencies within this Opinion. Formal consultation on the proposed action was conducted in accordance with Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.) (ESA).

The Action Agencies determined that the action will have "no effect" on Canada lynx (*Lynx canadensis),* gray wolf (*Canis lupis*), grizzly bear (*Ursus arctos horribilis*), North American wolverine (*Gulo gulo luscus*), yellow-billed cuckoo (*Coccyzus americanus*) monarch butterfly (*Danaus plexippus*), Spalding's catchfly (*Silene spaldingii*), and whitebark pine (*Pinus *albicaulis*). The Service has no regulatory or statutory authority for concurring with an Action Agencies' "no effect" determination, and consultation with the Service is not required.

On November 22, 2024, the Service received your request to initiate formal consultation on the effects to the bull trout and designated bull trout critical habitat, and for informal consultation on the effects to Ute ladies'-tresses.

The enclosed Opinion is based on information provided in a biological assessment, the Draft Programmatic Environmental Assessment, as well as through information shared through numerous meetings, telephone conversations, letters, and emails, and through other sources cited in the Opinion. A complete record of this consultation is on file at the Service's Regional Office in Portland, Oregon.

If you have any questions regarding the enclosed Opinion, or our shared responsibilities under the ESA, please contact Erin Kuttel, Columbia River System Coordinator, at 360-742-9659 or erin_brittonkuttell@fws.gov.

Sincerely,

Digitally signed by KATHERINE NORMAN
Date: 2025.02.20 16:54:08 -08'00'

Kate Norman, Assistant Regional Director for Ecological Services
Pacific Regional Office

Enclosure

cc:
Coeur d'Alene Tribe (T. Biladeau)
Spokane Tribe of Indians (C. Giorgi)
Confederated Tribes of the Colville Reservation (C. Baldwin)

Endangered Species Act - Section 7 Consultation

BIOLOGICAL OPINION

U.S. Fish and Wildlife Service Reference:
2025-0033182

PHASE 2 IMPLEMENTATION PLAN TESTING FEASIBILITY OF SALMON REINTRODUCTION IN THE UPPER COLUMBIA RIVER BASIN

Washington and Idaho

Federal Action Agency:

Bureau of Reclamation
Bonneville Power Administration
U.S. Army Corps of Engineers
U.S. Fish and Wildlife Service

Consultation Conducted By:

U.S. Fish and Wildlife Service
Pacific Regional Office
Portland, Oregon

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Date: 2025.02.20 17:03:58 -08'00'

February 20, 2025

Kate Norman, Assistant Regional Director for Ecological Services
Pacific Regional Office

Date

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1 INTRODUCTION

This document represents the U. S. Fish and Wildlife Service's (Service) Programmatic Biological Opinion (Opinion) and concurrence based on our review of the federal funding, support and authorization of activities conducted under the proposed Phase 2 Implementation Plan Testing Feasibility of Salmon Reintroduction in the Upper Columbia River Basin (P2IP) to be implemented by the Project Proponents, which consist of the Confederated Tribes of the Colville Reservation (CTCR), Spokane Tribe of Indians (SToI), and the Coeur d'Alene Tribe (CDAT), through and with the assistance of the Upper Columbia United Tribes (UCUT), altogether Project Proponents. The Bureau of Reclamation (Bureau), Bonneville Power Administration (BPA), Army Corps of Engineers (Corps) and the Service, as well as any other federal agency providing funding to activities described in the Proposed Action, are included as Action Agencies within this Opinion. The Opinion address effects to bull trout (*Salvelinus confluentus*) and its designated critical habitat, and the Concurrence section addresses effects to Ute ladies'-tresses (*Spiranthes diluvialis*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA). The Bureau, on behalf of the Action Agencies, submitted the request for formal consultation on November 22, 2024.

This Opinion is based on information provided in the November 2024 Biological Assessment (BA), the November 2024 draft Programmatic Environmental Assessment (NEPA document), telephone conversations, field investigations, and other sources of information as detailed below. A complete record of this consultation is on file at the Service's Pacific Region Office, Portland, Oregon.

2 MIXED FRAMEWORK PROGRAMMATIC CONSULTATION

The proposed P2IP Program includes a number of distinct but related projects that are anticipated to occur over approximately 20 years. Due to the fact that the nature of some of the projects in the Proposed Action are largely dependent on the resulting data and/or outcomes from other activities in the Proposed Action, the Service elected to analyze the P2IP Program via a mixed framework programmatic consultation, which will assist in a streamlined review process during the life of the P2IP Program. As details regarding project implementation are developed, the Action Agencies will conduct informal step-down consultations with the Service through the following process:

1. Annually, the Project Proponents, Action Agencies, and the Service will meet to review actions to be implemented in the next three years. During this annual review, new information or activities will be identified and reviewed in relation to the information presented in the original BA.
2. The Action Agencies will provide to the Service a description of any new activity or information not previously described and request confirmation from the Service that the specific project's effects on bull trout and its designated critical habitat, and Ute ladies'-tresses are addressed in this Opinion.
3. Within 30 calendar days of such request from the Action Agencies, the Service will confirm or deny that the specific project's effects are consistent with the BA and

Opinion, or request additional information. However, if the type or scope of effects, or effect determination is different than addressed in the BA, or if effects to species and/or designated critical habitat not included in this Opinion are likely to occur, the Action Agencies will prepare a "BA Amendment" and submit it to the Service for review. The BA Amendment will include the location, a detailed description of the activities, timelines for implementation, and other pertinent information requested by the Service.

4. Upon receipt of a BA Amendment and consultation request from the Action Agencies, the Service will review such a request and issue "Concurrence Amendments" and/or "Biological Opinion Amendments" as appropriate. In order to streamline this consultation process, the Service will issue Concurrence Amendments and/or Biological Opinion Amendments within 60 days of receipt of the BA Amendment. A 60-day review and concurrence period will assure that the proposed project(s) can be implemented in a timely manner.

3 CONSULTATION HISTORY

The following is a summary of important events associated with this consultation:

- In September 2023, CTCR, STOI, CDAT, and the federal government signed a Memorandum of Understanding and Mediated Settlement Agreement (P2IP Agreement) to resolve pending litigation and pursue a proactive, collaborative, and science-based approach to implementing the P2IP. The P2IP Agreement outlines funding and implementation commitments through the year 2043.
- Site visits were conducted on April 23-24, 2024.
- The Action Agencies, the Service, Cooperating Agencies, Tribes and other entities engaged in collaborative development of the P2IP program from January through November 2024.
- A draft programmatic Environmental Assessment ((PEA) NEPA document) was received on September 4, 2024.
- A draft programmatic BA was received on September 17, 2024.
- The final programmatic BA was received on November 22, 2024.
- Formal consultation was initiated on November 22, 2024.
- On December 6, 2024, the Service requested additional information from the Action Agencies regarding the Proposed Action.
- On December 12 and December 16, 2024, the Action Agencies and Project Proponents provided the requested additional information.
- On January 24, 2025. The Action Agencies provided an amended BA, updated Proposed Action, and other additional information.

4 CONCURRENCE

In their final BA, the Action Agencies reached a “no effect” determination for Canada lynx (*Lynx canadensis),* gray wolf (*Canis lupis*), grizzly bear (*Ursus arctos horribilis*), North American wolverine (*Gulo gulo luscus*), yellow-billed cuckoo (*Coccyzus americanus*) monarch butterfly (*Danaus plexippus*), Spalding’s catchfly (*Silene spaldingii*), and whitebark pine (*Pinus* *albicaulis*). There is no requirement under the ESA for the Service to concur with “no effect” determinations; therefore, these determinations rest with the Action Agencies.

The Action Agencies have requested the Service’s concurrence with their determination that implementation of the Proposed Action “may affect, but is not likely to adversely affect” Ute ladies’-tresses.

Ute ladies’-tresses is a terrestrial orchid found in the western United States and Canada. It inhabits early-to mid-seral stage wetlands along rivers, perennial streams, canals, lakeshores, and springs. It also occurs in wet meadows, both naturally occurring and human-created, borrow pits, and agricultural ditches. When it was first described as a species in 1984, it was known to occur only in Utah and Colorado. Today, it is found in a total of eight states – Colorado, Idaho, Montana, Nebraska, Nevada, Utah, Washington, and Wyoming – as well as in southern British Columbia. Within the P2IP Action Area, Ute ladies’-tresses are known to occur along the shore of Rocky Reach Reservoir, upriver from Bebee Bridge (Figure 1), which supports the largest known occurrence of the species in the state of Washington (2024 WANHP Database). However, presence/absence surveys for Ute ladies’-tresses have not been conducted throughout the entire P2IP Action Area.

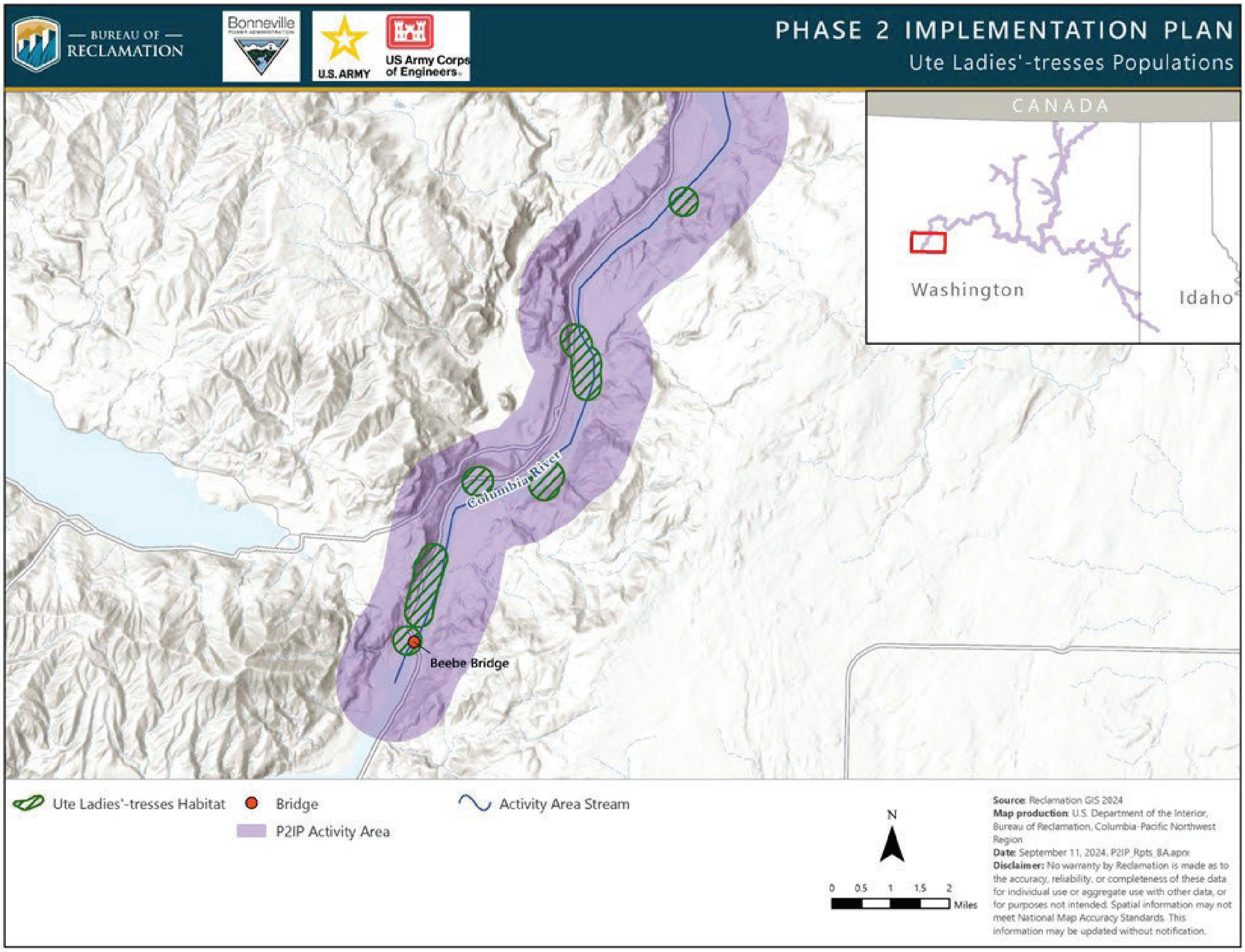

Figure 1. Known Ute ladies'-tresses Populations in P2IP Action Area

Ute ladies'-tresses is a perennial plant species that blooms in the late summer to early fall and requires pollinators, mainly native bees, for reproduction. Seeds are extremely small and easily spread by wind or water. The exact details of the Ute ladies'-tresses life cycle are not fully understood, but it can remain dormant underground for 11 or more years, and that it is likely dependent on symbiotic mycorrhizae during all life stages (USFWS 2023).

The primary threats to the long-term survival of Ute ladies'-tresses include habitat loss, overcollection, invasive species, herbicides, hydrological changes, reductions in pollinators, and drought (USFWS 2024).

Implementation of the Proposed Action will include projects that may affect Ute ladies'-tresses, specifically, implementation of geotechnical investigations at acclimation sites for the Louie Creek, sqweyu' and Glen Tana acclimation sites; and deployment of shore-based receivers.

Geotechnical investigations at the Louie Creek, sqweyu' and Glen Tana acclimation sites will involve digging trenches, drilling, and/or other surface disturbances, which could potentially disturb and/or remove Ute ladies'-tresses, if present. However, Ute ladies'-tresses are not known to inhabit those acclimation sites, which are currently composed of dense over-story vegetation and multiple invasive plant species (e.g., reed canary grass, yellow iris). Specific to the known populations of Ute ladies'-tresses in the Rocky Reach Reservoir area, the Proposed Action does not include ground disturbing or vegetation removal in those areas. Therefore, effects to Ute ladies'-tresses from implementation of geotechnical investigations at the Louie Creek, sqweyu' and Glen Tana acclimation sites are expected to be discountable.

Placement of shore-based receivers in areas known to support Ute ladies'-tresses populations could potentially harm plants if equipment were placed directly on top of them, crews stepped on them, or equipment disturbed them. However, the Proposed Action includes conservation measures specifically designed to minimize potential effects to Ute ladies'-tresses, namely pre-project coordination with Public Utility District No. 1 of Chelan County and the Washington Department of Natural Resources' Natural Heritage Program to determine if Ute ladies'-tresses exist at the site(s). Using this information, shore-based receivers will not be placed among populations of Ute ladies'-tresses. Therefore, effects to Ute ladies'-tresses from installation of shore-based receivers are expected to be insignificant.

After reviewing the information provided in the BA, the Service concurs with the Action Agencies' determination that implementation of the Proposed Action "may effect but is not likely to adversely affect" Ute ladies'-tresses. Concurrence by the Service is contingent on implementation of the Proposed Action, including conservation measures, as described in the BA.

This concludes informal consultation pursuant to section 7(a)(2) of the ESA. This project should be re-analyzed if new information reveals that effects of the action may affect listed species or critical habitat in a manner, or to an extent not considered in this consultation; if the project is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this consultation; and/or if a new species is listed or critical habitat is designated that may be affected by implementation of the Proposed Action. Effects to Ute ladies'-tresses will not be analyzed further in the following biological opinion.

5 BIOLOGICAL OPINION

6 DESCRIPTION OF THE PROPOSED ACTION

A federal action means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas (50 CFR 402.02).

6.1 Purpose and Need

The P2IP entails testing the feasibility of restoring salmon in the Upper Columbia River Basin upstream of Chief Joseph, Grand Coulee, and Spokane River dams. In September 2023, CTCR, STOI, CDAT, and the federal government signed a Memorandum of Understanding and Mediated Settlement Agreement (P2IP Agreement) to resolve pending litigation and pursue a proactive, collaborative, and science-based approach to implementing the P2IP. The P2IP Agreement outlines funding and implementation commitments through the year 2043, including the following:

- Bonneville will provide certain funding for implementation of the P2IP studies for reintroducing specific non-federally protected salmonid stocks above Chief Joseph and Grand Coulee dams in the Upper Columbia River Basin consistent with the Administrator's settlement authority described under 16 U.S.C. § 832a(f).

- Consistent with the P2IP Agreement, Reclamation, USACE, U.S. Fish and Wildlife Service (USFWS), and National Marine Fisheries Service (NMFS) will work with Project Proponents and Bonneville to identify additional funding needs for implementation of P2IP and seek additional funding as necessary and appropriate to ensure full funding of P2IP activities during the 20-year implementation period.

- Project Proponents may use existing hatchery facilities for activities related to P2IP implementation.

- The Action Agencies also committed to use all appropriate legal authorities to fund, support, and implement the agreement.

- The Service may provide surplus fertilized eggs and juvenile and adult salmon of non-listed stocks from federal hatchery facilities to support the study and testing of reintroduction.

The P2IP Agreement further establishes a mutual understanding that the Parties do not intend for P2IP implementation to require any material changes in operation and maintenance of any Columbia River System (CRS) dams or reservoirs and if material operations and maintenance changes were proposed, they could be subject to the completion of requisite compliance. The Agreement also "does not alter the Federal agencies' obligations under the court-approved management agreements or other court orders entered in United States v. Oregon, 68-cv-513-MO (D. Or.)."

Additionally, the U.S. v. Oregon Management Agreement (2018-2027) provides a framework for managing salmon and steelhead fisheries and hatchery programs in much of the Columbia River Basin. The Nez Perce, Umatilla, Warm Springs, Yakama, and Shoshone-Bannock tribes; the states of Washington, Idaho, and Oregon; and NOAA Fisheries, the Service, and Bureau of Indian Affairs (BIA) are signatories of the Management Agreement.

The Proposed Action is the federal funding and authorizations by the USACE, the Bureau, BPA, the Service, and the NMFS to support a 20-year study to test the feasibility of reintroducing salmon in the blocked area through juvenile and adult salmon research studies; the development and operation of fish-holding, fish-rearing, and acclimation facilities; and the development, testing, and operation of interim fish passage systems (see Table 1).

Table 1 Comparison of the Environmental Baseline and the Proposed Action

Federal Actions (Action Agencies)	**Environmental Baseline (No Action)**	**Proposed Action**
Federal Funding	No additional Federal funds	At least $200 M funding
Approval of P2IP Activities on Federally managed land/facilities	Only on an ad hoc basis	As possible to support P2IP activities, consistent with applicable law
Providing eggs, juvenile, and adult salmon	Only on an ad hoc basis	As possible to support P2IP activities, consistent with applicable law
P2IP Activities (Project Proponents)	***Environmental Baseline (No Action)***	***Proposed Action***
Telemetry Receivers		
P2IP telemetry receivers	68	107 or more
*Existing resident fish receivers**	0	94
Multidimensional fish tracking receiver array	0	Up to 200
Salmon Collection Facilities/Locations		
Existing hatcheries and acclimation facilities	3	12
Other collection methods (seining, fyke netting, hook and line, weirs, and screw traps)	3	5 or more
Rearing and Acclimation Facilities		
Utilization of existing hatcheries	6	9
*Land-based acclimation facility^*	0	5
Net pens	3	5
Tributary streamside incubation (Sanpoil River, Spokane River, Little Spokane River, etc.)	0	3 or more sites
Data Collection to Inform Design of Land-based Acclimation Facilities	0	3 or more sites
Salmon Release		
Release sites	22 or	36 or more

Interim Passage		
Trap and transport	Yes	Yes
Data Collection to Inform Design of Upstream and Downstream Passage Facilities	0	10 sites
Upstream Interim Passage (Construction, Testing, Operation) ^	0	5
Downstream Interim Passage (Construction, Testing, Operation) ^	0	5
Salmon		
*Juvenile Chinook salmon release***	Up to 180,000	Up to 250,000 +
*Juvenile sockeye salmon release***	0	Up to 250,000++
*Adult Chinook salmon annual release****	Up to 2,000	Up to 15,000+
*Adult sockeye salmon annual release****	Up to 500	Up to 15,000++

*Buoys may be used to install P2IP telemetry equipment
**Number would be dependent on salmon availability annually
***Number would be dependent on salmon availability and research stock returns annually
^Site-specific future environmental compliance process
+ The Proposed Action may have up to 70,000 additional juvenile and 13,000 adult Chinook salmon released in the blocked area.
++ The Proposed Action may have up to 250,000 additional juvenile and 14,500 adult sockeye salmon released in the blocked area.

Federal actions may include the following:

- Providing federal funding to support P2IP activities, within respective agency authorities, throughout the Project Area.

- Reviewing, approving, and issuing permits for actions including, but not limited to, data collection, installation of equipment, or construction of facilities (for example, interim passage and/or rearing facilities) on federally managed lands and facilities.

- Providing eggs, juveniles, and adult salmon from existing hatcheries and non-hatchery collection action.

- Participating in the planning, design, development, implementation, feasibility assessments, environmental compliance processes, and operations of interim passage facilities and guidance structures, where appropriate.

All federal actions that are a part of P2IP are being considered for potential impact on ESA-listed species. See Table D-1 in Appendix D of the PEA for a detailed table on the P2IP activities.

6.2 P2IP Activities

The federal actions would support the P2IP to test key biological assumptions from the Fish Passage and Reintroduction Phase 1 Report: Investigations Upstream of Chief Joseph and Grand Coulee dams (UCUT 2019) that are considered to critically influence the success of the reintroduction effort. See Table D-1 in Appendix D of the PEA for a detailed table of P2IP activities.

The P2IP is proposed to be completed in a stepwise fashion. Table 2 summarizes the activities proposed under each P2IP step.

Table 2. Summary of P2IP Activities by Step

Step 1 – Research Studies: baseline studies and small-scale salmon production programs to support research studies

• Juvenile and adult salmon research studies (ongoing and additional studies)
• Installation of research equipment
  o New telemetry receivers
• Development and installation of satellite rearing facilities
  o Net pens (expansion and new)
  o Land-based acclimation facilities
• Collection and transport of eggs, juvenile salmon, and adult salmon from existing hatcheries
• Fish-rearing activities
• Trap-and-transport operations for upstream passage of adult salmon[1]
• Data collection for design of new land-based acclimation facilities, fish collection, and interim passage facilities

Step 2 – Ongoing research studies, interim passage activities, long-term production programs, and supporting studies
• Ongoing juvenile and adult salmon research studies • Design, modification, and testing of existing long-term[2] hatchery facilities* • Design, modification, and testing of existing interim[3] fish passage
Step 3 – Future Activities
• Construction or installation of equipment to test upstream passage • Construction or installation of long-term downstream passage structures (including testing similar to upstream passage) • Construction and development of land-based acclimation facilities • Ongoing installation of research equipment

*The Project Proponents' site-specific designs would be submitted to the appropriate Action Agency for design sufficiency review and acceptance.

Detailed descriptions of the P2IP activities are presented in Appendices A, B, and C of the PEA. These activities are summarized below.

6.3 Research Studies

Juvenile survival and behavioral studies would be performed for subyearling and yearling summer/fall Chinook and sockeye salmon[4] using marking techniques, such as PIT tags, juvenile salmon acoustic telemetry systems (JSATS) or acoustic, and coded-wire tags (CWT). Up to 250,000 juvenile Chinook and 250,000 juvenile sockeye salmon could be released annually to accommodate the tagging studies for the 20-year study duration. The current research goals are

1 See PEA Appendix D for a detailed table of P2IP activities.
2 Fish ladders
3 Trap and transport activities
4 Juvenile Chinook and sockeye salmon would be obtained from federal and non-federal hatcheries with available eggs or juveniles for P2IP use. Juvenile salmon for P2IP activities would be subject to availability of surplus eggs and fish. P2IP Proponents would be responsible for coordination with appropriate parties to obtain surplus salmon. This PEA includes all potential sources of donor stock identified in the Phase 1 Report (2019) and Hardiman et al. 2017, in the Proposed Action for evaluation and disclosure of potential effects related to translocation of the eggs and fish.

to mark all released juvenile Chinook with CWT and to mark a subset of juveniles with PIT and or JSATS tags. Juvenile sockeye tagging would not include CWT but would include marking all or a subset of releases with PIT and/or acoustic tags. Sample sizes of tagging groups would vary depending on the tag type and study objectives.

Results from these studies would be used to evaluate behavior, migratory metrics, and dam passage survival; estimate smolt-to-adult return rates; and provide returning-migrating salmon for subsequent adult behavioral and survival studies. Estimates from juvenile survival studies would be used to update life cycle model (LCM) inputs, adaptively manage research projects, and evaluate the program's success.

Information from JSATS-tagged fish would inform the decision-making process for the need, design, and subsequent effectiveness testing (such as collection efficiency) of downstream passage facilities at each dam in the Action Area. PIT antennas and/or telemetry receivers, would be installed, operated, and maintained throughout the Action Area, including at dams. Researchers would collect, compile, manage, and interpret the fish data.

System-wide juvenile survival

- This PIT-based study would examine assumptions made in the LCM about survival of juvenile summer/fall Chinook and sockeye salmon as they migrate through the Columbia River System to the Pacific Ocean.
- The number of juvenile Chinook salmon released into the blocked area would increase from up to 180,000 to 250,000 individuals, annually.
- Up to 250,000 juvenile sockeye salmon could also be released into the blocked area annually.
- Researchers would collect, compile, manage, and interpret the fish data.
- Results from these studies would be used to estimate migratory survival and smolt-to-adult survival rates for fish released from the following general locations:
  - Kettle Falls
  - Sanpoil River
  - Little Falls Dam
  - Spokane River
  - Grand Coulee Dam or Lake Roosevelt
  - Chief Joseph Dam or Lake Rufus Woods
- Detections from existing PIT antennae at downstream Columbia River dams and other locations in the basin would be used to calculate survival estimates.
- Additional PIT antennae would be installed, operated, and maintained throughout the Action Area, including at dams and tributaries.
- Estimated survival rates would be used to update LCM inputs to adaptively manage research projects and evaluate the program's success.

Fish returning to the Columbia River as adult salmon would be used for subsequent upstream behavior and studies.

These studies are expected to continue through 2043 and are designed to be performed repeatedly, but the acoustic studies may not occur annually.

<u>Downstream Movement, Behavior, and Dam Passage of Juvenile Summer/Fall Chinook and Sockeye Salmon</u>

- This JSAT-based study would examine assumptions made in the LCM about survival of juvenile summer/fall Chinook and sockeye salmon and their behavior, dam passage routing, and travel time in the following reaches:
- Mouth of Sanpoil River to Grand Coulee Dam
    - Kettle Falls to Grand Coulee Dam
    - Little Falls Dam to Grand Coulee Dam
    - Long Lake Dam to Grand Coulee Dam
    - Nine Mile Dam to Grand Coulee Dam
    - Mouth of Hangman Creek to Grand Coulee Dam
    - Grand Coulee Dam to Chief Joseph Dam
    - Chief Joseph Dam to Chelan River/Beebe Bridge
- Up to 6,000 acoustic-tagged juveniles of each species, Chinook and sockeye salmon, would be released at the study sites annually to collect baseline data on downstream dam passage and survival through reservoirs in the blocked area.
- This study would use the deployed telemetry receivers described above to collect data from tagged fish.
- Acoustic tag detections would provide information on near-dam behavior and route-specific dam passage routing and survival at Grand Coulee Dam, Chief Joseph Dam, and the Spokane River dams (Little Falls, Long Lake, and Nine Mile dams).

Results would be used to inform planning and development of interim or permanent juvenile passage facilities at all five dams.

These multiyear studies are expected to begin early in the project and be repeated at strategic intervals through 2043 as fish passage facilities become operational.

<u>Juvenile Sockeye Survival through Lake Roosevelt, Grand Coulee Dam, Rufus Woods Lake, and Chief Joseph Dam</u>

- Juvenile behavior, movement, and survival would be evaluated through PIT tag, acoustic tag, and JSATS-based research studies.
- The studies would utilize existing deployed receivers and new receiver deployments, as described in Appendix A of the PEA, to collect data from tagged fish.
- Researchers would collect, compile, manage, and interpret fish data from these studies.
- These studies are expected to continue through 2043 and are designed to be performed repeatedly, but the acoustic studies may not occur annually.
- The PIT tag-based studies would examine assumptions made in the LCM about survival of juvenile summer/fall Chinook and sockeye salmon as they migrate through the Columbia River System to the Pacific Ocean and back to the Upper Columbia Basin as

adults. Annual juvenile fish releases are expected to occur annually for the PIT tag studies.

- The acoustic studies would evaluate the LCM assumptions of rearing and outmigration specifically within the blocked area. The acoustic studies would occur throughout the 20-year study period but would likely not occur each year.

This JSATS-based study would examine assumptions made in the LCM about survival of juvenile summer/fall Chinook and sockeye salmon, behavior, dam passage routing, and travel time through Project Area reaches. The JSATS-based studies would provide critical information about near-dam behavior and route-specific dam passage and survival at each of the five dams in the Project Area. These multiyear studies are expected to begin early in the project and be repeated at strategic intervals through 2043.

Appendix A of the PEA provides a detailed description of the P2IP research activities.

Adult Salmon Research Studies

Adult survival and behavior studies would be expanded for naive and local-origin Chinook and sockeye salmon. Project Proponents would transport up to 15,000 adult Chinook salmon and 15,000 adult sockeye from live-capture and regional hatchery operations with surplus salmon to various release locations within the blocked area[5]. The number of adult salmon would vary annually depending on availability. The collection of summer/fall Chinook salmon would be completed by the facility owner/operators consistent with their existing NMFS BiOps for the hatchery programs in the Upper Columbia River basin. Within the run schedule dates established by the Technical Advisory Committee (TAC) for the upper Columbia River summer Chinook Salmon management period or existing hatchery program or trapping facility Biological Opinions, surplus summer/fall Chinook and sockeye would be transported from corresponding collection sites to the blocked area. Chinook and sockeye salmon with known P2IP Upper Columbia River blocked area PIT tags may be transported to the blocked area from collection sites at any time. Morphometrics would be used to select against possible spring Chinook to reduce the probability of transporting a spring Chinook into the blocked area. Additionally, post hoc genetic analysis would be utilized to evaluate spring Chinook salmon's presence, prevalence, and origin in the trap and transport program and determine if additional coordination is needed with NMFS to adjust the P2IP trap and transport program.

All adults transported would have a tissue sample collected for genetic analysis and parentage-based tagging before being moved. A subset of fish could be marked with a PIT tag and either an acoustic or radio telemetry transmitter, so the fish could be actively tracked by researchers throughout the Project Area. The parentage-based tagging information would be stored in a centralized genetics database currently used within the Columbia River Basin. Genetics results would be used to calculate the number of adults returning per spawner transported previously, a

5 Adult Chinook and sockeye salmon would be obtained from federal and non-federal hatcheries and other collection actions available for P2IP use. Adult salmon for P2IP activities would be subject to availability of surplus fish. P2IP Proponents would be responsible for coordination with appropriate parties to obtain surplus salmon. This PEA includes all potential sources of donor stock identified in the Phase 1 Report (2019) and Hardiman et al. 2017, in the Proposed Action for evaluation and disclosure of potential effects related to translocation of the fish.

value termed AR/S. AR/S is a crucial performance metric that the Project Proponents would use when making decisions and evaluating the success of the project. Other elements of the proposed research are summarized below.

- Salmon research studies would examine factors that influence adult return rates to the blocked area and inform planning and development of interim adult passage facilities at all five dams. The adult plan, combined with studies designed to evaluate juvenile survival in the blocked area, would provide much of the information necessary to evaluate the project and identify areas where more detailed studies are needed.
- Adult sockeye and summer/fall Chinook salmon would be collected at collection facilities downstream of Chief Joseph Dam and marked with acoustic or radio tags. A subset of adults would be tagged and detected using existing acoustic tag receivers deployed for concurrent resident fish monitoring programs already in operation.
- Additional radio telemetry and acoustic receivers would be installed near the dam forebays and tailraces and within blocked area tributaries to assess near-dam behavior and spawning escapement. Additional receiver sites may be necessary based on information obtained from the initial deployment, range testing, and fish distribution.
- Tagged and transported adult salmon would be hauled via truck transport from existing facilities, then released in various locations including dam tailraces and forebays, mid-reservoir reaches, tributaries, and the transboundary reach. (Collaboration with Canadian researchers may be necessary to fully understand and assess survival and behavior in the transboundary reach and the Kettle River.)
- Researchers would collect, compile, manage, and interpret data.
- Spawning would be documented with traditional spawning ground surveys on foot, deepwater redd surveys, or aerial drones.

Salmon research studies would be repeated through 2043.

6.4 Fish-Rearing and Acclimation Facilities

The Proposed Action would require a source of both summer/fall Chinook and sockeye for research studies. In Phase 1, Chief Joseph Hatchery summer/fall Chinook and Okanogan sockeye salmon stocks were ranked highest for use in the reintroduction program and are the preferred stocks for use in P2IP efforts. Several other summer/fall Chinook salmon sources (such as Entiat National Fish Hatchery and Wells Fish Hatchery) were also identified as potential donor stocks. Appendix B of the PEA provides a detailed description of the P2IP fish-rearing activities, and the interim fish-rearing and acclimation facilities are summarized below.

- Project Proponents would collect summer/fall Chinook and sockeye salmon from a combination of regional hatcheries identified in Table A-1 of Appendix A of the PEA to be reared and released in the blocked area.
- Artificial production of Chinook and sockeye salmon needed for the Proposed Action would rely on either existing local land-based hatchery facilities or updated versions of these facilities, and new acclimation facilities. Additionally, the Project Proponents would work with the owner/operators of anadromous fish hatcheries downstream of Chief Joseph Dam to determine whether surplus fish production or rearing space is

available. Opportunities to develop new acclimation facilities in the Spokane and Sanpoil watersheds are described in Appendix B of the PEA.

- Egg incubation and early rearing would be done using existing hatchery facilities or through an expansion or upgrade of existing facilities, or development of new acclimation facilities in the Sanpoil and Spokane River watersheds.
- Siting, design, and construction plans would need to be developed for new facilities. Related activities could include geotechnical studies, surveying, and well drilling to characterize site conditions and inform designs.
- Designs and plans for new or expanded incubation and early rearing sites would be submitted to the applicable Action Agency or Agencies for design review and site-specific environmental compliance.
- Yearling production would require that subyearlings be transferred from hatcheries to new or existing net pens in reservoirs and to newly developed satellite acclimation sites.
- Net pen locations would include Sherman Creek (Kettle Falls), Two Rivers, Keller Ferry, Sanpoil Arm, and Rufus Woods Lake.
- Net pens would be similar in shape and dimension to those currently used by the Lake Roosevelt Artificial Production program for triploid rainbow trout (that is, approximately 20 feet square and 16 feet deep).
- New, expanded, or upgraded acclimation sites would occur in the Sanpoil and Spokane River watersheds.
- Siting of the acclimation facilities would be based on studies, existing infrastructure, and site conditions.
- Data collection may include geotechnical studies, surveying, and well drilling to characterize site conditions to inform the design process. These actions could occur at each potential site over a 20-year period[6].

Subyearling production would not require acclimation sites, as these fish would be released directly from hatcheries to various locations within the blocked area. Subyearlings may be released in the spring (March–May) or in the fall (September–November). Release locations are detailed in the maps in Appendix D of the PEA.

6.5 Interim Fish Passage

Interim passage actions would focus on the study, design, installation, testing, and operation of fish passage systems. Data collection could include geotechnical studies and surveys, along with existing operational data, to characterize site conditions, inform hydrologic modeling, and aid in the design process. These actions could occur at each dam over the next 20 years.

6 The duration of the Proposed Action is 20 years and would be ongoing; however, consultation would be reinitiated on an as-need-basis, after the initial 15-year consultation period.

The existing trap-and-transport program for native[7] and local-origin[8] adults would be expanded early in the P2IP project. Fish could be collected from Priest Rapids Dam, Wells Hatchery and Dam, and below Chief Joseph Dam, and from hatcheries with available surplus salmon[9]; then fish would be transported and released upstream in the blocked area. Adult traps at existing facilities would not change configurations or operational periods to supply the P2iP action. Adult trapping will continue at those sites, per the terms of prior agreements, reviews, and ESA consultations specific to the respective hatchery programs. Only the transport and release of surplus adults from these facilities is part of the P2iP action. Adult salmon release sites could include Rufus Woods Reservoir, Lake Roosevelt, the Columbia River transboundary reach, Hangman Creek, the Sanpoil River, the Spokane River, the Little Spokane River, and other spawning and rearing areas. See Table D-1 in Appendix D of the PEA for more information on the project activities.

Fish passage designs would be developed based on research studies, existing infrastructure, and site conditions. There is currently not sufficient information to provide a site-specific or implementation-level review of individual fish passage facility designs. The Project Proponents would employ fish passage experts to work with staff from Reclamation, the USACE, Avista Corporation, Bonneville, the National Oceanic and Atmospheric Administration, the USFWS, and Washington Department of Fish and Wildlife to develop fish passage alternatives. Interim fish passage designs, and construction plans related to any P2IP study activities (Appendix C of the PEA) would be submitted to the relevant owner/operator/agency for design review, site-specific (and as necessary) environmental compliance, and any other regulatory needs. The construction and operations of any long-term or permanent fish passage structures are not included in the P2IP and would require site-specific regulatory compliance with the relevant agencies.

Fish passage design, installation, operation, and testing efforts have been sequenced for the dams as follows; however, adjustments could be made based on research study results.

1. Chief Joseph Upstream Passage
2. Grand Coulee Downstream Passage
3. Grand Coulee Upstream Passage
4. Spokane River Dams Upstream Passage
5. Chief Joseph Downstream Passage
6. Spokane River Dams Downstream Passage

7 Naïve fish are defined as fish that originate (i.e., are hatched, reared, and released) from below Chief Joseph Dam. These adult fish are naïve to the blocked area.

8 Local-origin fish are defined as a hatchery fish that were reared and released upstream of Chief Joseph Dam as a juvenile or natural origin progeny of adult salmon spawning in the blocked area.

9 Adult Chinook and sockeye salmon would be obtained from federal and non-federal hatcheries and other collection actions available for P2IP use. Adult salmon for P2IP activities would be subject to availability of surplus fish. P2IP Proponents would be responsible for coordination with appropriate parties to obtain surplus salmon. This PEA includes all potential sources of donor stock identified in the Phase 1 Report (2019) and Hardiman et al. 2017, in the Proposed Action for evaluation and disclosure of potential effects related to translocation of the fish.

6.6 Conservation Measures

The following is a list of conservation measures and are a subset of the environmental protection measures (EPMs) from the P2IP PEA and future environmental compliance, as required, to reduce or eliminate environmental impacts during the P2IP project. See Appendix A of the PEA for the comprehensive list of EPMs.

Conservation measures for fish resources include:

- Continue to implement fish hatchery program operations during the P2IP research.
- Utilize live-capture, selective fishing gear to collect Chinook and sockeye brood stock that would allow release of non-target species immediately, or as soon as practicable. Use live-capture, selective gear when and where incidental take of Upper Columbia River spring-run Chinook, steelhead, and bull trout could occur. Upper Columbia River steelhead are more likely to be captured during August through November brood stock collection.
- Release incidentally captured individuals immediately or as soon as is practicable.
- During trapping operations for brood stock or to manage hatchery fish on the spawning grounds, apply measures that minimize the risk of harm to listed salmon and steelhead, including, but not limited to, limitations on the duration (hourly, daily, weekly) of trapping, limits on the duration of traps holding listed fish, and allowance for free passage of listed fish migrating through trapping sites in main stem and tributary river locations when those sites are not being actively operated.
- Sort and promptly release any listed steelhead that might enter the hatchery ladder and adult holding facilities.
- Continue to implement the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State and Pacific Northwest Fish Health Protection Committee (PNFHPC 2007) guidelines to minimize the risk of fish disease amplification or transfer and to ensure that artificially propagated fish are released in good health.
- Do not handle ESA-listed fish if the water temperature exceeds 69.8 degrees Fahrenheit at the capture site. Under these conditions, suspend collection until temperatures are lower.
- Internally tag (such as with coded-wire tag or PIT tag) at least a portion of each hatchery release group for monitoring and evaluation purposes.
- Seining operations
    - During purse and beach seine operations, release any non-target fish immediately (that is, within 60 seconds) or as soon as is practicable, including all ESA-listed fish (that is, bull trout, wild Chinook, or wild steelhead).
    - Sort by hand or by use of a knotless dip net. Sort and/or release all fish prior to removing the entire seine from the water. Do not dry sort.
    - Do not exceed a sorting time of 75 minutes.
        - For beach seine operations, the sorting time is defined as the elapsed time from when the outer towed end of the net first contacts the shore or block until the net is emptied of fish.
    - For purse seine operations, the sorting time is defined as the elapsed time from when all rings are pursed and out of the water until the net is emptied of fish.

- Check net pens for mortalities at least once per week. Remove mortalities and recover PIT tags.
- Fyke net operations
  - Check nets daily. Release any non-target fish immediately, including all ESA-listed fish (that is, bull trout, wild Chinook, or steelhead).
- Hook and line capture
  - Scan all potential non-target fish for PIT tags. Release any non-target fish with PIT tags immediately, including all ESA-listed fish (that is, bull trout, wild Chinook, or steelhead) and report data to the National Oceanic and Atmospheric Administration annually.
  - Use only barbless hooks. Do not use treble hooks.
- Geotechnical investigations
  - Limit disturbance of riparian vegetation to the minimum necessary to achieve investigation objectives, minimizing habitat alteration and the effects of erosion and sedimentation.

Conservation measures for vegetation and wetlands include:

- Revegetate disturbed areas to conditions similar to prework conditions by spreading stockpiled native materials (for example, spoils, vegetation, rock, and woody debris), seeding, and/or planting with certified weed-free seed mixes or native cultivars.
- Avoid mapped wetlands during construction activities to the maximum extent practicable. Where practicable, ensure no ground-disturbing activities occur within a 50-foot buffer area of mapped wetlands.

6.7 Action Area

The Action Area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). In delineating the Action Area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment. The Action Area for this proposed federal action is based on the geographic extent, biological consequences, and influence of reintroduced salmon to the aquatic environment in the Columbia River. The upstream extent of the action area is defined by all upstream habitats and areas accessible to reintroduced salmon. The furthest downstream effects are defined by the limit to which the number of individuals released are indistinguishable over background populations of salmon within the mainstem Columbia River. The Action Area (Figure 2) includes the Columbia River from Beebe Bridge (about 12 miles downstream of Wells Dam) upstream to the Canada border, the lower Okanogan River, and all major tributaries upstream of Chief Joseph Dam in the U.S. Those aquatic environments include a connected network of streams and reservoirs where fish passage, trap and transport activities, and research activities would occur. The Action Area also includes terrestrial areas adjacent to the aquatic environments, up to 1.5 miles from stream and reservoir centerlines. The 1.5-mile buffer accounts for the direct and indirect effects of activities that would occur during the project, including transportation routes, fish-rearing facilities, off-channel acclimation sites, geotechnical investigations, and job-box operation and maintenance for telemetry and antenna arrays that may result in physical changes to the environment from noise, ground disturbance, or other influences.

7 ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

7.1 Jeopardy Determination

In accordance with our regulations (see 50 CFR 402.02, 402.14(g)), the jeopardy determination in this Biological Opinion relies on the following four components:

1. The *Status of the Species* evaluates the species' current range-wide condition relative to its reproduction, numbers, and distribution; the factors responsible for that condition; its survival and recovery needs; and explains if the species' current range-wide population retains sufficient abundance, distribution, and diversity to persist and retains the potential for recovery (see Endangered Species Consultation Handbook, March 1998).

2. The *Environmental Baseline* section of this Biological Opinion evaluates the past and current condition of the species in the Action Area relative to its reproduction, numbers, and distribution absent the effects of the Proposed Action; including the anticipated condition of the species contemporaneous to the term of the Proposed Action; the factors responsible for that condition; and the relationship of the Action Area to the survival and recovery of the species.

3. The *Effects of the Action* section of this Biological Opinion evaluates all consequences to the species that are reasonably certain to be caused by the Proposed Action (i.e., the consequences would not occur but for the Proposed Action and are reasonably certain to occur) and how those consequences are likely to influence the survival and recovery of the species.

4. The *Cumulative Effects* section of this Biological Opinion evaluates the effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation, on the species and its habitat, and how those effects are likely to influence the survival and recovery of the species.

In accordance with policy and regulation, the jeopardy determination is made by formulating the Service's opinion as to whether the proposed Federal action, including its consequences, taken together with the status of the species, environmental baseline, and cumulative effects, reasonably would be expected to reduce appreciably the likelihood of both the survival and recovery of the species in the wild by reducing the reproduction, numbers, or distribution of that species.

7.2 Destruction or Adverse Modification Determination

In accordance with regulations and regional implementing guidance, the destruction or adverse modification (DAM) determination in this Biological Opinion relies on the following four components:

1. The *Status of Critical Habitat* section evaluates the range-wide condition of the critical habitat (CH) in terms of essential habitat features, primary constituent elements, or physical and biological features that provide for the conservation of the listed species; the factors responsible for that condition; and the intended value of the CH for the conservation of the listed species.

2. The *Environmental Baseline* section of this Biological Opinion evaluates the past and current condition of the CH in the Action Area absent the effects of the Proposed Action; including the anticipated condition of the species and its CH contemporaneous to the term of the Proposed Action; the factors responsible for that condition; and the conservation value of CH in the Action Area for the conservation of the listed species.

3. The *Effects of the Action* section of this Biological Opinion evaluates all consequences to CH that are reasonably certain to be caused by the Proposed Action (i.e., the consequences would not occur but for the Proposed Action and are reasonably certain to occur) and how those consequences are likely to influence the conservation value of the affected CH for the species in the Action Area.

4. *Cumulative Effects* section of this Biological Opinion evaluates the effects to CH of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal action subject to consultation, and how those effects are likely to influence the conservation value of the affected CH for the species in the Action Area.

In accordance with regulation, the DAM determination is made by formulating the Service's opinion as to whether the effects of the proposed Federal action, taken together with the status of the critical habitat, environmental baseline, and cumulative effects, reasonably would be expected to result in a direct or indirect alteration that appreciably diminishes the value of CH for the conservation of the species.

8 STATUS OF THE SPECIES: BULL TROUT

For a detailed account of bull trout biology, life history, threats, demography, and conservation needs, refer to Appendix A: Status of the Species: Bull Trout.

9 STATUS OF CRITICAL HABITAT: BULL TROUT

For a detailed account of the status of the designated bull trout critical habitat, refer to Appendix B: Status of Designated Critical Habitat: Bull Trout.

10 ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the condition of the listed species or its designated critical habitat in the Action Area, without the consequences to the listed species or designated critical habitat caused by the Proposed Action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the Action Area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from Federal agency activities or existing Federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.

10.1 General Baseline Conditions

The Columbia River Basin is the largest river system of the northwest U.S. The Columbia River and its tributaries travel more than 1,200 miles, drain approximately 200 million ac-ft, and cross portions of seven states and southern British Columbia, Canada (Corps et al 2020a; b). The headwaters of the mainstem Columbia River originate in the Rocky Mountains of British Columbia, where the river first flows northwest before heading south into the State of Washington. Eventually the Columbia River continues west along the boundary between Oregon and Washington until it drains into the Pacific Ocean. Where the river meets the coast, saltwater intrusion from the Pacific Ocean extends approximately 23 RM upstream from the mouth; tidal effects can be experienced up to Bonneville Dam, located 146 RM inland. Major tributary Basins feed the Columbia River, each having numerous tributaries of their own that influence habitat conditions within the Action Area. These include:

- The Kootenai River, which originates in British Columbia, Canada and flows through Montana and Idaho, and joins the Columbia River in British Columbia;

- The Clark Fork River Basin, which consists of the tributaries and mainstem portions of the Clark Fork River, Flathead River, and Pend Oreille River, originates at the Rocky Mountain Continental Divide. The Clark Fork River flows west through Montana and includes major tributaries such as the Blackfoot, Bitterroot, St. Regis, and Flathead Rivers. The Flathead River, which originates in British Columbia, Canada, flows south through western Montana and enters the Clark Fork River prior to flowing into Lake Pend Oreille in Idaho. The Pend Oreille River originates at the outlet of the Lake Pend Oreille and flows through northern Idaho and northeastern Washington before joining the Columbia River in British Columbia;

- The Colville, Kettle, Spokane, SanPoil, Okanogan, Methow, Chelan, Wenatchee, Yakima, White Salmon, Lewis and Cowlitz Rivers and several smaller tributaries flow into the Columbia River in Washington;

- The Snake River, which originates in Wyoming, flows westward through Idaho and eastern Washington. Major tributaries include the Tucannon, Clearwater, Grande Ronde, Salmon, Malheur, Payette, Owyhee, Boise, Bruneau, and Henry's Fork Rivers as well as several other smaller tributaries, and;

- The Willamette, Deschutes, John Day, Sandy, and Umatilla Rivers and several smaller tributaries flow into the Columbia River in Oregon.

The north-south Cascade Mountain Range, the Blue-Wallowa Mountains of northeast Oregon and southeast Washington, and the Rocky Mountains across the eastern and northern boundaries of the Basin strongly influence climate in the Columbia River Basin. The Basin is generally cooler and wetter on the western side of the Cascades and warmer and drier to the east toward the Rocky Mountains. The Basin has dramatic elevation changes ranging from sea level to more than 14,000 ft in the high mountains. The headwaters of the Columbia River and its major tributaries are in high-elevation and snow-dominant watersheds. High-elevation summers tend to be short and cool, while the lower-elevation interior regions are subject to greater temperature variability.

Over time, the Columbia River Basin has been altered from its historic wildness. Throughout the 19th and 20th centuries, the mainstem river and most of its tributaries were dammed, channeled and developed. While the exact number of dams and diversions throughout the entire Basin is unknown, rough estimates put the number well over 400. The construction and influence of these dams and diversions throughout the Columbia River basin, and particularly for the purposes of this Opinion, with the Action Area, altered the ecosystem through the loss of salmon and marine derived nutrients. Other land management actions (i.e. mining, forestry, residential and commercial development) across the basin have altered sediment transport, habitat availability, shoreline and riparian structure, and water quality conditions. This historic development has shaped the current fish populations and ecological structure of the Columbia River Basin.

11 CURRENT CONDITION OF BULL TROUT AND DESIGNATED CRITICAL HABITAT IN THE ACTION AREA

A general description of the environmental baseline conditions within the Columbia River Basin was provided in Section 10.1. The following provides the environmental baseline for the bull trout and its designated critical habitat within the Action Area. Section 11.3 "Consulted on Effects for Bull Trout" summarizes ongoing projects that have undergone ESA Section 7 consultation and influence the baseline conditions for bull trout and bull trout critical habitat within the Action Area.

To understand the status of bull trout in the Action Area, it is necessary to discuss the bull trout in a broader area, including Recovery Units, Core Areas, and CHUs. The Proposed Action encompasses a large portion of the Columbia River Basin (Figure 2). A smaller portion of the Action Area falls within bounds of designated critical habitat for the bull trout. Bull trout are listed as a single DPS divided into six Recovery Units. Each Recovery Unit is subdivided into multiple bull trout Core Areas. Migratory life history forms of bull trout are key to the persistence and genetic diversity of each Core Area across the range, as well as throughout the Action Area. The Action Area falls within the boundaries of the Mid-Columbia Recovery Unit.

Bull trout individuals from three Core Areas and one Research Needs Area (RNA) may be present within the bounds of the Action Area. Recently, the Service completed a bull trout species status assessment (USFWS 2024b entire). In the species status assessment, the current condition of each core area was systematically evaluated using a condition category table (CCT). The CCT is a model which defines categories of health and functionality for each of the five demographic and six habitat factors representing the habitat and demographic needs of bull trout.

These categories were used to assess the current condition of each factor and, when combined, to evaluate the resiliency of each core area. Our evaluation of resiliency is calibrated to the standardized categories in the condition category table, insuring to the extent possible, a consistent and methodical approach across the core areas and bull trout DPS. Those core areas with higher levels of resiliency are more likely to persist than those with lower levels of resiliency, as calibrated by the CCT. We summarized our evaluation of current condition for the bull trout DPS in terms of the 3Rs: resiliency, redundancy, and representation.

All bull trout core areas were assigned a total resiliency score which was the weighted sum of the individual scores for all eleven current condition factors, including six habitat factors and five demographic factors. Scores were assigned consistently to all 110 core areas, both simple and complex, recognized as extant at listing to characterize the current viability of bull trout. Simple core areas have only one local population and inherently have reduced resiliency when compared to complex (more than one local population) core areas. Total resiliency scores fell within one of the following 5 equal interval score categories: Very High (3.97–4.62), High (3.30–3.96), Medium (2.64–3.29), Low (1.97–2.63) and Very Low (1.31–1.96). The categories represent relative levels of stochastic risk for each factor, with very high being the most resilient, and functionally extirpated (a sixth category) being without resiliency, based on the condition of the factor as described in the table's rows. There are seven historical core areas and one Resource Needs Area (RNA), all extirpated at the time of listing with no current resiliency, which were included in Future Resiliency ranking for a total of 118 core areas in that evaluation.

Critical habitat is discussed in the context of CHUs within each of the Recovery Units (USFWS 2010a). Critical habitat is characterized based on function (USFWS 1998).

11.1 Mid-Columbia Recovery Unit

The Mid-Columbia Recovery Unit (MCRU) includes portions of central Idaho, eastern Washington, and eastern Oregon (USFWS 2015a; 2015c). Major drainages include the Yakima River, John Day River, Umatilla River, Walla Walla River, Grande Ronde River, Imnaha River, Clearwater River, and smaller drainages along the Snake River and Columbia River. The MCRU encompasses 21 Core Areas, two historically occupied areas, and one RNA (Northeast Washington RNA). Bull trout throughout this Recovery Unit co-exist with salmon, steelhead, and, in some areas, Pacific lamprey (USFWS 2015c). Historically, salmon, steelhead and lamprey were present above Chief Joseph and Grand Coulee dams. Due to unknown status of bull trout above the dams and the historic presence of salmon and steelhead, the Service identified the area upstream of Chief Joseph Dam as the Northeast Washington RNA (USFWS 2015c; USFWS 2024).

The status of bull trout Core Areas in the MCRU is variable across the unit ranging from highly resilient core areas to three core areas considered historic, including the Northeast Washington RNA (USFWS 2024 p11). The stronghold populations tend to occur within intact habitat areas, such as wilderness areas and protected forestlands in the Clearwater River Basin. Throughout the MCRU, consistent primary threats from upland/riparian land management, habitat loss, fish passage barriers, and water quality and quantity exist (USFWS 2015c). Connectivity between Core Areas of the MCRU is key to the persistence and genetic stability of bull trout.

The Action Area includes the mainstem Columbia River from Beebe Bridge (about 12 miles downstream of Wells Dam) upstream to the Canada border as well as portions of the Okanogan, Sanpoil, Spokane, and Kettle Rivers.

Construction of Grand Coulee Dam and Chief Joseph Dam without fish passage facilities completely blocked passage of salmon, steelhead, bull trout, and other native fish species from areas upstream. Since fish-passage facilities were not constructed, current fish assemblages, above both dams, contain resident native and non-native species. Entrainment (downstream movement) of both non-native and native fish occurs at both dams, but the extent is unclear. Above the two dams, including Rufus Woods Lake, Lake Roosevelt and their tributaries some of which were also dammed by FERC-licensed dams, little information exists on the history and status of bull trout populations.

Downstream of Chief Joseph Dam, bull trout populations face threats from connectivity impairment and reduced access to historic foraging, migrating, and over-wintering (FMO) habitat in the mainstem Columbia River (USFWS 2015c; USFWS 2024b). Five non-federal dams (Wells, Rocky Reach, Rock Island, Priest Rapids, and Wanapum) are located downstream of Chief Joseph Dam on the mainstem Columbia River. Each non-federal hydroelectric project has undergone FERC licensing, consultation with the Service on operational impacts to bull trout and bull trout critical habitat including flow and backwater fluctuations at tributary mouths, and each coordinates operations with other dams throughout the Columbia River System[10] (USFWS 2020). The impacts of their ongoing operation for the length of their FERC licenses are considered in the baseline. McNary Dam is located downstream of the Snake River confluence with the Columbia River, and upstream of the confluence of the Umatilla River and the Columbia River. John Day Dam is located approximately 76 miles downstream of McNary Dam. The John Day River enters the Columbia River just upstream of John Day Dam near Rufus, Oregon. Additionally, the operation and maintenance of 12 federal dams (including Grand Coulee, Chief Joseph, and McNary dams) continue to have impacts to bull trout, which were evaluated in the Service's July 2020 Biological Opinion on the CRS (USFWS 2020) and are part of the baseline for this Opinion.

Within the Action Area downstream of Chief Joseph Dam, bull trout individuals could be present originating from Core Areas in the Entiat, Wenatchee, and Methow. Upstream of Chief Joseph Dam, all elements of the proposed action occur within the Northeast Washington Research Needs Area.

11.1.1 Northeast Washington Research Needs Area

The total drainage area above Grand Coulee Dam is 74,100 mi^2 and includes all of the Columbia River in Canada, and the Kootenai, Pend Oreille/Clark Fork and Spokane Rivers in the U.S., with an average annual runoff of 77 million acre feet (maf) (Corps et al. 2020a). The reservoir impounded by Grand Coulee Dam is Franklin D. Roosevelt Lake (Lake Roosevelt), which has a

10 The Columbia River System is made up of fourteen multiple purpose dams and related facilities that are operated as a coordinated system. These multiple purpose dams are Libby, Albeni Falls, Dworshak, Chief Joseph, Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, The Dalles, Bonneville, Hungry Horse, and Grand Coulee.

total storage of approximately 9.4 maf, with an active capacity of 5.2 maf, and extends 151 miles upstream to the U.S.-Canada border (Corps et al. 2020a). Grand Coulee Dam and Lake Roosevelt provide the diversion dam for the Columbia Basin Project (CBP). Water from Lake Roosevelt is pumped through the John W. Keys III pump generating plant to Banks Lake (a reregulation reservoir) for distribution to the CBP. Banks Lake is a 715,000 ac-ft reservoir formed by the North Dam, which is located about 2 miles southwest of Grand Coulee Dam, and the Dry Falls Dam, which is located about 29 miles south of Grand Coulee Dam. Banks Lake feeds water to the CBP through the Main Canal at Dry Falls Dam and provides water to operate the pump/generators in generation mode at John W. Keys III. Current deliveries have a range that average around 2.9 maf, for nearly 700,000 acres of land, but the consultation is for a maximum diversion of up to approximately 3.4 maf when fully implemented providing water to around 770,000 acres. This total of 3.4 maf includes other irrigation diversions for the CBP that are already part of the environmental baseline; these include 164,000 acre-feet covered by the Odessa Subarea Special Study 2012 Final Environmental Impact Statement and corresponding Section 7 consultation (Reclamation 2012a). The Service completed consultation on the Odessa Special Study on October 10, 2012 (USFWS 2012b) and determined that impacts to bull trout were insignificant (USFWS 2012b). More detail on the CBP is in Section "11.3 Consulted on Effects for Bull Trout."

The Northeastern Washington RNA encompasses the mainstem Columbia River and its tributaries above Chief Joseph Dam upstream to the Canadian Border, Spokane River and tributaries upstream to Post Falls Dam, and the Pend Oreille River mainstem and its tributaries, in the U.S., downstream of Boundary Dam.

Geographically, the area is located in the Okanogan Highlands and bounded by the Kettle, Calispell, and Huckleberry Mountain Ranges. Ceded lands of the Colville, Spokane, Coeur d'Alene and Kalispel Tribes overlap much of the area. Major tributaries include the Nespelem, Sanpoil, Spokane (up to Post Falls Dam), Kettle, Colville, and Pend Oreille (up to Boundary Dam) rivers. The Northeast Washington RNA is approximately 18% Federal Lands, 51% Private Lands, 25% Tribal Lands, and 6% State. Approximately 90 percent of this RNA is in public or tribal ownership managed by the U.S. Forest Service (USFS), Colville Confederated Tribes, and the Spokane Tribe of Indians. The National Park Service manages Lake Roosevelt. Lake Roosevelt and numerous other tributaries with sufficient water and temperatures to support bull trout are also present in the area, including Big Sheep, Wilmont, Barnaby, Deep, Sherman, Onion, Ninemile, Stranger, and Hall creeks.

The threats to bull trout in the Northeast Washington RNA are (USFWS 2024b):

- Historic or current water and land management activities resulting in the loss of riparian habitat sufficient to support wood recruitment, pool formation, and water temperatures needed for spawning, incubation, and rearing in historic tributaries (i.e., Kettle, San Poil, Spokane, Sherman, Sheep, Hawk, and Onion Rivers);

- Historic or current water and land management activities resulting in altered flows, channelization, and reduced complexity in historic tributaries (i.e., Kettle, San Poil, Spokane, Sherman, Sheep, Hawk, and Onion Rivers) that support restoration of bull trout populations or forage species;

- Historic water and land management activities resulting in elevated temperatures, sediment, and/or contaminants limiting spawning, incubation, and rearing in historic tributaries (i.e., Kettle, San Poil, Spokane, Sherman, Sheep, Hawk, and Onion Rivers) or mainstem connectivity;

- Manmade barriers within the mainstem Columbia River and its tributaries that prevent or limit free movement and connectivity between FMO and spawning and rearing (SR) areas as well as hinder the historical free movement of bull trout between core areas in the Salmo, Pend Oreille, Methow, Entiat, Wenatchee and, to some extent, the Coeur d'Alene Rivers and suitable habitat and forage within the Northeast Washington Research Needs Area;

- Lake Roosevelt and its tributaries have numerous nonnative fish species, which compete with (e.g., coastal rainbow trout, brook trout, lake whitefish) and prey upon (e.g., northern pike, walleye, smallmouth bass) native fishes. Brook trout and other nonnative fish compete with native salmonids in tributaries and represent a hybridization risk for bull trout.

Operations of Chief Joseph and Grand Coulee dams have negatively altered bull trout habitat and populations. These dams impound the mainstem Columbia River as managed reservoirs. Some of the major negative impacts include changed flow regimes, increased barriers to movement, and increased interactions with non-native species (Wissmar and Craig 1997, 2004; Rieman and McIntyre 1993). A significant loss of range in Northeast Washington and Canada as well as connectivity between Core Areas throughout the Columbia River Basin occurred with construction of Chief Joseph and Grand Coulee dams.

Based on interviews with Tribal elders, bull trout appear to have been ubiquitous throughout streams on the Colville Reservation (Hunner and Jones 1996). Accounts by Colville Tribal elders confirm historic presence of bull trout in several of the larger creeks that are direct tributaries to Lake Roosevelt including: Ninemile Creek, Wilmont Creek, Twin Lakes/Stranger Creek, Hall Creek and Barnaby Creek (Hunner and Jones 1996). Bull trout are thought to have been extirpated in several rivers of the Northeast Washington RNA, including the Nespelem, Sanpoil, and Kettle Rivers (USFWS 1998; Mongillo 1993; USFWS 2015c). The Northeast Washington RNA has limited but consistent observations of subadult and adult bull trout, particularly within Lake Roosevelt and occasionally near the mouths of tributaries to the Lake. However, no known spawning or early rearing areas have been identified to date (USFWS 2024b). Observation data is sporadic and often anecdotal (USFWS *unpublished data*). Since 2011, reports of bull trout observations in Lake Roosevelt have increased, often in association with high water years. In 2012, observations of 19 bull trout were reported throughout Lake Roosevelt by tribal and educational survey crews, local citizens, and fishing charters (USFWS 2015c). Most of these were assumed to be entrained fish from spawning areas in Canada and the Pend Oreille River. However, genetic assignment to populations has not occurred on any of the bull trout observed. Six bull trout were observed in Sheep Creek that year (Honeycutt in litt. 2014). Another four bull trout were documented in Lake Roosevelt in 2017 (Baker in litt. 2017;

Paluch in litt 2019). Since 2019, only a few bull trout observations have been reported.

In Rufus Woods Lake, bull trout accounted for less than 0.1 percent of the catch during a fish inventory of the lake in 1999 (LeCaire 2000; Beeman et al. 2003). As with Lake Roosevelt bull trout observations, the bull trout likely stem from populations upstream in Canada or the Pend Oreille River Basin. The Colville Confederated Tribes and the Northwest Power and Conservation Council (NPCC) concluded that bull trout use of Rufus Woods Lake was minimal (CCT 2000). Although Chief Joseph Dam operates as a run-of-the-river project, it also reduces the peak discharges from Grand Coulee dam. If bull trout exist in the Nespelem River, a tributary to Rufus Woods Lake, it is likely a resident population upstream of a natural migration barrier located at RM 1.5 (CCT 2000). Although suitable spawning habitat is located in several tributaries to Lake Roosevelt and Rufus Woods Lake, no known spawning occurs in the tributaries.

To date, there are no known observations of bull trout in Banks Lake or Potholes Reservoir. Poor habitat quality, elevated contaminants (303d listed areas, Washington Department of Fish and Wildlife [WDFW] fish consumption restrictions), and high water temperatures within Banks Lake and Potholes Reservoir likely make them inhospitable for bull trout. High levels of non-native species such as bass and walleye further make the reservoirs unsuitable for bull trout.

11.1.2 Methow, Entiat, and Wenatchee River Core Areas

Between Chief Joseph Dam and the Yakima River, the Service considers the mainstem Columbia River as FMO habitat for bull trout. This reach encompasses five non-Federal dams and their associated reservoir pools on the mainstem Columbia River, including Wells Dam (Douglas County Public Utility District (PUD), Rocky Reach and Rock Island dams (Chelan County PUD), and Wanapum and Priest Rapids dams (Grant County PUD). There are six Core Areas adjacent and connected to the mainstem Columbia River through this reach, including the Entiat River, Methow River, Wenatchee River, and Yakima River Core Areas. In addition, the Service identified Chelan and Okanogan rivers as important FMO habitat for bull trout (USFWS 2015c).

Bull trout in the reach below Chief Joseph Dam represent fluvial and adfluvial populations that migrate into the Columbia River mainstem from natal tributaries in nearby Core Areas mentioned above. As many as 34 local populations in the four Core Areas (Methow 10, Entiat 2, Wenatchee 7, and Yakima 15) are connected to the mainstem Columbia River between Chief Joseph Dam and the Yakima River (USFWS 2015c). Evidence of migration to the Columbia River exists for roughly half of these local populations (USFWS 2015c; Barrows et al. 2016; Nelson and Johnson 2012). Abundance in the Action Area reflects habitat conditions and carrying capacity in the tributaries as well as connectivity to the Columbia River. The Service assumes sub-adult and adult presence in the mainstem Columbia River during most months. Crews at Chief Joseph Dam collected two adult bull trout from Turbine 2 in January 2016 during turbine dewatering (S. Stonecipher, Chief Joseph Dam, pers. comm. as cited in Bonneville et al. 2017a). Additional documentation of bull trout in the Chief Joseph Dam tailrace has occurred sporadically in the past during surveys and recreational fisheries. These fish likely originated from a local Core Area and migrated upstream into the draft tube, given the low likelihood bull trout originated from populations upstream of Grand Coulee Dam that were entrained.

Approximately 73 adult (~16 per year bull trout have been counted at Wells Dam. Crews count an average of 176 adult bull trout at Rocky Reach Dam and an average of 93 adult bull trout at Rock Island Dam each year (Stevenson et al. 2009). Radio telemetry and PIT tag information have showed that bull trout from the Methow Core Area have been observed at each of these dams and adults can migrate downstream through turbines, spill, or smolt bypass systems and return through upstream adult salmon ladders. BioAnalysts, Inc. (2004; 2007; 2008) and LGL and Douglas PUD (2008) described successful spawning migrations with minimal delay between dams. A total of 414 PIT tagged bull trout have interacted with Wells Dam, recently (Douglas PUD 2016 p. 11). At Rocky Reach and Rock Island dams, total detections of bull trout have been 1,413 (Stevenson et al. 2009). An average of five adult bull trout are observed in the upstream passage facilities at Priest Rapids and Wanapum dams annually. While observations of adult and sub-adult bull trout have occurred at all five non-federal dams between Chief Joseph and McNary dams, there is limited information on which populations they derive from. Therefore, these observations could stem from any population in the Methow, Entiat, Wenatchee, Yakima, and Walla Walla Core Areas.

Since 2000, the Service has completed several consultations on the five non-federal dams operated in this reach of the Columbia River (USFWS 2006b; 2007; 2008b; 2011b; 2012c). In the following sections, the Service provides a brief summary of baseline conditions for Core Areas between Chief Joseph Dam and the Yakima River, including use of the Action Area by bull trout from those adjacent Core Areas. Detailed descriptions on the status of bull trout and bull trout critical habitat is incorporate by reference (USFWS 2006b; 2007; 2008b; 2011b; 2012c).

11.1.2.1 Methow River Core Area

The Methow River Core Area is located in Okanogan County and drains an area of approximately 4,895 square kilometers (km^2) (1,890 mi^2) (NPCC 2004b). The watershed drains in a northwest to southeast direction and over 60 percent of the annual precipitation within the Methow River Basin occurs between October and March (NPCC 2004b; Parametrix, Inc. et al 2000). The confluence of the mouth of the Methow River with the Columbia River is at RKM 843 (RM 524) near Pateros in north central Washington. The Methow River Core Area consists of approximately 84% federal lands, with a large portion of its headwaters occurring in designated wilderness (USFWS 2024b). Both legacy and ongoing threats continue to impact bull trout populations in the Methow Core Area. Management actions such as fire suppression and timber harvesting have changed much of the area to an unnatural high intensity fire regime with increased fire burned areas, where high-intensity summer rainstorms and rain on snow events can accelerate rates of erosion. Forest management on both National Forest and private timber lands, agriculture operations, fish management at the Winthrop National Fish Hatchery, and numerous irrigation diversions have both legacy and current ongoing impacts affecting the Core Area. Connectivity between Core Areas from dam operations impact persistence of bull trout in the Core Area (USFWS 2015c).

In the Methow River Core Area, bull trout persist at low numbers, in ten small, fragmented, local populations (DeHaan and Neibauer 2012). Based on trend data through 2020, bull trout abundance in the Methow River Core Area is low but relatively stable (USFWS 2024b). Future condition modeling has projected a 51% loss of spawning and rearing habitat in the Methow River Core Area by 2071-2090 (USFWS 2024b). The Methow River Core Area exhibits multiple life history strategies similar to other Core Areas in the Columbia River. As many as 15 to 20 percent of bull trout in this Core Area migrate between other Core Areas and to the mainstem Columbia River annually (USFWS 2015c; USFWS 2006b; Nelson and Nelle 2008; Kelly Ringel et al. 2014; BioAnalysts 2004; Stevenson et al. 2009).

Radio telemetry, screw traps, and other monitoring occurring throughout the Basin indicates that sub-adult bull trout move into the Columbia River in spring and fall months, while the majority of adult movements occur between September and December after spawning (Barrows et al. 2016). Early fall movement of sub-adult bull trout may be impacted in the Twisp River, Lost River, and mainstem Methow River because of seasonal dry or subsurface flow reaches (Nelson and Johnsen 2012; LGL and Douglas PUD 2008).

The threats to bull trout in the Methow River Core Area are (USFWS 2024b):

Habitat

Upland/Riparian Land Management

- Agriculture/Livestock Grazing/Forest Management Practices – legacy and current practices including forest roads, have resulted in a lack of habitat complexity (i.e., wood, primary pools, functioning floodplains). Agriculture practices have channelized streams, altered floodplains, and reduced riparian vegetation.

- Development/Transportation Networks – legacy and current structures and features impact both SR and FMO habitat.

- Recreation – legacy and new recreational developments impact SR habitat (i.e., rock dam building, reduced riparian areas, and compacted stream banks) and reduce habitat complexity.

Instream Impacts

- Agriculture/Forest Management Practices/Grazing/Development/Transportation Networks/Recreation (legacy and current) – actions have degraded habitat. Past timber, fire, recreation, and grazing management have compounded impacts in stream reaches (i.e., sediments, reduced riparian areas, and high stream temperatures). Current grazing management plans need to be maintained and improved in spawning areas and FMO areas. Highways and county roads along FMO and development in floodplains reduce complexity, create passage issues, and degrade water quality.

- Dewatering and Altered Flows – streams with natural dewatering are further impacted during low flow years. Mainstem diversion dams have altered instream flows and water quality.

- Entrainment and Connectivity/Fish Passage – hydropower dams on the mainstem Columbia River, Methow River mainstem and tributary irrigation dams, and historic splash dams altered channel structure, floodplains, and impede fish passage.

Water Quality

- Water Quality Impairment (legacy and current) – management has led to 303(d) listed reaches with water quality degradation. Standards are frequently not met in FMO areas. Irrigation returns, runoff, application of pesticides/herbicides/deicer impacts occur in adjacent FMO and several SR areas.

- Climate Change – current science predicts temperature changes will impact stream flow and temperature patterns. Quality of the lower elevation SR habitat and FMO will be further degraded (stream temperatures, turbidity, sediments, dissolved oxygen levels).

Demographic

Connectivity Impairment

- Agriculture – irrigation diversions cause impacts to fish passage entrainment. Some reaches within SR and FMO have listed 303(d) reaches. Stream temperature and agriculture chemicals have legacy and current impacts that reduce habitat complexity and degrade connectivity of bull trout habitat.

- Forest Management/Transportation Networks (legacy and current) – forest roads/highways/county roads continue to impair connectivity for migration. Forest Management and Transportation Networks have impeded passage and contributed to a lack of complex habitat.

- Dewatering – several streams natural dewater during times of low snowpack/rain and may be further impacted with climate change and management impacting these populations.

- Entrainment (hydropower and diversions)/Fish Passage/Altered Flows – entrainment and altered flows occur at all FERC-licensed (PUD and Avista) dams and Federal hydropower dams on the Columbia River and at other diversions/dams in the Methow Core Area where, fish passage is impeded, causing altered movement from SR and migration areas. Altered flows and climate change have caused reduced or limited use of migratory corridors.

- Climate Change – climate change is predicted to impact stream flows and temperatures that will cause barriers for passage and reduced refuge.

Fisheries Management

- Angling/Harvest/Poaching – fishing regulations and harvest rules need to continue to protect bull trout. Illegal poaching occurring in several basins.

- Fisheries Management – increased fish management and need for fish monitoring cause increased handling impacts. Species interactions from hatchery fish are likely; degree of impacts is unknown.

Small Population Size

- Genetic/Demographic Stochasticity – half of the local populations in the basin are small and unstable or stable at very low numbers. Several populations are at the lowest they have been in years.

- Loss/Altered Migratory Life History – life histories have been altered due to long-term impediment of fish passage at long-time PUD dams and irrigation diversions.

- Fisheries Management – species interactions from hatchery-released smolts/fishes and overlapping adult spawners may be greatest on low abundance populations.

Forage Fish Availability

- Fish Passage/Introduced Species/Fish Management – Columbia River dams, irrigation diversions, and legacy splash dams or other culverts currently or historically impeded passage for potential native prey species (i.e., other salmonids). Hatchery releases may both impact and benefit bull trout especially where low numbers of bull trout exist. Brook trout outcompete bull trout for habitat and food.

Nonnatives

Nonnative Fishes

- Introduced Species/Fish Management – brook trout are nonnative predators in the basin and will impact recovery. Brook trout overlap with bull trout in both SR and FMO habitat. Distribution is unknown. Fisheries for brook trout continue to occur. Salmon recovery involves output of high numbers of smolts, with some residualization and species competition, which may have impacts to prey base and small populations of bull trout. Genetic analysis has identified brook trout x bull trout hybrids within the basin.

Climate Change – predatory nonnative species occur within FMO habitats and risk potential spread especially as waters warm with climate change.

Entiat River Core Area

The Entiat River is located in Chelan County and drains an area of approximately 1,085 km^2 (419 mi^2) (NPCC 2004b; Andonaegui 1999). The Entiat River Core Area consists of approximately 80% federal, 12% private, and 8% State lands, with a portion of its headwaters occurring in designated wilderness. The headwaters of the Entiat River are in glaciated Basins near the Cascade Crest. Flowing southeasterly the Entiat River enters the Columbia River near the town of Entiat, approximately 32 kilometers (km) (20 miles) upstream from Wenatchee at RM 484 of the Columbia River (USFS 2017). Due to the small size of the watershed, bull trout habitat and carrying capacity is limited in the Entiat River Core Area. Entiat Falls, located at approximately RM 34, limits the upstream range of bull trout in the Basin (USFS 2017). Legacy and ongoing land management actions have negatively affected bull trout habitat and have included timber harvest and fire suppression that have increased the risk for catastrophic and high intensity fires in the Basin. In addition, irrigation diversions, grazing, and overfishing threatened bull trout populations. The Entiat River is also subject to anchor ice scour in winter and flooding in spring and fall rainstorms, which combined with fire, irrigation, and grazing impacts has led to increased loss of habitat complexity. Loss of connectivity between Core Areas in this region of the Columbia River have further impacted bull trout population resiliency. Unique to the Entiat River Core Area, as much as 90 percent of the population uses the mainstem Columbia River for FMO (USFWS 2015c).

Currently, the Entiat Core Area supports two local populations of bull trout: one in the upper mainstem Entiat River and one in the Mad River. Since 2004, the number of redds in the Entiat River has fluctuated widely between 7 and 50 (Vazquez and Nelle 2022 p. 15). Future condition modeling projected an 87% loss of SR habitat y 2071-2090 (USFWS 2024b). Within the Mad River, redd counts have varied from 7 to 52, continuing this trend through 2012 (USFS 2003 p. 1; Nelson 2014 p. 27). The low numbers of spawning migratory bull trout in the Entiat Core Area increases the risk of extirpation from stochastic events. High variations in annual redd counts, high risk of extirpation from stochastic events, and reduced connectivity with other Core Areas classifies the Entiat River Core Area as depressed in this Opinion. Bull trout from the Entiat Core Area move into the Columbia River at similar timing as the Methow populations (Barrows et al. 2016). Returning spawners begin staging at the mouth of the Entiat River in May and June (Nelson 2014 p. i). Sub-adults move out of the Entiat in both the spring and fall and have been documented moving upstream of Wells Dam, downstream into the Wenatchee (Nelson et al. 2011; Nelson 2014 p. i), Yakima Rivers, and moving up into the Yakima River in June, staying for up to 9 months and moving back to the spawning grounds in the Entiat River.

The threats to bull trout in the Entiat River Core Area are (USFWS 2024b):

<u>Habitat</u>

Upland/Riparian Land Management

- Agriculture/Livestock Grazing/Forest Management Practices – legacy and current practices, including forest roads, have resulted in a lack of habitat complexity (i.e., wood, primary pools, functioning floodplains). Agriculture practices have channelized and reduced riparian vegetation and floodplain functions.

- Development/Transportation Networks – legacy and current facilities impact both SR and FMO habitat.

- Recreation – legacy and new recreational developments impact SR habitat (i.e., rock dam building, reduced riparian areas, and compacted stream banks) and reduce habitat complexity.

Instream Impacts

- Agriculture/Forest Management Practices/Development/Transportation Networks – legacy and current management actions have degraded habitat. Past timber, fire, recreation, and grazing management are compounded and have impacted stream reaches and stream temperatures, increased sediments, and reduced riparian areas. Current grazing management plans need to be maintained and improved in spawning areas. Highways and county roads along FMO and development in floodplains reduce complexity, create passage issues, and degrade water quality.

- Altered Flows – there are streams with naturally dewatering reaches impacted during low flow years. Mainstem diversion dams have altered instream flows and water quality.

- Entrainment and Connectivity/Fish Passage – hydropower dams on the mainstem Columbia River, irrigation dams, and historic splash dams altered channel structure.

Water Quality

- Water Quality Impairment – legacy and current management have led to 303(d) listed reaches with water quality degradation. Standards are frequently not met in FMO areas. Irrigation returns, runoff, application of pesticides/herbicides/deicer impact FMO and SR areas.

- Climate Change – current science predicts temperature changes will impact stream flow/temperature patterns. Quality of the lower elevation SR habitat and FMO will be further degraded (stream temperatures, turbidity, sediments, dissolved oxygen levels).

Demographic

Connectivity Impairment

- Agriculture – irrigation diversions block fish passage and cause entrainment. Some reaches within SR and FMO have 303(d) listed reaches. Stream temperature and agricultural chemicals have legacy and current impacts and reduce habitat complexity and connectivity of bull trout habitat.

- Forest Management/Transportation Networks – legacy and current forest roads/highways/county roads continue to impair connectivity for migration. Forest Management and Transportation Networks have impeded passage and contributed to a lack of habitat.

- Entrainment (hydropower and diversions)/Fish Passage – entrainment occurs at all hydropower dams on the Columbia River and at other diversions/dams in the Entiat Core Area where fish passage is impeded, causing altered movement from SR to migration areas. Climate change has or will have caused reduced or limited use of migratory corridors.

- Climate Change – climate change is predicted to impact stream flows and temperatures that will cause barriers for passage and reduced refuge.

Fisheries Management

- Angling/Harvest/Poaching – fishing regulations and harvest rules need to continue to be improved to reduce incidental catch of bull trout. Illegal poaching is occurring in several basins.

- Fisheries Management – increased fish management and need for fish monitoring cause increased handling impacts. Species interactions from hatchery fish are likely, degree of impacts is unknown.

Small Population Size

- Genetic/Demographic Stochasticity – both populations in the basin are very small and unstable or stable at very low numbers. Recent downward trends are a concern.

- Loss/Altered Migratory Life History – life histories have been altered due to long-term impediment of fish passage at long-time diversions, large hydropower Columbia River dams, and splash dams. Almost all migratory fish use the Columbia River for FMO habitat.

- Fisheries Management – species interactions from hatchery-released smolts/fishes may be greatest on low abundance populations.

Forage Fish Availability

- Fish Passage/Introduced Species/Fish Management – Columbia River dams, irrigation diversions, and legacy splash dams or other culverts currently or historically impede passage for potential native prey species. Hatchery releases may both impact and benefit bull trout. Brook trout outcompete bull trout for habitat and food.

Nonnatives

Nonnative Fishes

- Introduced Species/Fish Management – Brook trout are nonnative predators in the basin and will impact recovery. Brook trout overlap with bull trout in both SR and FMO habitat. Fisheries still occur for brook trout. Genetic analysis has identified Brook trout x bull trout hybrids within the basin. Salmon recovery involves output of high numbers of smolts, with some residualization and species competition, which may have impacts to prey base on small populations of bull trout.

- Climate Change – predatory nonnative species occur within FMO habitats and risk potential spread especially as waters warm with climate change.

11.1.2.2 Wenatchee River Core Area

The Wenatchee Basin is located in Chelan County and encompasses approximately 3,551 km^2 (1,371 mi^2) in central Washington (NPCC 2004b; Andonaegui 2001). The Wenatchee River Core Area consists of approximately 80% federal lands with a large portion of the headwaters occurring in designated wilderness. The Wenatchee River drains into the Columbia River at RM 470 near the town of Wenatchee (NPCC 2004b). There are seven local populations in tributaries of the Wenatchee River including the White and Little Wenatchee Rivers, the Chiwawa River, Nason Creek, Chiwaukim Creek, Icicle Creek, and Peshastin Creek, (USFWS 2015c).

The Wenatchee River Core Area exhibits multiple life history patterns and is one of the most diverse populations in the MCRU (USFWS 2015c). Most populations spawn from mid-September to mid-October. Local populations consist of a migratory form that migrates from spawning areas near the crest of the Cascade Mountains to Lake Wenatchee, the mainstem Wenatchee, the Columbia River and back to other Core Areas to forage and overwinter. A small percentage (15 to 20 percent) is estimated to migrate long distances, including into other Core Area, for foraging or overwintering and may migrate back to spawning areas annually, semiannually, or every few years (USFWS 2006b; Kelly Ringel et al. 2014; BioAnalysts 2004; Nelson and Nelle 2008; Stevenson et al. 2009). Resident bull trout exist upstream of barrier falls (i.e., Little Wenatchee River). Bull Trout subpopulation status upstream of Tumwater is complex. There are 5 subpopulations upstream of Tumwater Dam. Two are especially healthy due to their reliance on Lake Wenatchee rather than the Wenatchee or Columbia Rivers (i.e. Chiwawa and White River pops at >400 and >100 redds per year respectively), two are at or near extirpation for a variety of reasons (Nason and Little Wenatchee), and one appears to be relatively stable but is very small (Chiwaukum at ~20 migratory redds per year) (Vazquez and Bowerman 2025 pers. comm.).

Downstream of Tumwater Dam, there are up to three Bull Trout populations: Icicle Creek and Etienne and Ingalls Creeks in the Peshastin Creek watershed. All these populations live in remote locations and have resident life histories, which makes them very difficult to monitor.

Based on our latest data, though, the Icicle Creek population appears to be small but stable within French Creek, but in danger of extirpation due to Brook Trout competition in other rearing creeks in the watershed. Data from 2024 in the Etienne and Ingalls creeks indicates that Bull Trout may be extirpated in Etienne Creek and experiencing distribution contractions within Ingalls Creek, but more research will be needed to confirm this. We are currently planning on surveying Etienne Creek and potentially Ingalls Creek in 2025 to further assess their status (Vazquez and Bowerman 2025 pers. comm.).. The Chiwawa is the only population in the Wenatchee River Core Area that exhibits all life history stages and remains stable with 500 to 1,000 migratory redds annually. The Chiwawa River also exhibits both lacustrine-fluvial and lacustrine adfluvial forms, which migrate both upstream and downstream of rivers and lakes to spawn. Overall, the trend for the Wenatchee Core Area seems to be stable and suggests a slightly increasing trend, although most of the stable trend is due to a single local population in the Chiwawa River. Future condition modeling projected a 62% loss of SR habitat in the Wenatchee River Core Area by 2071-2090 (USFWS 2024b).

The threats to bull trout in the Wenatchee River Core Area are (USFWS 2024b):

Habitat

Upland/Riparian Land Management

- Agriculture/Livestock Grazing/Forest Management Practices – legacy and current practices, including forest roads, have resulted in a lack of habitat complexity (i.e., wood, primary pools, functioning floodplains). Agriculture practices have channelized streams, altered floodplains, and reduced riparian vegetation.

- Development/Transportation Networks – legacy and current roads and railroads impact both SR and FMO habitats.

- Recreation – legacy and new recreational developments impact SR habitat (i.e., rock dam building, reduced riparian areas, and compacted stream banks) and reduce habitat complexity.

Instream Impacts

- Agriculture/Forest Management Practices/Grazing/Development/Transportation Networks/Recreation – legacy and current management actions have degraded habitat, impacted stream channels, altered fish passage, reduced water flows, and constricted floodplains. Legacy timber, fire, recreation, and grazing management have added impacts to sediments, reduced riparian areas, and stream temperatures. Current grazing management plans need to be maintained and improved in spawning and FMO areas. Highways, county roads along FMO, and development reduce complexity, create passage issues, and degrade water quality.

- Dewatering and Altered Flows – there are reaches of stream in FMO SR areas that naturally dewater and are further impacted during low flow years. Mainstem diversion dams have also altered instream flows and water quality.

- Entrainment and Connectivity/Fish Passage – hydropower dams on the mainstem Columbia River, irrigation dams, historic dams (i.e., Tumwater Dam), and splash dams altered channel structure, cause harm, and impede fish passage.

- Mining Impacts – legacy and current suction dredging practices lead to increased sediments and altered SR habitat.

Water Quality

- Water Quality Impairment – both legacy and current management have led to 303(d) listed reaches with water quality degradation. Standards are frequently not met in FMO areas. Irrigation returns, runoff, application of pesticides/herbicides/deicer impacts occur in adjacent FMO and several SR areas.

- Climate Change – current science predicts temperature changes will impact stream flow and stream temperature. Quality of the lower elevation SR habitat and FMO will be further degraded (i.e., stream temperatures, turbidity, sediments, dissolved oxygen levels).

Demographic

Connectivity Impairment

- Agriculture – irrigation diversions cause fish passage barriers and entrainment. Some reaches within SR and FMO have listed 303(d) reaches. Stream temperature and agriculture chemicals have legacy and current impacts to FMO habitat and reduce complex habitat and impact connectivity of bull trout habitat.

- Forest Management/Grazing/Recreation/Transportation Networks – legacy and current forest roads/highways/county roads continue to impair connectivity for migration. Forest Management and Transportation Networks have impeded passage and have reduced habitat complexity.

- Dewatering – stream reaches naturally dewater during times of low snowpack/rain and may be further impacted with climate change.

- Entrainment (hydropower and diversions)/Fish Passage/Altered Flows – entrainment and altered flows occur at all hydropower dams on the Columbia River and at other diversions/dams in the Wenatchee Core Area where fish passage is impeded. Some passage barriers alter timing and migration from SR to migration areas. Altered flows and climate change have or will have caused reduced or limited use of some migratory corridors.

- Climate Change – climate change is predicted to impact stream flows and temperatures that will cause barriers for passage and reduced refuge.

Fisheries Management

- Angling/Harvest/Poaching – fishing regulations and harvest rules have improved but need to continue to protect bull trout. Illegal poaching occurring in several basins.

- Introduced Species – brook trout overlap with bull trout in both SR and FMO habitat.

- Fisheries Management – increased fish management and need for fish monitoring cause increased handling impacts. Species interactions from hatchery fish are likely, especially in areas of overlap with bull trout populations; the degree of impacts is unknown.

Small Population Size

- Genetic/Demographic Stochasticity – half of the local populations in the basin are small and unstable or stable at very low numbers.

- Loss/Altered Migratory Life History – life histories have been altered due to long-term impediment of fish passage at long-time diversion dams.

- Fisheries Management – species interactions from hatchery-released smolts/fishes and may be greatest where they overlap with low abundance bull trout populations.

Forage Fish Availability

- Fish Passage/Introduced Species/Fish Management – Columbia River dams, irrigation diversions, and legacy splash dams or road culverts currently or historically impede passage for potential prey species. Hatchery releases may both impact and benefit bull trout (especially where low numbers of bull trout exist). Lake trout, brown trout, and brook trout outcompete bull trout for habitat and food.

<u>Nonnatives</u>

Nonnative Fishes

- Introduced Species/Fish Management – lake trout, brown trout, and brook trout are nonnative predators in the basin and impact recovery. Brook trout overlap with bull trout in both SR and FMO habitat. The distribution of lake trout and brown trout is unknown and may alter with climate change. Fisheries still occur on lake trout, brown trout, and brook trout. Genetic analysis has identified brook trout x bull trout hybrids within the basin. Salmon recovery involves output of high numbers of smolts, with some residualization and species competition, which may have impacts to preybase and small populations of bull trout.

- Climate Change – predatory nonnative species occur within FMO habitats and risk potential spread especially as waters warm with climate change.

11.2 Designated Bull Trout Critical Habitat in the Mid-Columbia Recovery Unit

Within the MCRU, the mainstem Upper-Columbia River CHU 22, which includes the Columbia River from John Day Dam upstream to Chief Joseph Dam, falls within the bounds of the Action Area (USFWS 2010b). Critical habitat for bull trout upstream of Chief Joseph Dam to the Canadian border is not designated within the Action Area.

The Mainstem Upper Columbia River CHU 22 includes the mainstem Columbia River from Chief Joseph Dam downstream to John Day Dam and all inundated/backwater portions of tributaries (USFWS 2010b). This CHU was identified essential for bull trout to conserve migratory corridors for fluvial bull trout in adjacent Core Areas (USFWS 2010b). The entirety of the Mainstem Upper Columbia River CHU 22 falls within the Action Area.

The Mainstem Upper Columbia River CHU 22 supports FMO habitat for bull trout and provides connectivity between the mainstem Lower Columbia River (CHU 8), Snake River (CHU 23), and several tributary CHUs adjacent to the Action Area (USFWS 2010b; USFWS 2008a; BioAnalysts 2004, 2007, 2008). Numerous tributaries as well as associated designated CHUs drain into the Mainstem Upper Columbia River CHU 22. These include the Upper Columbia River Basins CHU 10, Yakima River CHU 11, Mainstem Snake River CHU 23, Walla Walla River CHU 14, Umatilla River CHU 13, and the John Day River CHU 12.

The Columbia River upstream of Chief Joseph Dam, including Rufus Woods Lake and Lake Roosevelt above Grand Coulee Dam, is not designated critical habitat. However, changes to water quality from elevated TDG, temperature, and other factors as well as flow conditions upstream influence PBFs within designated critical habitat downstream. TDG levels below Lake Roosevelt, including Rufus Woods Lake, can increase relative to state water quality criteria during times of high flows and spill is necessary at Grand Coulee Dam in order to manage flood risk or lack of market or turbine capacity or when operations are necessary at Grand Coulee Dam in order to meet operational constraints downstream. These elevated TDG levels can persist, and at times be further elevated, when spilling also occurs at Chief Joseph Dam. Adjustments to past system operations to minimize spill have helped improve conditions in designated critical habitat. Grand Coulee Dam outflow water temperature has a temporal lag behind the warming/cooling inflow to Lake Roosevelt, observed at the U.S.-Canada border. In general, water temperatures released from Grand Coulee tend to be cooler than reservoir inflows throughout much of the spring and early summer, and warmer in late summer/fall. Because Lake Rufus Woods does not stratify and has a residence time of about 4 days, it passes on the lagged water temperatures created by Lake Roosevelt.

Land ownership in the reach is a mixture of local, state, tribal, Federal, and private interests, though the majority of land use consists of agriculture, rangeland, and residences (USFWS 2015c p. C-344). Major habitats include waterbodies such as the Columbia River reservoirs and associated tributaries, wetlands associated with tributary floodplains and low-lying depressions, riparian areas, and the adjacent upland communities that include managed agriculture/pasture lands, shrub-steppe, and forest habitats (Douglas County PUD 2011). While bull trout spawning and rearing does not occur within CHU 22, bull trout occur year round using the unit for FMO. The mainstem Upper Columbia River (CHU 22) provides connectivity between many core habitats and is likely impaired due to the presence of nine dams and temperature and habitat constraints.

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

Mainstem Upper Columbia River CHU 22

Reservoirs in the mainstem Columbia River have inundated wetlands and off-channel habitats, which influence subsurface water connectivity and thermal refugia. Shoreline development for transportation corridors has further reduced the interaction between the mainstem river and shoreline springs. High in-stream temperatures are common.

Presence of thermal refugia is also a function of thermal stratification within the reservoirs. Tributary inflow may also play a role in providing subsurface connectivity between cold-water refugia in the reservoir and tributary habitat. Some groundwater influence may occur in riverine areas of the mainstem not dominated by bedrock or immediately below dams, although little is known regarding the ecological significance of this exchange (Corps 2013). Areas throughout that provide some coldwater or natural hyporheic connectivity likely provide bull trout in the mainstem with summer refugia, particularly for sub-adults.

This PBF is considered Not Properly Functioning within the Action Area due to lost wetlands and floodplain connectivity from dam operations and shoreline development.

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

Mainstem Upper Columbia River CHU 22

PBF 2 has been significantly altered by construction and operation of dams throughout the CHU. The lack of fish passage facilities at Chief Joseph and Grand Coulee dams block access to historic FMO habitat and limit connectivity with historic populations upstream and in Canada.

Passage facilities (i.e., fish ladders) at the non-Federal dams on the Mainstem Columbia River downstream of Chief Joseph Dam were primarily designed and operated for anadromous salmon and steelhead (NMFS 2011a), but are also used by bull trout.

Bull trout are observed passing the upstream fishways and downstream through turbines and spillways at the non-federal Priest Rapids, Wanapum, Rock Island, Rocky Reach, and Wells dams at similar or lower rates compared to salmon and steelhead (BioAnalysts, Inc. 2004;

USFWS 2008b). These fishways also comply with NMFS fishway design guidelines and are therefore similar in design, dimension, and operations to upstream fishways at the Federal mainstem dams. Fishway operations at Wells Dam did not appear to influence the movements of adult bull trout as upstream passage events appeared to be associated with water temperature, photoperiod, and time of year (Douglas County PUD 2011). A small number of sub-adults and adult bull trout have been collected at the Rock Island Dam Smolt Monitoring Facility and at the Rocky Reach Dam surface collector sampling facility (FPC 2018). USFWS (2008b) reports that although juvenile fish passage facilities were not developed for the downstream passage of larger fish such as adult bull trout, verifiable injury or mortality of adult bull trout passing downstream through turbines and spillways has not been reported at the mainstem Columbia River dams, including those in the project reach. The fallback rate for salmon and steelhead at the mid-Columbia hydroelectric projects has been documented to range between 0 percent and 7 percent (NMFS 2002b). "Fallback" rates relate to the potential for fish to "fallback" through the dams, resulting in contact with structural features of the dam (spillways, turbines, or fish ladders). Adult mortality is likely to be higher than for juveniles (USFWS 2000, 2012c). Further, incidents of fallback or downstream passage of adult bull trout through the mid-Columbia hydroelectric projects appeared to be low (4 percent) and show no apparent mortality (BioAnalysts, Inc. 2004 and LGL and Douglas PUD 2008). This operation may not represent sufficient passage for bull trout and the function of this PBF is limited.

Given the above information, passage and migration corridors throughout the Mainstem Upper Columbia River CHU 22 are likely insufficient for bull trout. This PBF is considered Functioning at Risk.

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

Mainstem Upper Columbia River CHU 22

PBF 3 is present in and contributes to FMO habitat in this reach of the Columbia River. The variation in inundation due to the dams has reduced riparian areas and limited terrestrial organism and nutrient inputs (extended inundation followed by drawdown). The conversion of riverine habitat into reservoirs may have improved the productivity and the quantity of available prey, though species assemblages are likely different from before the dams (USFWS 2011b). The mainstem Columbia River in this reach, including the reservoirs, provides an abundant food source for migratory bull trout during the fall, winter, and spring (USFWS 2007). Forage fish such as juvenile salmon and steelhead provide a large forage base for bull trout, as well as whitefish, sculpins, suckers, and minnows that inhabit the reservoir (USFWS 2010b). The declines of native salmon and steelhead populations have likely reduced or altered bull trout diets in the Action Area.

Upper Columbia River mainstem habitats and reservoirs provide rearing habitat for both stream-type and ocean-type Chinook, which provide a source of prey for bull trout. Large numbers of hatchery-raised salmonids are released into the CRS annually and provide an abundant source of prey for bull trout (USFWS 2007), though smolts may also compete with bull trout for smaller prey species. Tributary mouths support populations of non-endemic rainbow trout, bass, crappie, carp, bluegill, catfish and other species that may provide forage for bull trout.

Based on reduced native salmon forage and riparian function through the Action Area, the Service considers this PBF functioning at risk.

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

Mainstem Upper Columbia River CHU 22

PBF 4 has been functionally reduced by impoundments created by the hydroelectric projects throughout the Upper Columbia River CHU. Mainstem Columbia reservoirs have inundated off channel habitats and wetlands. The dams have converted previously free-flowing riverine habitats to more lacustrine habitats in reservoir reaches and homogenized habitat conditions in much of the reach. Pools have been inundated and essentially replaced by deep-water habitat in the mainstem (USFWS 2011b). Riparian areas along the mainstem Columbia River are generally narrow in this project reach, and their structure and condition are influenced by daily fluctuations in river level due to dam operation (USFWS 2011b). Dam operations, flow management, and the related inundation of off-channel and floodplain areas have reduced the size, quality, and function of floodplains along the upper Columbia River (NMFS 2000a as cited in USFWS 2002f). Off-channel diking, levees and bank armoring along the mainstem and within tributaries has resulted in the loss of floodplain and off-channel habitats that could provide important rearing areas for bull trout (USFWS 2002f). Roads and other features have disconnected hydrologic linkages between off-channel areas and the main channel, interrupted overbank-flow processes, and degraded both wetland function and riparian vegetation.

Residential, agricultural, and recreational development along the mainstem has resulted in the loss of riparian vegetation. Streambanks throughout the mainstem Upper Columbia River are typically characterized as sparsely vegetated steep canyons, with steep shorelines, often armored with riprap, especially along the banks immediately downstream of dams, to prevent erosion during larger spill events. In Wells Reservoir (Lake Pateros) downstream of Chief Joseph Dam, shorelines are relatively steep, with banks rising sharply to 20 ft to 40 ft above reservoir elevations. Shoreline areas near point bars and at the mouths of tributaries are more gradual, with a diversity of habitats, including dense riparian vegetation, unstable and eroding areas, areas of minimal vegetation and exposed bedrock, and areas that are relatively unvegetated and have been stabilized by riprap (Douglas County PUD 2011). One area of diverse habitat that remains is at the mouth of the Okanogan River, near Brewster.

Residential, agricultural, and recreational development along the mainstem has also resulted in the loss of riparian vegetation. Dam operations and reservoir management have reduced the size, quality, and function of floodplains along the upper Columbia River (NMFS 2000a).

Transportation corridors along the Columbia River further limit the formation of off-channel habitat. Reduced floodplain connectivity has also decreased the recruitment of LW needed for

the formation of complex habitat. Levees along the Columbia River and the lower portions of tributaries have also limited the development of complex habitats.
Habitat complexity in the Mainstem Upper Columbia CHU is not properly functioning based on the information above.

PBF 5: Water temperatures ranging from 2 °C to 15 °C (36 °F to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range.

Mainstem Upper Columbia River CHU 22

In the designation of critical habitat, PBF 5 was identified as not present in the Mainstem Columbia River due to construction of the dams and elevated temperatures. While not identified as a PBF in the CHU, temperatures in the Columbia River influences distribution, migration, and foraging opportunities for bull trout throughout the Action Area and between Core Areas. Seasonally, elevated temperatures in passage facilities and in the river impede movement of bull trout, specifically non-spawning adults and sub-adults.

PBF 6: In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo over-winter survival, fry emergence, and young-of-the-year and juvenile survival.

Mainstem Upper Columbia River CHU 22

Spawning and rearing does not occur within this CHU, therefore this PBF is not present.

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

Mainstem Upper Columbia River CHU 22

The current hydrograph is significantly altered as a result of construction and operation of the dams. Dams have increased the river cross-section and moderated peak and base flows in the mainstem, with the river level only changing a few feet annually. Surface water withdrawals throughout the mainstem and tributaries have also reduced in-stream flow, particularly in smaller Basins. The hydrograph, although varying from the natural hydrograph, currently provides for FMO habitat.

The Chief Joseph Dam is a run-of-river facility, meaning that daily inflow through the dam generally equals daily outflow. Run-of-river projects cannot store or draft a significant volume of water. As such, flows at the dam and downstream are primarily shaped by the operations at the Canadian and Federal storage projects upstream, particularly Grand Coulee Dam. Overall, storage dams in the Columbia River Basin have modified the natural, historical hydrographs, generally with decreased magnitude of high flow events during the spring and summer and increased duration of low flows during the winter months to store water for both future power generation and augmenting flows in the spring and summer months for operations intended to benefit ESA-listed species (National Research Council 2004). Flows at Chief Joseph Dam can also vary on shorter timescales (i.e., hourly and daily) to optimize power generation during peak energy demands.

The inflow to the Wells Reservoir (Lake Pateros) is controlled by operations of Chief Joseph Dam and Grand Coulee Dam. In Lake Pateros, reservoir fluctuations are minor (1 ft to 2 ft daily). From 2001 through 2005, the reservoir operated within the upper 4 ft (781 ft to 777 ft mean sea level in elevation) 95.1 percent of the time (Devine, Tarbell & Associates 2006). The uppermost 5-mile section of Lake Pateros immediately downstream from the Chief Joseph Dam tailrace is characteristic of a riverine environment, with relatively fast flow through the narrow canyon (Douglas County PUD 2011). The middle 10-mile section between the town of Brewster and just upstream of Chief Joseph State Park resembles a more lacustrine environment, with slower water velocities. The lowermost 15-mile section is relatively narrow and fast-flowing but eventually slows and deepens on approach to Wells Dam (Douglas County PUD 2011).

In addition to the dams, but to a much lesser extent, irrigation or other surface water diversions have reduced river flows. Agriculture, grazing, and development have altered the mainstem Columbia River corridor and stream hydrology with increased runoff and decreased floodplain storage connectivity. These flow reductions and subsequent alterations to in-stream habitat are more evident in the contributing tributaries.

Within the Mainstem Upper Columbia River, numerous dams alter the flow regime and hydrograph of critical habitat. Therefore, this PBF is not properly functioning in the Action Area.

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

Mainstem Upper Columbia River CHU 22

The mainstem Columbia River is CWA 303(d) listed for several impairments, including temperature, DO, pH, TDG, metals, polychlorinated biphenyls (PCBs) dichlorodiphenyltrichloroethane (DDT), and its derivatives, dioxin, and pesticides (USFWS 2011b). Primary water quality concerns in this area include the potential for dissolved gas supersaturation (in excess of state standards of 110 percent), which can harm fish. Because little degassing occurs during transport through Rufus Woods Lake, TDG measured at the Chief Joseph forebay is largely a function of TDG released from Grand Coulee.

The Corps and Bureau have made operational and structural modifications to reduce TDG levels downstream of Chief Joseph Dam. At Grand Coulee, if the reservoir water surface elevation is above 1265.5 ft, spill can be directed over the drum gates, which produces significantly lower levels of TDG compared to spill though the outlet tubes. When the reservoir water surface elevation is below 1265.5 ft, the Bureau operates the upper and mid-level outlet tubes at the same time, in an over/under method. This method has been effective in reducing TDG when using the outlet tubes. At Chief Joseph Dam, spillway flow deflectors have been successful at reducing TDG levels in the spillway releases. A pre-deflector study determined that TDG exchange in spillway flows ranged from about 111 percent to 134 percent and were a direct function of the specific spillway discharge (Schneider and Carroll 1999 as cited in Easthouse 2011). The post-deflector study showed that spillway deflectors substantially reduced TDG exchange in spillway flows with measured TDG saturations ranging from about 110 percent to 120 percent (Schneider 2012). This is still above the state maximum standard of 110 percent saturation, but considered less harmful for bull trout than the higher saturations generated by Grand Coulee Dam, and is within design parameters for the deflectors.

If the Chief Joseph Dam powerhouse is operating when Grand Coulee Dam is spilling, then high TDG concentrations can be passed through the powerhouse and entrained into spilled water, propagating high TDG levels downstream. But the system spill priority list has been able to prioritize power generation to be favored at Grand Coulee with spill at Chief Joseph during times when spill is necessary. This supports improved water quality not only downstream of Chief Joseph Dam, but also in Rufus Woods Lake.

The five non-Federal dams in this reach of the CHU have been subject to separate regulatory compliance requirements and relicensing agreements addressing TDG generation. A combination of operational and/or structural modifications have been implemented at each of these dams to increase juvenile salmon survival during outmigration while avoiding or minimizing adverse water quality impacts.

In addition to water quality concerns in the CHU, water quantity is highly influenced by Federal and non-Federal actions in the mainstem Upper Columbia River. As much as 6 percent to 10 percent of river flows are withdrawn from the Columbia River for federal irrigation projects. This does not include non-Federal irrigation withdrawals which are difficult to quantify. Reduced flows, especially during warmer summer months, can impact overall water temperatures and reduce the functionality of the habitat for bull trout. In the mainstem Columbia River the federal CRS storage projects release stored water to augment summer flows. Additionally, Grand Coulee Dam outflow water temperature has a temporal lag behind the warming/cooling inflow to Lake Roosevelt, observed at the U.S.-Canada border. In general, water temperatures released from Grand Coulee tend to be cooler than reservoir inflows throughout much of the spring and early summer, and warmer in late summer/fall. Because Lake Rufus Woods does not stratify and has a residence time of about 4 days, it passes on the lagged water temperatures created by Lake Roosevelt.

Thus, PBF in the Mainstem Upper Columbia River is not properly functioning.

PBF 9: Sufficiently low levels of occurrence of non-native predatory (e.g., lake trout, walleye, northern pike, smallmouth bass), interbreeding (e.g., brook trout), or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

Mainstem Upper Columbia River CHU 22

Introduced species are present throughout the Columbia River (Wydoski and Whitney 2003). Conditions in reservoir reaches typically favor non-native species, and these are prevalent in the mainstem Columbia River. Some of these species, such as brown trout, may compete with bull trout for food resources, thereby affecting bull trout survival. Many were historically stocked to provide additional recreational and sport fishing opportunities. Hybridization between brook trout and bull trout has been documented in some tributaries. Non-native predatory fish including walleye, smallmouth bass, and northern pike have entered or been introduced into the Mainstem Upper Columbia River.

Based on the numerous species of non-native species found in the Columbia River, the Service considers this PBF as not properly functioning.

11.2.1 Conservation Role of the Action Area to Mid-Columbia River Recovery Unit

The MCRU includes varying statuses of bull trout populations. Some areas within the MCRU are characterized by small, increasingly threatened bull trout populations. Other areas with intact riverine habitat, including wilderness areas and protected forestlands, support more robust bull trout populations. The Action Area is located in a portion of the MCRU, which includes 24 Core Areas, two historically occupied areas, and one RNA (the Northeastern Washington RNA). While bull trout occupying this unit fall primarily outside of the Action Area, they still use the Action Area during the year for foraging, migration, and overwintering purposes. Throughout these areas, bull trout populations are impacted by Federal and non-Federal operations on the mainstem Mid-Columbia River.

The Action Area within the MCRU, is characterized by rearing and FMO habitat for sub-adult and adult bull trout. Bull trout individuals from the three Core Areas (Methow, Entiat, and Wenatchee) use the Action Area for foraging and overwintering. In addition, the RNA provides FMO for bull trout entrained from populations outside of the Action Area and provides potential suitable habitat for spawning and rearing. While no spawning or rearing currently occurs within the RNA, this habitat may provide important habitat in the future for bull trout individuals present.

Without safe, timely and effective (adequate) fish passage facilities, dams and associated infrastructure associated with the Action Area have limited connectivity among aquatic environments and threatened bull trout and native migratory fish (e.g., salmon and steelhead) from accessing critical upstream habitat. The presence of the dams have also negatively altered flow, water quality, and temperature regimes, limiting bull trout survivability throughout their complex life history stages. Legacy and ongoing human and land management activities (e.g. irrigation diversions and grazing) have led to overall reductions in bull trout habitat complexity, thereby negatively impacting the resiliency of bull trout populations in facing future ecological threats and challenges, like the potential establishment of non-native species (e.g., bass and walleye). Additionally, entrainment of bull trout has been cited as a risk factor negatively affecting population sustainability in the MCRU.

Within the MCRU, one bull trout CHU falls within the bounds of the Action Area and, within adjacent tributaries, additional CHUs are designated. In general, these CHUs are essential for maintaining bull trout distribution patterns, providing access to FMO habitat, and ensuring connectivity (i.e., conserving critical migratory corridors). In the upstream areas of the Action Area, habitat is relatively intact apart from some developed areas with passage barriers (i.e., culverts). Due to a variety of environmental and anthropogenic factors (e.g., elevated TDG levels and water temperature, encroachment, lack of adequate and appropriately-sized fish passage facilities, and habitat fragmentation) resulting from dam presence within the Action Area, bull trout critical habitat in the MCRU is generally considered either "at risk" or not functional.

11.3 Consulted on Effects for Bull Trout and Designated Critical Habitat

Consulted-on effects represent the effects of proposed Federal actions on listed species and designated critical habitat that have been the subject of past Opinions. Consideration of consulted-on effects is an important component of objectively characterizing the environmental baseline for the species or critical habitat at the range-wide and Action Area scales.

The consulted-on effects from federal activities within the Action Area ranged from beneficial or improved conditions, to insignificant or discountable effects, and to adverse effects resulting in injury, mortality or loss of habitat function at the individual, population, and Core Area scales. Numerous consultations completed across the region included bank stabilizing that in many cases resulted in loss or degraded riparian conditions within the Action Area.

Most formal consultations for bull trout included an analysis of critical habitat, and types of activities considered would be similar. Critical habitat was designated on the mainstem Columbia and Snake Rivers in 2010, and critical habitat would have been considered for federal actions in those locations after that date.

The duration of effects can be a single event (one day or week), a year or multiple years, and in perpetuity. Life histories affected include adult holding pre-spawning, fertilization to emergence, emergence to juvenile out migration, juvenile out migration, adult migration to spawning areas, and sub adult FMO, and adult FMO. The effects associated with all but a few of these projects sampled will be fully part of the baseline by 2024.

11.3.1 <u>Columbia Basin Project</u>

Grand Coulee Dam is the primary storage and diversion structure for the CBP. Irrigation diversions are pumped from Lake Roosevelt to Banks Lake via the John W. Keys III Pump/Generating Plant (JWKIII). Operations for the CBP irrigation diversions are coordinated with other authorized project purposes in a complex operational regime.

The irrigation season extends from about mid-March to November 1. The CBP diverts up to 3.4 maf annually, which includes 30,000 ac-ft diverted through JWKIII for the Lake Roosevelt Incremental Storage Releases Project. This total of 3.4 maf also includes other irrigation diversions for the CBP that are already part of the environmental baseline; these include 164,000 ac-ft covered by the Odessa Subarea Special Study 2012 final EIS and corresponding Section 7 ESA consultation (letter of concurrence for that project (October 12, 2012; Reference number 01EWFW00-2013-I-0004). These diversions occur at the JWKIII. Reclamation is currently in the early stages of a formal consultation with the Service on the operation and maintenance of the CBP.

11.3.1.1 Chief Joseph Dam (Pumping Project)

The Chief Joseph Dam Project occupies lands along the Columbia and Okanogan Rivers in north-central Washington and is not part of Chief Joseph Dam, which the Corps operates (Corps et al. 2020a Appx C p.9). There are four diversions and a total of seven units, five of which result in depletions to the Columbia River. All of the units are separate land areas with independent irrigation systems. The project serves about 16,760 irrigable ac. Facility operation is generally limited to the irrigation season, which begins about mid-April to mid-May and ends between mid-September to October 1. The average annual depletions for the Chief Joseph Dam Project add up to about 37,150 ac-ft. The depletion compared to the total flow at Priest Rapids Dam varies from 0.01 percent (October; 5 cfs) to 0.12 percent (July; 180 cfs) of the flow at Priest Rapids (Corps et al. 2020a Appx C Table C-2 and C-4).

11.3.1.2 Okanogan Project

Reclamation is currently conducting a separate consultation of the Okanogan Project. That consultation will include all impacts from the operation of the Okanogan Project, including Okanogan River flow depletions and their effects on Columbia River flows. Because the flow depletions of the Okanogan and Columbia Rivers from the Okanogan Project are small, these impacts are anticipated to be extremely small or unmeasurable in the Columbia River. For that reason, Reclamation's Columbia River flow effects from future operation of the Okanogan Project have been removed from this consultation.

11.3.1.3 Hatcheries

Implementation of the Proposed Action will not alter the federal agencies obligations under the court-approved management agreements or other court orders entered in *United States v. Oregon*, 68-cv-513-MO (D. OR) or other mitigation or production agreements such as Habitat Conservation Plans or Relicensing Agreements. Some facilities identified as potential sources of surplus adults, eggs and/or rearing capacity include the Entiat National Fish Hatchery, Chelan Falls Hatchery, Rocky Reach Juvenile Fish Bypass, Priest Rapids Hatchery, Ringold Springs Hatchery, Wells Dam Hatchery, Tumwater Dam, and the Wenatchee River Program. These facilities relate to the Proposed Action because they will all be potential sources of fish, eggs or rearing space for Project Proponents to release in the blocked area.

11.3.1.3.1 Chief Joseph Hatchery

In 2006, the Confederated Tribes of the Colville Reservation, BPA, and the Corps submitted a Biological Assessment on the construction and operation of Chief Joseph Hatchery with the Service. The Service issued a concurrence letter agreeing with the action agencies' determinations that the action "may affect but is not likely to adversely affect" bull trout. The Service's concurrence included several recommendations for developing a better understanding of bull trout use in the Columbia and Okanogan Rivers.

Pursuant to the P2IP Agreement, a portion of the Chief Joseph Hatchery juvenile summer Chinook production may be used annually to support the P2IP studies (see P2IP Agreement § IV.7.a.iv).

11.3.1.3.2 Entiat National Fish Hatchery

In 2017, the Service issued an intra-Service Biological Opinion (reference: 01EWFW00-2015-F-0324) on the ongoing operation and maintenance of the Entiat National Fish Hatchery (NFH). The Service's Fisheries and Aquatic Conservation Division, which operates and maintains the hatchery, served as the Action Agency for the consultation. The consultation addressed hatchery infrastructure and water supply systems, adult salmon returns, and releases of salmon smolts. The Entiat NFH is located in the Entiat River watershed, which contains bull trout SR and FMO habitat. In the Biological Opinion, the Service determined that continued operation and maintenance of the Entiat NFH will adversely affect individual bull trout from the Entiat Core Area, although those adverse effects were expected to be sub-lethal (harm and harassment from handling and displacement). The Service also concluded that continued operation and maintenance of the Entiat NFH was not likely to jeopardize the continued existence of the coterminous U.S. population of bull trout, and "may affect but is not likely to affect" designated bull trout critical habitat. In the Biological Opinion the Service also included Reasonable and Prudent Measures and Terms and Conditions designed to minimize incidental take caused by handling bull trout, and reduce uncertainty associated with adverse ecological interactions associated with returns of adult salmon.

11.3.1.4 Tributary Habitat Improvement and Restoration Programs

Various federal agencies (e.g., BPA, the Bureau, USFS) conduct and fund tributary habitat improvements throughout the Columbia River Basin. The federal agencies have completed consultation with the Service on the impacts and benefits of tributary habitat improvement and restoration actions occurring within bull trout habitat. For example, the Habitat Improvement Programmatic Consultation (USFWS reference: 01EOFW00-19FY-F-0710) has been renewed several times. In these consultations, the Service has authorized take of bull trout from handling, capture, and other behavioral effects as a result of restoration projects. The intent of the action is to improve habitat conditions for aquatic species.

Both the USFS and Corps have developed programmatic consultations with the Service for habitat restoration activities occurring within their jurisdiction. As with the Habitat Improvement Programmatic consultation, the Service has authorized take of bull trout during activities to improve aquatic habitat. The USFS also implements, and consults with the Service on, various forest management activities.

11.3.1.5 Columbia River Systems Operations and Maintenance

In July 2020, the Service issued a final Biological Opinion to the Corps, BPA, and the Bureau on the operations and maintenance of 14 federal dams and reservoirs in the Columbia River Basin (reference: 01EWFW00-2017-F-1650). The Opinion addressed effects to bull trout and bull trout critical habitat (among other species and their designated critical habitats) and reached a "likely to adversely affect" determination for bull trout and designated bull trout critical habitat. The Opinion addressed Columbia River Systems Operations and Maintenance (CRS) for 15 years (2020-2035) and included Reasonable and Prudent Measures and Terms and Conditions designed to minimize the impact of passage barriers and entrainment caused by CRS operations on bull trout, and minimize and monitor take of bull trout from research and monitoring activities. In July 2024, the Action Agencies reinitiated consultation with the Service to address the listing of the North American wolverine as threatened. That consultation is ongoing.

11.3.1.6 FERC Consultations

Within and adjacent to the Action Area are non-federal dams that require licenses from the Federal Energy Regulatory Commission (FERC), the largest of which is Wells Dam (a 774.3-megawatt facility). In 2012, the Service issued a Biological Opinion on the relicensing of Wells Dam (reference: 13410-2011-F-0090) for the ensuing 30-50 years. Public Utility District No. 1 of Douglas County (Douglas PUD) owns and operates the project and served as the designated non-federal representative for the purposes of the consultation. No changes to Wells Dam operations were proposed in the consultation, and the Douglas PUD included new resource management plans and settlements. Specifically, the Douglas PUD proposed to include measures contained in the Wells AFA/HCP, the Aquatic Settlement Agreement (White Sturgeon, Pacific Lamprey, Bull Trout, Resident Fish, Water Quality and Aquatic Nuisance Species management plans), the Wildlife and Botanical Management Plan, Avian Protection Plan, Historic Properties Management Plan, Recreation Management Plan, and Douglas PUD's Land Use Policy.

11.4 Climate Change

Consistent with Service policy, our analyses under the ESA include consideration of ongoing and projected changes in climate. The term "climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2014a, pp. 119-120). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2014a, p. 119). Various types of changes in climate can have direct or indirect effects on species and critical habitats. These effects may be positive, neutral, or negative, and they may change over time. The nature of the effect depends on the species' life history, the magnitude and speed of climate change, and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2014b, pp. 64, 67-69, 94, 299). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change and its effects on species and their critical habitats. We focus in particular on how climate change affects the capability of species to successfully complete their life cycles, and the capability of critical habitats to support that outcome.

11.4.1 Climate Change and the Columbia River Basin

Climate change research for the larger Northern Rockies area predicts warmer springs, earlier snowmelt, and hotter, drier summers with longer fire seasons (Isaak et al 2015 p. 2540). In the Pacific Northwest, most models project warmer air temperatures, increases in winter precipitation, and decreases in summer precipitation (ISAB 2007 p. iii). Warmer temperatures will lead to more precipitation falling as rain rather than snow. As the seasonal amount of snow pack diminishes, the timing and volume of stream flow are likely to change, and peak river flows are likely to increase in affected areas. Higher air temperatures are also likely to increase water temperatures (ISAB 2007 p. 16).

Over the last century, average annual temperatures in the US have increased about 2 °F (0.2 °F per decade) over the last 50 years (USDA 2010 p. 3; Bonneville et al. 2017 p.92). Winter temperatures have increased more than other seasons, and the daily minimum temperatures, typically occurring at night, have increased more than daily maximums. Models indicate that temperature increases would occur during all seasons, with the greatest increases projected in summer. Precipitation predictions are considered less certain, but most models project decreased summer precipitation and increased winter precipitation.

The variation in precipitation and temperature patterns from one year to the next, combined with the geographic complexity of the Basin, result in highly variable Columbia River flows from year to year (Bonneville et al. 2017 p.19). The Columbia River has an annual average runoff of approximately 200 maf per year, with roughly 25 percent of that volume originating in the Canadian portion of the Basin (Reclamation 2016; Bonneville et al. 2017 p.92).

11.4.2 Climate Change and Bull Trout

Climate change affects the habitat needs of bull trout through impacts to seasonal water quality, riparian quality, and habitat quantity which in turn affect the essential spawning and rearing and FMO habitats. All the demographic needs of bull trout are intricately connected to and can be affected by these habitat impacts. Specific climate-related effects on the current condition of bull trout include declines in snowpack and snow water equivalent which affect stream flow and timing, as well as quality (e.g., temperature) to which bull trout are particularly vulnerable. All life stages of the bull trout rely on cold water. Increasing air temperatures are likely to impact the availability of suitable cold-water habitat (Isaak et al 2015 p. 2540; Dunham 2015). For example, ground water temperature is generally correlated with mean annual air temperature and has been shown to strongly influence the distribution of many trout species (Rieman et al 2007 p.1557). Ground water temperature is linked to bull trout selection of spawning sites and has been shown to influence the survival of embryos and early juvenile rearing of bull trout (Rieman et al. 2007 p. 1553). Increases in air temperature are likely to be reflected in increases in both surface water and groundwater temperatures.

Bull trout require very cold (<10 °C) water for spawning and incubation (Dunham 2015). Suitable spawning habitat is often found in accessible higher elevation tributaries and headwaters of rivers. However, impacts on hydrology associated with climate change are related to shifts in timing, magnitude and distribution of peak flows that are also likely to be most pronounced in these high elevation stream Basins (Battin et al. 2007 p. 6720). The increased magnitude of winter peak flows in high elevation areas is likely to impact the location, timing, and success of spawning and incubation for the bull trout and Pacific salmon species as well as juvenile survival. Additionally, increases in air and water temperatures may drive cold-dependent species like bull trout to higher elevations with more limited access and connectivity. Low elevation river reaches are unlikely to provide suitably cold temperatures for bull trout spawning, incubation, and juvenile rearing under current temperatures. Therefore, the general impact of temperature and hydrologic changes may not be as extreme, or range constrictions as pronounced as what may occur in higher elevation streams. As climate change progresses and stream temperatures warm, thermal refugia will be critical to the persistence of many bull trout populations.

Future climate models for the Pacific Northwest project warmer air temperatures, with increases in winter precipitation, decreases in summer precipitation, and precipitation more likely to fall as rain rather than snow (ISAB 2007). Projected changes in climate may be expected to result in several impacts to bull trout and habitat including contraction of the range of bull trout; variable or elevated stream temperatures that reduce survival and reproduction; altered ground water exchange that limits egg development; and changed geomorphology that reduces presence or quality of spawning habitat USFWS 2015a). In addition, increased or variable flows from extreme precipitation events, rain on snow and longer dry periods may increase scouring of spawning areas, reduce juvenile rearing capacity of habitat, and inhibit movements during summer low flow conditions (USFWS 2015a). Increased frequency and extended periods of wildfires may result in loss and fragmentation of habitat (USFWS 2015a).

There is still a great deal of uncertainty associated with predictions relative to the timing, location, and magnitude of future climate change. It is also likely that the intensity of effects will vary by region (ISAB 2007). For example, several studies indicate that climate change has the potential to impact ecosystems in nearly all streams throughout the State of Washington (ISAB 2007; Isaak et al 2015; Battin et al. 2007; Rieman et al. 2007). In streams and rivers with temperatures approaching or at the upper tolerance limits for bull trout, such as occurs in the Walla Walla, Yakima, Umatilla and Snake Rivers, there is little if any likelihood, that bull trout will be able to adapt to or avoid the effects of climate change/warming without connectivity to cooler waters. As bull trout distribution contracts, patch size (contiguous catchment area of suitable spawning/rearing habitat) decreases and connectivity is truncated. Bull trout populations that may be currently connected will likely face increasing isolation (Dunham 2015; Rieman et al. 2007 p. 1553). Due to variations in landform and geographic location across the range of the bull trout, it appears that some populations face higher risks than others. Bull trout in areas with currently elevated water temperatures and/or at the southern edge of its range may already be at risk of adverse impacts from current as well as future climate change.

In the 2024 Species Status Assessment for Bull Trout (USFWS 2024b), the Service examined the effects climate change may have on the future condition of bull trout, and concluded that although climate variance is increasing (i.e., extreme events occurring more frequently, for longer durations, and at greater intensities/magnitudes), accounting for the unpredictable nature of these events both spatially and temporally made it difficult to project their impact consistently across the range in all scenarios and was beyond the scope of the Service's analysis of future condition.

11.5 Summary of Baseline Conditions

In 1999, the Service listed all populations of bull trout in the coterminous U.S. as threatened under the ESA under one single DPS. Though wide ranging in parts of Oregon, Washington, Idaho, and Montana, bull trout in the Columbia River Basin presently occur in only about 45 percent of the historical range (USFWS 2015a). As the Service developed the Recovery Plan, bull trout populations were further refined into six Recovery Units across the listed entity and 109 Core Areas, six Historic Areas, and one RNA (USFWS 2015a). The Action Area for the Proposed Action overlays with one of the six Recovery Units and interacts to some extent with bull trout from three Core Areas and one RNA.

Across the Action Area, declining trends due to the combined effects of habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, entrainment into diversion channels and dams, and introduced non-native species (e.g., brook trout) have reduced resiliency in the Mid-Columbia Recovery Unit (USFWS 2024). In the Mid-Columbia Recovery Unit, the main threat facing the stability and long-term viability of bull trout is diminishing connectivity between Core Areas and local populations. The impacts from lost connectivity have historically changed the fish population structure within the Action Area.

Within the Action Area, bull trout presence consists of no spawning and rearing areas. However, individuals frequently use the action area for foraging, overwintering, and migration between populations.

The Action Area's large geographic extent makes it critically important to bull trout by providing foraging and overwintering habitat needed for the continued persistence and recovery of bull trout in the Mid-Columbia Recovery Unit.

11.5.1 Bull Trout Critical Habitat

As with the listed entity of bull trout, designated critical habitat in the Action Area overlays one of 32 CHUs. The majority of the Action Area occurs within important FMO habitat for bull trout. In the one CHU in the Action Area, PBFs are degraded or not properly functioning due to impacts to migratory corridors, natural hydrographs, water quality and temperature, and introduced species.

12 EFFECTS OF THE ACTION

The effects of the action are all consequences to listed species or critical habitat that are caused by the Proposed Action, including the consequences of other activities that are caused by the Proposed Action but that are not part of the action. A consequence is caused by the Proposed Action if it would not occur but for the Proposed Action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02).

12.1 Effects to Bull Trout

In this section, we examine the response of bull trout to the various stressors and determine the effects these may have on individual bull trout, local populations, the Core Area, and ultimately the Recovery Unit. First, we examine bull trout exposure to the stressors. Then we assess the consequences of the actions, while acknowledging and isolating the consequences of non-discretionary actions, baseline and outside influences, where possible. In some cases, the consequences may result in beneficial impacts or insignificant and/or discountable effects. The majority of the discussion will revolve around the expected and foreseeable adverse effects of the action.

12.1.1 Exposure Analysis

Bull trout are found throughout the Action Area and represent individuals from as many as three Core Areas and one Research Needs Area within one of six recovery units. In most portions of the Action Area, bull trout adults and sub-adults are overwintering, or during any time of the year, can be found foraging and migrating. Spawning and juvenile rearing areas are located outside of the Action Area and unlikely to be affected by the Proposed Action. Across the Action Area, specific numbers of bull trout are difficult to quantify, and the use of the entire Action Area by bull trout is not fully understood. For example, the Service considers the reservoir areas above Grand Coulee and Chief Joseph dams, as a research needs area for bull trout where observations are rare and, in most cases, the source populations of individuals observed are unknown. In contrast, downstream of Chief Joseph Dam in the mainstem Columbia River, bull trout use is well documented and occurs year-round. Given the rarity of individuals, and based on past observations from similar activities, the Service expects fewer than 10 individuals will experience effects of the action in any given year. The following sections describe the exposure risk for bull trout within each Recovery Unit in the Action Area.

12.1.2 Categories of Effects

Effects to bull trout from implementation of individual projects within the Proposed Action fall into the following general categories: introduction of sediment; general construction noise; increases in diseases/pathogens; increased competition; degradation of water quality; and direct handling.

12.1.2.1 Introduction of Sediment

Implementation of the following projects within the Proposed Action is expected to cause temporary increases in sediment and turbidity in the vicinity of each project: 1) installation of telemetry/tracking receivers; 2) construction of acclimation facilities (including net pens); 3) placement and retrieval of fyke nets; 4) seining; 5) placement of screw traps; 6) installation and operation of tributary streamside incubation boxes; 7) construction of upstream and downstream interim passage facilities; and 8) spawning ground surveys (on foot).

Installation of Telemetry/Tracking Receivers

As described in the Proposed Action section of this Opinion, installation of telemetry and tracking receivers in the Action Area will occur at various locations in Lake Roosevelt, the mainstem Columbia River, the Spokane River, Lake Rufus Woods, the Little Spokane River, the Sanpoil River, Hangman Creek, Banks Canal, and other sites in the blocked area as needed. The receivers fall into three general categories: 1) anchored submersible, 2) shore-based, and 3) track and trolly shore-based. Installation of receivers at forebay log booms is not expected to generate increases in sediment or turbidity, as they will be installed at existing forebay log booms and will not include placement of anchors or weights on the lake/river bottom.

Installation of anchored submersible receivers is likely to cause temporary increases in suspended sediment and turbidity in the immediate area of the 300-pound concrete anchor as it makes initial contact with the river/lake bottom.

Installation of shore-based receivers will involve mounting of solar panels to existing structures above the high-water mark, installation of housing boxes above the high-water mark, running wire from housing boxes to hydrophones (includes running wire underwater), and underwater placement of hydrophones that are attached to 50-pound steel mounting plates (that also act as anchors). At locations where existing structures are not available, antennae will be mounted to T-posts that are pounded into the ground via T-post pounders. Placement of the 50-pound steel plates into the water is likely to cause temporary increases in suspended sediment and turbidity in the immediate area of the plates. The other activities involved in shore-based receiver installation are not expected to cause increases in suspended sediment and turbidity.

Track and trolley shore-based receivers will be installed at existing dams or other existing structures (e.g., bridge pilings). Tracks for the trolleys will be bolted to the concrete of the existing structures, wiring between the job boxes and hydrophones will be installed (includes running wire underwater), and hydrophones will be attached to either the track and trolly, or to a 50-pound weight placed on the river/lake bottom. Placement of the 50-pound steel plates into the water is likely to cause temporary increases in suspended sediment and turbidity in the immediate area of the plates. The other activities involved in track and trolley shore-based receiver installation are not expected to cause increases in suspended sediment and turbidity.

In sum, installation of telemetry/tracking receivers is expected to cause temporary increases in suspended sediment and turbidity, specifically in the immediate vicinity of the anchors and/or steel plates as they are placed. However, because the sediment and turbidity increases will only occur when the plates are first installed and given their small size relative to the surrounding aquatic environments, any sediment and turbidity that is produced is likely to quickly dissipate and/or resettle to the river/lake bottom. Therefore, the Service expects that sediment/turbidity effects to bull trout and designated bull trout critical habitat from installation of telemetry and tracking receivers will be insignificant.

Construction of Acclimation Facilities

Implementation of the Proposed Action will require construction of multiple rearing and acclimation facilities, i.e., net pens and land-based facilities, as well as expansion and/or upgrades to existing rearing facilities. New facilities are proposed to be constructed and installed in the Little Spokane River (Glen Tana), the Sanpoil arm of Lake Roosevelt, the Sanpoil River at Louie Creek, the upper Sanpoil River, and Hangman Creek (sqweyu'). Some existing facilities will require expansions or upgrades as needed.

In the Sanpoil Arm of Lake Roosevelt (approximately six miles south of Keller, WA), up to four new net pens will be constructed. For a full description of how the net pens will be constructed and installed, see Section 6 (Proposed Action). Installation of new net pens and expansion of existing net pens will include placement of 400-800-pound concrete anchor blocks on the lake bottom, and where feasible, placement of a drag anchor. Placement of the blocks and anchors is expected to cause temporary increases in suspended sediment and turbidity, specifically in the immediate vicinity of the blocks and anchors as they are placed. However, because the sediment and turbidity increases will only occur when the blocks and anchors are first installed and given their small size relative to the surrounding aquatic environments, any sediment and turbidity that is produced is likely to quickly dissipate and/or resettle to the river/lake bottom. Therefore, the Service expects that sediment/turbidity effects to bull trout from installation and expansion of net pens will be insignificant. Given that installation and expansion of net pens will occur outside of designated bull trout critical habitat, no effects to bull trout critical habitat from those activities are anticipated.

Implementation of the Proposed Action includes the siting, design, construction, and operation of new land-based acclimation facilities for juvenile salmon at Louie Creek (adjacent to the Sanpoil River), sqweyu' (adjacent to Hangman Creek), the Upper Sanpoil River, and Glen Tana (adjacent to the Little Spokane River). However, at the time of this consultation details regarding specific designs, construction methods, operation, and other key aspects of the new land-based acclimation facilities have not been established. Therefore, as details are developed for construction and operation of specific acclimation facilities, the Action Agencies will consult with the Service as per the Programmatic Agreement described in Section 2.

Placement and Retrieval of Fyke Nets

Implementation of the Proposed Action includes deployment and retrieval (to collect trapped fish) of fyke nets in near-shore lake environments, which is expected to cause temporary increases in suspended sediment and turbidity, specifically in the immediate vicinity of the nets as they are placed and retrieved. However, because the sediment and turbidity increases will only occur when the nets are placed and retrieved and given their small size relative to the surrounding aquatic environments, any sediment and turbidity that is produced is likely to quickly dissipate and/or resettle to the lake bottom. Therefore, the Service expects that sediment/turbidity effects to bull trout and designated bull trout critical habitat from placement and retrieval of fyke nets will be insignificant.

Seining

Implementation of the Proposed Action includes the use of near-shore seines to collect juvenile salmon. Deployment and retrieval of the seines is expected to cause temporary increases in suspended sediment and turbidity, specifically in the immediate vicinity of the seines as they are deployed and retrieved. However, because the sediment and turbidity increases will only occur when the seines are deployed and retrieved and given their small size relative to the surrounding aquatic environments, any sediment and turbidity that is produced is likely to quickly dissipate and/or resettle to the river/lake bottom. Therefore, the Service expects that sediment/turbidity effects to bull trout and designated bull trout critical habitat from deployment and retrieval of near-shore seines will be insignificant.

Placement of Screw Traps

Rotary screw traps will be deployed in Hangman Creek, the Kettle River, the Little Spokane River, the Okanogan River, and various tributaries of Lake Roosevelt. Unassembled trap parts will be hauled to the nearest boat ramp where they will be assembled in the water. The assembled trap will then be towed by boat to the operating location, where they will be anchored in place. Anchoring the traps to the stream/river bottom is expected to cause temporary increases suspended sediment and turbidity, specifically in the vicinity of the traps. However, because the installation of the traps will be a short-term, ephemeral activity any resulting increases in sediment and turbidity are likely to quickly dissipate and/or resettle to the stream/river bottom. Therefore, the Service expects that sediment/turbidity effects to bull trout from installation and operation of rotary screw traps in Hangman Creek, the Kettle River, the Little Spokane River, the Okanogan River, and tributaries to Lake Roosevelt will be insignificant. Given that rotary screw traps will be deployed outside of designated bull trout critical habitat, no effects to bull trout critical habitat from those activities are anticipated.

Installation and Operation of Tributary Streamside Incubation Boxes

Implementation of the Proposed Action includes the installation and operation of streamside incubation boxes in the Sanpoil, Spokane, and Little Spokane Rivers. The incubation boxes will use small, screened pumps to deliver water to fertilized salmon eggs inside the incubation boxes that will be placed in gravels along the river margins. Placement of the incubation boxes and pumps, as well as operation of the pumps, are expected to cause temporary increases in suspended sediment and turbidity, specifically in the immediate vicinity of the boxes and pumps. However, due to the small size of the boxes and pumps relative to the surrounding aquatic environments, and given that this activity will not involve ground disturbance or consumptive water use, sediment and turbidity that is produced is likely to quickly dissipate and/or resettle to the river bottom. Therefore, the Service expects that sediment/turbidity effects to bull trout from installation and operation of streamside incubation boxes in the Sanpoil, Spokane, and Little Spokane Rivers will be insignificant. Given that streamside incubation boxes will be placed outside of designated bull trout critical habitat, no effects to bull trout critical habitat from those activities are anticipated.

Construction of Upstream and Downstream Interim Passage Facilities

The Proposed Action includes construction of new, future upstream and downstream interim fish passage facilities at various locations in the Columbia River Basin. However, the details associated with construction of those facilities are largely dependent on the nature of the designs that are also currently unknown. Therefore, as details are developed for construction and operation of specific interim fish passage facilities, the Action Agencies will consult with the Service as per the Programmatic Agreement described in Section 2.

<u>Spawning Ground Surveys</u>

Implementation of the Proposed Action includes conducting spawning ground surveys for adult salmon in the blocked area (i.e., shallow rivers and streams, such as the Sanpoil River, and in tributaries of the Columbia and Spokane Rivers) via traditional spawning ground surveys on foot. Researchers will hike upstream in the designated watershed and record all salmon spawning locations. As researchers wade through the shallow rivers, streams, and tributaries, they will cause temporary increases in suspended sediment and turbidity. However, due to the small size of the area each researcher will impact relative to the surrounding aquatic environments, any sediment and turbidity that is produced is likely to quickly dissipate and/or resettle to the river/stream bottom. Therefore, the Service expects that sediment/turbidity effects to bull trout and designated bull trout critical habitat from on-foot spawning ground surveys will be insignificant.

12.1.2.2 General Construction Noise

Implementation of the following projects within the Proposed Action will result in general construction noise in the vicinity of each project: 1) installation of telemetry/tracking receivers; 2) construction of acclimation facilities (including net pens); and 3) construction of upstream and downstream interim passage facilities.

<u>Installation of Telemetry/Tracking Receivers</u>

Installation of telemetry and tracking receivers at various locations in the Action Area is expected to generate elevated levels of general construction noise in habitats where bull trout may be present, via placement of anchors and steel plates, attachment of cables to buoys, pounding of T-posts, attachment of solar panels and job boxes, and installation of antennae. However, any bull trout that would be disturbed by construction noise from those activities to the point of being caused to flee would be leaving poor-quality habitats (e.g., dam forebays) and/or would have ample adjacent areas to swim to. Therefore, the Service expects that general construction noise effects to bull trout from installation of telemetry/tracking receivers will be insignificant. No general construction noise effects to designated bull trout critical habitat from installation of telemetry/tracking receivers is anticipated.

<u>Placement of Screw Traps</u>

Rotary screw traps will be deployed in Hangman Creek, the Kettle River, the Little Spokane River, the Okanogan River, and various tributaries of Lake Roosevelt. Unassembled trap parts will be hauled to the nearest boat ramp where they will be assembled in the water. The assembled trap will then be towed by boat to the operating location, where they will be anchored in place. These activities are expected to generate elevated levels of general construction noise in habitats where bull trout may be present. However, because the installation of the traps will be a short-term, ephemeral activity any resulting disturbance to bull trout from general construction noise is expected to be similarly temporary. Therefore, the Service expects that general construction noise effects to bull trout from installation of rotary screw traps in Hangman Creek, the Kettle River, the Little Spokane River, the Okanogan River, and tributaries to Lake Roosevelt will be insignificant. Given that rotary screw traps will be deployed outside of designated bull trout critical habitat, no effects to bull trout critical habitat from those activities are anticipated.

Construction of Acclimation Facilities

Implementation of the Proposed Action will require construction of multiple rearing and acclimation facilities, i.e., net pens and land-based facilities, as well as expansion and/or upgrades to existing rearing facilities. New facilities will be constructed and installed in the Little Spokane River (Glen Tana), the Sanpoil arm of Lake Roosevelt, the Sanpoil River at Louie Creek, the upper Sanpoil River, and Hangman Creek. Some existing facilities will require upgrades as needed.

In the Sanpoil Arm of Lake Roosevelt (approximately six miles south of Keller, WA), up to four new net pens (20 square feet each) will be constructed. For a full description of how the net pens will be constructed and installed, see Section 6 (Proposed Action). New net pens will be constructed and installed in the Sanpoil Arm of Lake Roosevelt and the Spokane River Reservoir. Two new additional net pens may also be added to the Pacific Aquaculture Net Pen Program currently operating in Rufus Woods Reservoir. Construction of the net pens will involve securing the frames (assembled in the water at the boat launch site) to 6-foot-by 46-foot docks, towing the frames and docks to the deployment site via boat, dropping the anchors to the lake/river bottom, tying the docks to buoys, and attaching the docks to existing concrete structures or ecology blocks (on land) when concrete anchors aren't feasible. These activities associated with installation of new net pens and expansion of existing net pens are likely to generate elevated levels of general construction noise in habitats where bull trout may be present. However, any bull trout that would be disturbed by construction noise from those activities to the point of being caused to flee would be leaving poor-quality habitats (e.g., slack-water reservoirs) and/or would have ample adjacent areas to swim to. Therefore, the Service expects that general construction noise effects to bull trout from installation of new net pens and expansion of existing net pens will be insignificant. No general construction noise effects to designated bull trout critical habitat from installation of new net pens and expansion of existing net pens is anticipated.

Implementation of the Proposed Action includes the siting, design, construction, and operation of new land-based acclimation facilities for juvenile salmon at Louie Creek (adjacent to the Sanpoil River), sqweyu' (adjacent to Hangman Creek), the Upper Sanpoil River, and Glen Tana (adjacent to the Little Spokane River). However, at the time of this consultation details regarding specific designs, construction methods, operation, and other key aspects of the new land-based acclimation facilities have not been established. In general, the sites for the new facilities will likely require resource-specific surveys, and ground disturbing activities (e.g., boreholes, trenches, ground water drilling and testing). Construction activities will likely include demolition of existing dilapidated structures, site preparation, water system construction, circular tank installation, and electrical power supply development. Therefore, as details are developed for construction of specific acclimation facilities, the Action Agencies will informally consult with the Service as per the Programmatic Agreement described in Section 2.

Construction of Upstream and Downstream Passage Facilities

The Proposed Action includes construction of future upstream and downstream interim fish passage facilities at various locations in the Columbia River Basin. However, the details associated with construction of those facilities are largely dependent on the nature of the designs that are also currently unknown. Therefore, as details are developed for construction of specific passage facilities, the Action Agencies will informally consult with the Service as per the Programmatic Agreement described in Section 2.

12.1.2.3 Increases in Diseases and/or Pathogens

Net Pens and Rearing Facilities

Implementation of the Proposed Action includes construction of multiple rearing and acclimation facilities, i.e., net pens and land-based facilities, as well as expansion and/or upgrades to existing rearing facilities. New facilities will be constructed and installed in the Little Spokane River (Glen Tana), the Sanpoil arm of Lake Roosevelt, the Sanpoil River at Louie Creek, the upper Sanpoil River, and Hangman Creek. New net pens will be constructed and installed in the Sanpoil Arm of Lake Roosevelt and the Spokane River Reservoir. Two new additional net pens may also be added to the Pacific Aquaculture Net Pen Program currently operating in Rufus Woods Reservoir.

The addition of new net pens and rearing facilities, as well as the expansion of existing net pens and rearing facilities will involve introducing, holding, and rearing significant numbers of juvenile salmon and salmon eggs into the blocked areas, which is likely to increase the prevalence of disease and pathogens in habitats where bull trout are likely to be present. However, the Proposed Action includes multiple environmental protection measures (EPMs) specifically designed to reduce the risk of increasing levels of disease or pathogens, and the risk of introducing new diseases or pathogens, including: 1) implementation of the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State and Pacific Northwest Fish Health Protection Committee (PNFHPC 2007) guidelines, and 2) regular inspection of fish in net pens and rearing facilities for signs of infection. Further, bull trout exist in very low densities at the locations identified for new and expanded net pens and rearing facilities (USFWS *unpublished data*). For these reasons, the Service expects disease and pathogen effects to bull trout from the operation of net pens and rearing facilities (both new and expanded) will be insignificant. Disease and pathogen effects to designated bull trout critical habitat from the operation of net pens and rearing facilities are not expected to occur, as the locations identified for new and expanded net pens and rearing facilities are not within designated bull trout critical habitat.

Salmon Releases

Under the Proposed Action, up to 250,000 juvenile chinook and 250,000 juvenile sockeye salmon will be released annually into the blocked area, and up to 15,000 adult Chinook salmon and 15,000 adult sockeye (from downstream of Chief Joseph Dam and hatcheries with surplus salmon) will be released annually into the blocked area. The annual release of up to 500,000 juvenile salmon and up to 30,000 adult salmon into the blocked area is likely to increase the prevalence of disease and pathogens in habitats where bull trout are likely to be present. However, the Proposed Action includes EPMs that are specifically designed to reduce the risk of increasing levels of disease or pathogens, and the risk of introducing new diseases or pathogens, including: 1) implementation of the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State and Pacific Northwest Fish Health Protection Committee (PNFHPC 2007) guidelines, and 2) sampling juvenile salmon for disease and pathogens at each release site, prior to release, by a Washington Department of Fish and Wildlife fish health specialist. For these reasons, the Service expects disease and pathogen effects to bull trout from release of adult and juvenile salmon will be insignificant. Disease and pathogen effects to designated bull trout critical habitat from the operation of net pens and rearing facilities will be addressed later in this Opinion.

12.1.2.4 Increased Competition

Under the Proposed Action, up to 250,000 juvenile chinook and 250,000 juvenile sockeye salmon will be released annually into the blocked area (note: given that adult salmon typically do not eat while on spawning runs and don't spawn in bull trout spawning habitats, adult salmon are not anticipated to compete with bull trout). The annual release of up to 500,000 juvenile salmon into the blocked area is likely to increase competition with bull trout for food, habitat, and other resources in habitats where bull trout are present. Data from Phase 1 of the salmon reintroduction study showed competition between resident species such as bull trout and reintroduced salmonids is more likely to occur in tributary habitats, whereas competition for food is more likely to occur in reservoir habitats (UCUT 2019).

Juvenile salmon released into tributary habitats where bull trout are present are likely to compete with bull trout for habitat, food, and other resources. However, bull trout exist in low densities in the sites planned for juvenile salmon releases (includes Kettle Falls, Lower Hangman Creek, Nine Mile Dam forebay and tailrace, Little Spokane River, Sanpoil River, Grand Coulee Dam forebay and tailrace, Long Lake Dam forebay and tailrace, Little Falls Dam forebay and tailrace, Keller Ferry (Lake Roosevelt), Rufus Woods Reservoir, and Chief Joseph Dam forebay and tailrace). Further, in some locations (e.g., reservoirs and the mainstem Columbia River) juvenile salmon are likely to add to the prey base for adult bull trout, and the release of adult salmon into the blocked areas is likely to inject vital nutrients into the Columbia River ecosystem and increase overall biological productivity. For these reasons, the Service expects competition effect to bull trout from release of juvenile salmon will be insignificant. Competition effects to designated bull trout critical habitat from the operation of net pens and rearing facilities are also expected to be insignificant.

12.1.2.5 Degradation of Water Quality

Implementation of the Proposed Action includes construction of multiple rearing and acclimation facilities, i.e., net pens and land-based facilities, as well as expansion and/or upgrades to existing rearing facilities. New facilities will be constructed and installed in the Little Spokane River (Glen Tana), the Sanpoil arm of Lake Roosevelt, the Sanpoil River at Louie Creek, the upper Sanpoil River, and Hangman Creek. New net pens will be constructed and installed in the Sanpoil Arm of Lake Roosevelt and the Spokane River Reservoir. Two new additional net pens may also be added to the Pacific Aquaculture Net Pen Program currently operating in Rufus Woods Reservoir.

The addition of new net pens and rearing facilities, as well as the expansion of existing net pens and rearing facilities will involve introducing, holding, and rearing significant numbers of juvenile salmon and salmon eggs into the blocked areas, which is likely to negatively affect temperature, pH, dissolved oxygen, dissolved nitrogen, and dissolved phosphorus. It is however, important to note the total volume of the new and expanded net pens relative to the locations they will be placed into. The new net pens that will be installed under the Proposed Action will be 20-feet wide by 20-feet long by 16-feet deep, giving a volume of 6,400 cubic feet for each new net pen. In the Sanpoil Arm of Lake Roosevelt (approximately six miles south of Keller, WA), up to four new net pens will be constructed, resulting in 25,600 total cubic feet of new net pens in Lake Roosevelt. For context, Lake Roosevelt impounds over 392 million cubic feet (11.1 billion cubic meters) of water, which means the new net pens will occupy less than one one-millionth of a percent (6.5^{-8}) of the total volume of Lake Roosevelt. Even with the assumption that the extent of effects from each net pen will be ten times the total volume of the actual net pen, the affected area would be miniscule when compared to the overall area into which they will be placed. Additionally, bull trout presence in Lake Roosevelt is very sparse and although potential suitable spawning habitat is located in several tributaries to Lake Roosevelt, no spawning has been documented in them (USFWS *unpublished data*) and net pens would not be placed in any potential spawning or rearing habitat for bull trout. For these reasons, the Service expects the effects to bull trout from the addition of new net pens, as well as the expansion of existing net pens, in Lake Roosevelt will be insignificant.

In Rufus Woods Reservoir, two new net pens (same size as those installed in Lake Roosevelt) may also be installed under the Proposed Action. Similar to the circumstances in Lake Roosevelt, the area the new net pens in Rufus Woods Reservoir will occupy and affect constitutes a miniscule percentage of the total volume of the reservoir (48 million cubic feet; 1.3 million cubic meters). Further, Chief Joseph Dam, which impounds Rufus Woods Reservoir, operates as a run-of-the-river project, which will allow regular flushing of the byproducts of the new net pens (e.g., excess food and waste) from the reservoir. Additionally, bull trout presence in Rufus Woods Reservoir is very sparse and no suitable spawning habitat is present in any tributary to the reservoir (USFWS *unpublished data*). For these reasons, the Service expects the effects to bull trout from the addition of new net pens in Rufus Woods Reservoir will be insignificant.

Implementation of the Proposed Action includes the siting, design, construction, and operation of new land-based acclimation facilities for juvenile salmon at Louie Creek (adjacent to the Sanpoil

River), sqweyu' (adjacent to Hangman Creek), the Upper Sanpoil River, and Glen Tana (adjacent to the Little Spokane River), all of which may affect water quality at each site. However, at the time of this consultation details regarding specific designs, construction methods, operation, and other key aspects of the new land-based acclimation facilities have not been established. In general, the sites for the new facilities will likely require resource-specific surveys, and ground disturbing activities (e.g., boreholes, trenches, ground water drilling and testing). Construction activities will likely include demolition of existing dilapidated structures, site preparation, water system construction, circular tank installation, and electrical power supply development. Therefore, as details are developed for construction of specific acclimation facilities, the Action Agencies will informally consult with the Service as per the Programmatic Agreement described in Section 2.

12.1.2.6 Direct Handling

Capture and direct handling of bull trout is associated with a variety of activities included in the Proposed Action, including operation of rotary screw traps, seining, use of juvenile collection facilities downstream of Chief Joseph Dam, fyke netting, hook-and-line sampling, and adult salmon trap-and-haul operations at various sites in the Action Area. Although each of these activities will be targeted towards juvenile and adult salmon, since bull trout are known to exist in the activity areas (albeit at low densities), bull trout are likely to be captured and handled as the activities are implemented.

The Proposed Action includes the following EPMs that are specifically designed to reduce impacts to bull trout from capture and handling:

- Use of live-capture, selective gear during salmon broodstock collection
- Limiting the duration of trapping activities
- Immediate release of all bull trout captured, except for those captured at the Chief Joseph Hatchery ladder
- Seining operations
    - Immediate release of all bull trout
    - Use of nets with 3.5-inch or smaller mesh
    - Hand-sorting of captured fish in the water (no dry-sorting)
    - Sorting time will not exceed 75 minutes.
        - For beach seine operations, the sorting time is defined as the elapsed time from when the outer towed end of the net first contacts the shore or block until the net is emptied of fish.
        - For purse seine operations, the sorting time is defined as the elapsed time from when all rings are pursed and out of the water until the net is emptied of fish.
- Daily checks of fyke nets, and immediate release of all bull trout
- Immediate release of all bull trout during hook-and-line capture
- Use of only barbless hooks during hook-and-line capture

The capture and direct handling of bull trout has some potential to result in injury or death. Mortality may be immediate or delayed. Handling of fish increases their stress levels and can reduce disease resistance, increase osmotic-regulatory problems, decrease growth, decrease reproductive capacity, increase vulnerability to predation, and increase chances of mortality (Kelsch and Shields 1996). Fish may suffer from thermal stress during handling, or may receive subtle injuries such as de-scaling, abrasions, and loss of slime layer. Handling can contribute directly or indirectly to disease transmission and susceptibility, or increased post-release predation. Fish that have been stressed are more vulnerable to predation (Mesa 1994; Mesa and Schreck 1989). Large bull trout may prey on smaller bull trout if both are held in the same container.

Studies investigating acute, sublethal physiological stress in captured and handled salmonids consistently document induced changes in blood chemistry (e.g., cortisol, corticosteroid, and blood sugar levels; lymphocyte numbers) (Barton and Iwama 1991, p. 3; Frisch and Anderson 2000, p. 23; Hemre and Krogdahl 1996, p. 249; Pickering et al. 1982, p. 229; Wydoski et al. 1976, p. 602). Even short and mild bouts of handling have been shown to induce protracted changes, lasting hours or days (Frisch and Anderson 2000, p. 23; Hemre and Krogdahl 1996, p. 249; Wydoski et al. 1976, p. 604). Stress induced effects to blood chemistry may have consequences for metabolic scope, reproduction (i.e., altered patterns or levels of reproductive hormones), and immune system function or capability (Barton and Iwama 1991, p. 3; Frisch and Anderson 2000, p. 29; Pickering et al. 1982, p. 229). Pickering et al. (1982, p. 231) reports a marked reduction in feeding activity lasting three days after handling. Pickering and others (1982, p. 229) state that fish need a minimum of two weeks to fully recover from stress associated with handling. Barton and Iwama (1991, p. 3) and Frisch and Anderson (2000, p. 23) both point to the possibility of increased disease susceptibility attributable to handling related physiological stress.

Additionally, data obtained from these activities will provide information valuable to bull trout recovery. This activity will adversely affect bull trout that are captured and handled. However, since the majority of the activities in the Proposed Action will occur in a research needs area where data regarding bull trout presence, abundance, and other areas are limited and/or lacking, acquiring such information via implementation of the Proposed Action will also beneficially affect the bull trout.

Rotary Screw Traps

Natural-origin juvenile Chinook and sockeye salmon will be collected from existing rotary screw traps operating in the Sanpoil River and Tshimakain (Chamokane) Creek. Additionally, the Proposed Action includes the installation and operation of new screw traps in Hangman Creek, the Kettle River, the Little Spokane River, the Okanogan River, and various tributaries of Lake Roosevelt. Fish will be passively captured in the spinning drum of the trap as they swim downstream and forced into a live well at the base of the trap. Traps will be checked daily while in operation. Bull trout may be captured and handled at each of the screw traps. All bull trout captured in rotary screw traps will be immediately released.

Seining

Seining is a technique to trap fish in shallow water environments; it is traditionally completed with nets in areas with large schools or groups of fish. Modern near-shore seine nets typically have weights on the bottom (lead line) and buoys on the top (float or cork line) to keep the net vertical when pulled through the water to entrap fish. A beach seine is typically set from the shore to encircle a school of fish and then is closed off to trap the fish against the shore. Purse seines are typically deployed via boat, where a vertical net "curtain" is used to surround fish and the bottom of the net is then drawn together to enclose the fish, after which the net is pulled towards the side of the boat where researchers will use dip nets to process the captured fish.

Beach seining will be conducted in Lake Roosevelt, the mainstem Columbia River (downstream of Chief Joseph Hatchery), the Okanogan River, the free-flowing reach of the Columbia River (between the international border and the backwater of Lake Roosevelt), the Columbia River upstream of Rufus Woods Reservoir, the Spokane Arm of Lake Roosevelt, and the Spokane River (between Little Falls Dam and Spokane Falls, Washington).

Purse seining will be conducted in the mainstem Columbia River, near the mouth of the Okanogan River and downstream of Chief Joseph Dam.

Juvenile Collection Facilities

The Proposed Action includes utilizing the existing Rocky Reach Juvenile Bypass Facility to collect juvenile sockeye salmon. The Bypass Facility will continue to be operated as normal, with the exception of capturing and holding juvenile sockeye salmon for subsequent tagging and transport upstream. All bull trout captured at this juvenile bypass facility will continue to be immediately released.

Fyke Netting

Fyke netting is a passive technique for capturing juvenile salmon in reservoir and backwater habitats. Fyke nets are typically large hoop nets with wings that guide fish into a trap. The nets are deployed near shore and left to capture fish for up to 24 hours. Fyke nets will be deployed in the transboundary reach of the free-flowing Columbia River between the international border and the backwater of Lake Roosevelt, the Columbia River upstream of Rufus Woods Reservoir, the Okanogan River, the Spokane Arm of Lake Roosevelt, and the Spokane River between Little Falls Dam and Spokane Falls, Washington. All fyke nets will be checked daily and all captured bull trout will be immediately released.

Hook-and-Line Sampling

Hook-and-line sampling involves the use of angling gear to capture target fish species or populations. Under the Proposed Action, hook-and-line sampling for adult salmon will occur in the mainstem Columbia River downstream of Chief Joseph Dam. Only barbless hooks will be used, and all captured bull trout will be immediately released.

Adult Salmon Trap-and-Haul

Under the Proposed Action, currently ongoing trap-and-transport activities (described in Section

6) will be expanded to include additional salmon stocks and collection facilities.

The actual number of bull trout affected by capture and direct handling under the Proposed Action is difficult to anticipate. In all cases except for bull trout captured at the Chief Joseph Hatchery ladder, the handled bull trout will be released immediately after their capture, minimizing stress. However, depending on the number of bull trout encountered during these activities, some injury or even deaths may occur during the handling and/or transfer process. Due to the rarity of bull trout in the Action Area, particularly upstream of Chief Joseph and Grand Coulee dams, few bull trout are expected to experience effects of the action each year. Since the early 2000's, fewer than ten bull trout have been observed in the Action Area during existing fisheries and angling activities. Therefore, no more than ten bull trout are expected to experience effects of capture and direct handling in any given year. While every attempt to minimize the duration of handling or potential for mortality from these activities will be employed, a small percentage (<10%) of bull trout handled may result in death.

Mid-Columbia Recovery Unit

Anticipated impacts to bull trout individuals from capture and handling during implementation of the Proposed Action may result in altered bull trout behaviors and in rare cases mortality. Information obtained regarding bull trout presence, use of the Action Area, and other information for recovery efforts will also be obtained. Given the very low number of bull trout expected to be adversely affected by capture and handling, the Service does not anticipate that expected impacts will result in the reduction of recovery potential at the Core Area scale across the Action Area.

12.2 Effects to Designated Bull Trout Critical Habitat

Below, we list each critical habitat PCE/PBF, and discuss the long-term impact of the Proposed Action on each to only bull trout CHU in the Action Area, the Mainstem Upper Columbia River CHU 22. Detailed impacts occurring to the elements are discussed above in relation to bull trout individuals.

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

The Proposed Action does not include any activities that are expected to affect PBF 1 in the Mainstem Upper Columbia River CHU 22.

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

The Proposed Action includes activities that are expected to increase the quantity and quality of migration habitats, and access to those habitats, in the Mainstem Upper Columbia River CHU 22. Specifically, the construction and operation of interim passage facilities (both upstream and downstream) at various locations in the Mainstem Upper Columbia River CHU 22 will increase bull trout access to migration habitats. Further, the data collected from these activities will inform future analyses and decision-making regarding the design, construction, and operation of future long-term passage structures in the Mainstem Upper Columbia River CHU 22. Therefore, the Service expects the effects to PBF 2 from implementation of the Proposed Action will be beneficial.

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

Under the Proposed Action, up to 250,000 juvenile chinook, 250,000 juvenile sockeye salmon, 15,000 adult Chinook salmon, and 15,000 adult sockeye salmon will be released annually into the blocked area. Juvenile salmon will be released at the Chief Joseph Dam forebay and trailrace, which is within the Mainstem Upper Columbia River CHU 22. Additionally, juvenile salmon released upstream of CHU 22 will migrate downstream and use the mainstem Columbia River as FMO habitat, which may increase competition with bull trout for food, habitat, and other resources. However, juvenile salmon are likely to add to the prey base for adult and sub-adult bull trout that exist in CHU 22, and the release of adult salmon into the blocked areas is likely to inject vital nutrients into the Columbia River ecosystem and increase overall biological productivity. For these reasons, the Service expects the effects to PBF 3 from implementation of the Proposed Action will be beneficial.

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

The Proposed Action does not include any activities that are expected to affect PBF 4 in the Mainstem Upper Columbia River CHU 22.

PBF 5: Water temperatures ranging from 2 °C to 15 °C (36 °F to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range.

The Proposed Action does not include any activities that are expected to affect PBF 5 in the Mainstem Upper Columbia River CHU 22.

PBF 6: In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo over-winter survival, fry emergence, and young-of-the-year and juvenile survival.

The Proposed Action does not include any activities that are expected to affect PBF 6 in the Mainstem Upper Columbia River CHU 22.

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

The Proposed Action does not include any activities that are expected to affect PBF 7 in the Mainstem Upper Columbia River CHU 22.

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

Implementation of the Proposed Action includes construction of multiple rearing and acclimation facilities for juvenile salmon, i.e., net pens and land-based facilities, as well as expansion and/or upgrades to existing rearing facilities. New facilities will be constructed and installed in the Little Spokane River (Glen Tana), the Sanpoil arm of Lake Roosevelt, the Sanpoil River at Louie Creek, the upper Sanpoil River, and Hangman Creek. New net pens will be constructed and installed in the Sanpoil Arm of Lake Roosevelt and the Spokane River Reservoir. Two new additional net pens may also be added to the Pacific Aquaculture Net Pen Program currently operating in Rufus Woods Reservoir.

The addition of new net pens and rearing facilities, as well as the expansion of existing net pens and rearing facilities will involve introducing, holding, and rearing significant numbers of juvenile salmon and salmon eggs into the blocked areas, which is likely to negatively affect temperature, pH, dissolved oxygen, dissolved nitrogen, and dissolved phosphorus. However, as described in the Effects to Bull Trout section of this Opinion, the new and expanded net pens, and their areas of effect, will make up a miniscule portion of the overall aquatic habitats into which they will be installed. Additionally, Chief Joseph Dam is generally a run-of-the-river facility, which will allow regular flushing of the byproducts of the new net pens (e.g., excess food and waste) from the reservoir. Therefore, the Service expects that effects to PBF 8 in the Mainstem Upper Columbia River CHU 22 from installation of new net pens, and expansion of existing net pens will be insignificant.

Implementation of the Proposed Action includes the siting, design, construction, and operation of new land-based acclimation facilities for juvenile salmon at Louie Creek (adjacent to the Sanpoil River), sqweyu' (adjacent to Hangman Creek), the Upper Sanpoil River, and Glen Tana (adjacent to the Little Spokane River), all of which may affect water quality at each site. However, at the time of this consultation details regarding specific designs, construction methods, operation, and other key aspects of the new land-based acclimation facilities have not been established. In general, the sites for the new facilities will likely require resource-specific surveys, and ground disturbing activities (e.g., boreholes, trenches, ground water drilling and testing). Construction activities will likely include demolition of existing dilapidated structures, site preparation, water system construction, circular tank installation, and electrical power supply development. Therefore, as details are developed for construction of specific acclimation facilities, the Action Agencies will informally consult with the Service as per the Programmatic Agreement described in Section 2.

PBF 9: Sufficiently low levels of occurrence of non-native predatory (e.g., lake trout, walleye, northern pike, smallmouth bass), interbreeding (e.g., brook trout), or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

The Proposed Action does not include any activities that are expected to affect PBF 9 in the Mainstem Upper Columbia River CHU 22.

12.3 Summary of Effects

Implementation of the Proposed Action is likely to cause introduction of sediment; general construction noise; increases in diseases/pathogens; increased competition; and degradation of water quality in the Action Area. However, as described in Section 12.1 above, the Service expects these effects to be insignificant.

Implementation of the Proposed Action is expected to cause stress, injury, and mortality to individual bull trout from capture and direct handling. The Service expects fewer than 10 individuals will experience effects of the action in any given year. Therefore, given the low numbers of bull trout expected to be affected annually over the 20-year implementation period and the geographic range over which the actions will occur, these adverse effects are not likely to be detectable beyond the local population level. In addition, all bull trout observed and handled during the Proposed Action will provide valuable information on the distribution, abundance, and source populations of bull trout within the Northeast Washington Research Needs Areas.

The effects to the Mainstem Upper Columbia River CHU 22 from implementation of the Proposed Action include alterations to bull trout prey base (PBF 3) and degradation of water quality (PBF 8). However, as described in Section 12.2 above, these effects to the Mainstem Upper Columbia River CHU 22 are expected to be insignificant, and in the case of PBFs 2 and 3, beneficial (i.e., juvenile salmon adding to the bull trout prey base). Therefore, the Service does not expect implementation of the Proposed Action to significantly impact the function of designated bull trout critical habitat in the Action Area.

13 CUMULATIVE EFFECTS: BULL TROUT AND DESIGNATED BULL TROUT CRITICAL HABITAT

Cumulative effects 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 ESA.

Cumulative effects from a variety of activities are likely to adversely or beneficially affect bull trout and their habitat. These actions include, but are not limited to, industrial and residential development, road construction and maintenance, mining, forest activities, fish management activities, irrigation, agriculture, grazing, and fire management.

Potential impacts that may contribute to cumulative effects include water flow fluctuations, degraded water quality, migration barriers, habitat degradation, resource competition, and introduction of non-native invasive species. Effects to bull trout in and near the Action Area are primarily the result of residential development, agriculture, and associated water diversion and water control activities. Urban and rural land uses for residential, agricultural, commercial, industrial, and recreational activities, such as boating and golf courses, often require water withdrawals and can further contribute pollutants and sediments to surface waters. Irrigation is ongoing throughout the Action Area. There may be potential new water development such as storage projects, ongoing private water withdrawals, and ground-water wells. The Washington Department of Ecology regulates the quantity of water withdrawals throughout the Action Area.

Many impacts from non-Federal activities in the Action Area that have degraded or hindered the conservation of listed species, specifically bull trout and its designated critical habitat, will continue in the foreseeable future at similar intensities as in the recent past. Information on specific planned or foreseeable non-Federal activities is uncertain. The types of ongoing non-Federal activities and land uses expected to continue to affect listed species and critical habitat within the Action Area include development, coal mining, agriculture, recreation, timber harvest, and climate change as a result of human activities. We are not aware of any specific, significant new or changes to existing state, tribal, local, or private activities within the Action Area.

14 INTEGRATION AND SYNTHESIS OF EFFECTS: BULL TROUT AND DESIGNATED BULL TROUT CRITICAL HABITAT

The Integration and Synthesis section is the final step in assessing the risk posed to species and critical habitat as a result of implementing the Proposed Action. In this section, we add the effects of the action and the cumulative effects to the status of the species and critical habitat, and the environmental baseline, to formulate our Biological Opinion as to whether the Proposed Action is likely to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) result in the destruction or adverse modification of critical habitat.

The Proposed Action involves testing the feasibility of restoring salmon in the Upper Columbia River Basin upstream of Chief Joseph and Grand Coulee dams. Included within the action are a suite of activities designed to collect baseline information and develop support programs and facilities, and design, build, and test interim fish passage facilities. Effects to bull trout from implementation of the Proposed Action range from insignificant, to adverse, to beneficial. Additionally, the Proposed Action includes EPMs that are specifically designed to reduce the adverse effects to bull trout and its designated critical habitat. Also, related actions included in the baseline (i.e. previously consulted on and implemented in relation to this action) will further reduce the impact of the Proposed Action over the long-term for bull trout and bull trout critical habitat.

In 1999, the Service listed all populations of the bull trout in the coterminous U.S. under a single DPS as threatened. Although wide-ranging in parts of Oregon, Washington, Idaho, and Montana, the bull trout presently occurs in about 45 percent of its historical range in the Columbia River Basin (USFWS 2015a). In the Bull Trout Recovery Plan, bull trout populations were segregated into six Recovery Units across the range of the species, which encompasses 109 Core Areas, 6 Historic Areas, and one RNA (USFWS 2015a). The Action Area for this Opinion overlays one of the six established Recovery Units and includes parts of three Core Areas and all of one RNA.

Bull trout individuals from populations in the Action Area currently face threats from diminished connectivity, habitat degradation, poor or impacted water quality, and introduced non-native species. These threats have resulted in declines in the bull trout's distribution and abundance. The main threat to the stability and long-term viability of bull trout populations is diminishing connectivity between Core Areas and local populations caused by passage and migration barriers. In the Action Area, adult and sub-adult bull trout are overwintering and can be found foraging and migrating at any time of the year. The Action Area occurs within foraging, migrating and overwintering habitat or in a research needs area, where no known spawning populations occur, and individuals are rare. Interactions are primarily caused by entrainment of bull trout into the Action Area and then the inability of those individuals to return to natal waters as a result of factors not associated with the Proposed Action (e.g., natural or man-made barriers). In most portions of the Action Area, adult and sub-adult bull trout are overwintering and can be found foraging and migrating at any time of the year. Spawning and juvenile-rearing areas are located outside of the Action Area and are unlikely to be affected by the Proposed Action.

Bull trout observations in the Action Area are more frequent downstream of Chief Joseph Dam, especially closer to spawning tributaries in the Entiat, Wenatchee and Methow basins. Upstream of Chief Joseph and Grand Coulee dams, bull trout are very rare, with fewer than 10 observed in the action area in any given year.

Bull trout critical habitat in the Action Area includes one of 31 designated CHUs, the Mainstem Upper Columbia River CHU 22. The Action Area occurs within important FMO habitat for the bull trout. In the affected CHU, PCE/PBFs have been degraded or are not properly functioning due to past impacts to migratory corridors, natural hydrographs, water quality, habitat complexity and temperature, and the presence of introduced species. Past actions have reduced the function of critical habitat in the Action Area to provide adequate forage and migratory corridors to support the non-spawning life stages of the bull trout.

14.1 Mid-Columbia Recovery Unit

The status of bull trout populations within the MCRU is variable across the Action Area. Some populations are small and increasingly threatened due to reduced habitat availability, barriers to inter-population connectivity, the presence of invasive species, and declining native food resources (USFWS 2015c p. C-9-34). Other areas in the Action Area with intact riverine habitat are located within wilderness areas or protected forestlands and support more robust bull trout populations. Within the Action Area, the MCRU includes three Core Areas and one RNA (the Northeastern Washington RNA). Bull trout in these three Core Areas of the MCRU overlap the Action Area year-round in some capacity of bull trout foraging, migratory, or overwintering activities. Bull trout populations within this recovery unit evolved with anadromous salmon and steelhead, which are a primary prey base for bull trout in this recovery unit. In addition, most of the Action Area occurs within a research needs area, where the status, distribution and abundance of bull trout is limited. For most Core Areas in the MCRU, declining or depressed salmon and steelhead populations have led to a reduced or altered food base and ultimately reduced health and fitness of bull trout populations in the MCRU.

Bull trout populations within the MCRU are subject to ongoing adverse impacts caused by Federal and non-Federal dam operations on the mainstem Columbia River, Lower Snake River, and the Clearwater River. The effects of barriers on bull trout migration, historical land management activities, elevated water temperatures, the presence of non-native fish, and low habitat complexity are recognized as threats to the bull trout in most of the Core Area populations in this recovery unit (USFWS 2015c p. C-9-34). The presence and operation of dams in this recovery unit have adversely affected river flow, water quality, and water temperature regimes, to an extent that is limiting the survival of affected bull trout in all life stages, as well as adversely impacting the availability of native food sources (e.g., salmon and steelhead) for bull trout.

14.1.1 Methow, Entiat, Wenatchee Core Areas, and NE Washington RNA

The status and trend of bull trout populations within these Core Areas is generally described as depressed and/or declining. Bull trout from these Core Areas interact and are present in the Action Area year-round. Telemetry and PIT-tag data indicate the migratory corridors located in the Columbia River are important to the survival, distribution and abundance of bull trout in these Cores Areas and to genetic exchange among and across the Core Areas.

For the Northeast Washington Research Needs Area, only very small numbers of bull trout are likely to use the Action Area. While downstream movement into the Action Area is possible, the quantity of bull trout moving upstream into the Action Area is either unknown or undocumented. Information on bull trout populations is generally unknown or extremely lacking upstream of Chief Joseph Dam and Grand Coulee Dam to the Canadian border. A few bull trout are observed in this area annually, however, the source populations are unknown and there is no documented spawning occurring in the area.

In all cases for the three Core Areas and the Research Needs Area, a very small number of bull trout may be present in the Action Area at any time and may experience adverse impacts caused by the Proposed Action, i.e., stress, injury, and in rare cases mortality from capture and direct handling. However, given the very low numbers of bull trout present in this portion of the Action Area from any of these Core Areas, it is unlikely that the adverse impacts likely to occur will be measurable at the Core Area scale. If bull trout populations increase in these Core Areas over the term of the action, more bull trout may be exposed to these stressors. However, the Proposed Action is not expected to negatively influence the survival and recovery of these Core Areas because only a portion of these Core Areas is located within the Action Area and only low numbers of bull trout are likely to be adversely affected. Additionally, the Proposed Action may positively influence the survival and recovery of these Core Areas by increasing the prey base (i.e., juvenile salmon) for sub-adult and adult bull trout and increasing the delivery of important marine-derived nutrients into the blocked areas (via adult salmon). Additionally, data obtained from implementation of the Proposed Action will provide information valuable to bull trout recovery. Since the majority of the activities in the Proposed Action will occur in a research needs area where data regarding bull trout presence, abundance, movement, genetics, and other areas are limited and/or lacking, acquiring such information via implementation of the Proposed Action will be a net benefit to bull trout.

14.1.2 Mainstem Upper Columbia River CHU #22

In general, the Mainstem Upper Columbia River CHU #22 is essential for maintaining bull trout distribution patterns, providing access to FMO habitat, and ensuring connectivity (i.e., conserving critical migratory corridors) between Core Areas. Due to a variety of environmental and anthropogenic factors (e.g., elevated TDG levels and water temperature, lack of fish passage at Grand Coulee and Chief Joseph dams) or undetermined fish passage effectiveness (at Columbia river dams), an altered hydrograph that limits or reduces riparian habitat growth, reduced and altered native food sources (e.g., salmon and steelhead) and habitat fragmentation within the Action Area, bull trout critical habitat in the MCRU is generally considered either "at risk" or not functional for all PCE/PBFs, except spawning substrate, which is not present. The Proposed Action includes multiple EPMs that are specifically designed to minimize adverse effects to the bull trout from implementation of the Proposed Action. However, the existing degraded function of critical habitat will continue under the Proposed Action. As described above, the Proposed Action is expected to benefit, maintain or insignificantly affect the existing degraded function of critical habitat within the MRCU.

14.1.3 MCRU Summary

When the effects of the Proposed Action on the bull trout and its critical habitat, and cumulative effects are added to the baseline, minor to measurable adverse impacts in three of the 24 Core Areas and one CHU within this portion of the Action Area are likely to occur. The Proposed Action is also likely to cause adverse effects to bull trout in one RNA. However, these impacts to the species and its critical habitat are not expected to reach a level that is measurable at the Core Area and critical habitat range-wide scales over the 20-year duration of the Proposed Action because: (1) few bull trout are likely to be exposed to these stressors in this portion of the Action Area or it is uncertain the extent to which individuals from these Core Areas use the Action Area; and (2) only a small portion of bull trout critical habitat is likely to be exposed to these stressors. Additionally, data obtained from implementation of the Proposed Action will provide information valuable to bull trout recovery. Since the majority of the activities in the Proposed Action will occur in a research needs area where data regarding bull trout presence, abundance, and other areas are limited and/or lacking, acquiring such information via implementation of the Proposed Action will be a net benefit to bull trout.

The affected CHU is likely to continue to be degraded as a result of ongoing flow management, an altered hydrograph, and the presence of barriers to bull trout migration. The affected CHU provides important FMO habitat but does not provide for bull trout spawning and rearing. The FMO function within this CHU is expected to continue to function with implementation of the Proposed Action but at a reduced level for the full duration of the Proposed Action. Resident bull trout populations in the affected Core Areas are not likely to be affected by the Proposed Action. The Proposed Action includes multiple EPMs that are expected to reduce adverse impacts to the bull trout in this Recovery Unit and to the CHU. In addition, the Proposed Action includes the transport of juvenile and adult salmon into the blocked area that will contribute to the survival and recovery of bull trout in the MCRU.

14.2 Summary of Effects of the Proposed Action on Bull Trout at the Range-Wide Scale

The Proposed Action is expected to result in adverse effects to individual bull trout. No adverse effects to designated bull trout critical habitat are expected to occur. However, the adverse effects to bull trout are not expected to significantly impact Core Areas because few bull trout will experience the effects due to low documented use of the Action Area.

The Service, however, expects that elements of the Proposed Action will minimize the long-term impact to survival and recovery of all affected Core Areas over the duration of the Proposed Action. Implementation of EPMs are likely to minimize the extent of the above adverse effects over the full duration of the Proposed Action with frequent coordination with the Services. Additionally, annual releases of adult and juvenile salmon into the blocked area are likely to benefit the Core Areas by providing increased forage opportunities for bull trout and delivering marine-derived nutrients into the area. Collectively, we expect the full effects of the Proposed Action, in combination with ongoing actions considered in the baseline, will maintain the survival of bull trout across the range and not reduce the likelihood of recovery of the species.

Therefore, as described in the above sections, while measurable impacts are expected in three Core Areas and one RNA of one Recovery Unit, the Proposed Action, combined with ongoing activities in the baseline and cumulative actions, is not likely to appreciably reduce the likelihood of survival and recovery of the bull trout. This is due to:1) the low number of bull trout affected over the 20-year timeframe of the Proposed Action; 2) the large geographic area over which the impacts will occur; 3) the likelihood that, bull trout will continue to persist in tributaries and existing strongholds; 4) resident populations of bull trout will be unaffected and maintain broad distribution; 5) spawning habitats will be unaffected; 6) the beneficial effects of increased forage and marine-derived nutrients in the blocked area; and 7) information on bull trout distribution and abundance in the Research Needs Area will further expand our understanding of the distribution of bull trout within the Recovery Unit. The Proposed Action will not appreciably diminish the conservation value of critical habitat as a whole because no adverse effects to designated bull trout critical habitat are expected to occur. This is important because over the duration of the Proposed Action, bull trout spawning and rearing habitat will be unaffected and continue to provide for survival, reproduction, and recovery of bull trout. For the Mainstem Upper Columbia River CHU #22, effects from the Proposed Action are expected to be insignificant, even as the CHU is expected to degrade over the full duration of the Proposed Action. Therefore, under the Proposed Action the overall continued function of critical habitat as a whole is expected to continue.

15 CONCLUSION: BULL TROUT AND DESIGNATED BULL TROUT CRITICAL HABITAT

After reviewing the current status of bull trout, the environmental baseline for the Action Area, the effects of the Proposed Action and the cumulative effects, it is the Service's Opinion that the Action, as proposed, is not likely to jeopardize the continued existence of the bull trout and is not likely to destroy or adversely modify bull trout critical habitat for the reasons discussed above.

16 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special 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* is defined by the Service as an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). *Harass* is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary and must be undertaken by the Action Agencies so that they become binding conditions of any activity authorized or funded by the Action Agency, as appropriate, for the exemption in section 7(o)(2) to apply. The Action Agency has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the Action Agency 1) fails to assume and implement the terms and conditions or 2) fails to require any contractor to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the agency or applicant must report the progress of the action and its impact on the species to the Service as specified in this Incidental Take Statement [50 CFR 402.14(i)(4)].

17 AMOUNT OR EXTENT OF TAKE

The Service anticipates the following form and amount of take of the bull trout as a result of the Proposed Action:

- Up to ten adult, sub-adult, and/or juvenile bull trout will be taken in the form of harm from capture and direct handling within the Action Area, each year for 20 years. While every attempt to minimize the duration of handling or potential for mortality from these activities will be employed, a small percentage (<10%, or 1 per year) of bull trout may be killed by capture and direct handling.

18 EFFECT OF THE TAKE

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

19 REASONABLE AND PRUDENT MEASURES

The Service finds the following reasonable and prudent measure(s) (RPM) are necessary and appropriate to minimize the impact of incidental take of bull trout:

a) Minimize take of bull trout caused by capture and direct handling.

b) Monitor and report on the extent of take of bull trout caused by capture and direct handling, as well as the effectiveness of implementing the above RPM.

20 TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, the Action Agencies must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1) To implement RPM 19 (a), the Action Agencies shall:

   a. Ensure all bull trout capture operations are conducted by a qualified biologist, and all staff participating in the operation have the necessary knowledge, skills, and abilities to ensure safe handling of fish.

      i. Unless otherwise coordinated and mutually agreed to by the Service, WDFW, Project Proponents and the Action Agencies, bull trout captured and handled will be released where safe to do so in the immediate vicinity of any collection site. Changes in disposition of captured bull trout such as transport upstream or downstream of a dam will be discussed during regular implementation and coordination meetings and/or during development of interim fish passage facilities.

      ii. Fish capture and removal operations shall take all appropriate steps to minimize the amount and duration of fish handling;

      iii. In order to prevent and minimize stress to the maximum extent possible, the operations shall ensure captured fish remain in water that is within 1 degree (Celsius) of the temperature of the water body from which they were captured;

      iv. The Action Agencies shall ensure water quality conditions are adequate in the buckets or tanks used to hold and transport captured fish. The operations shall use aerators to provide for the circulation of clean, cold, well-oxygenated water, and/or shall stage fish capture, temporary holding, and release, to minimize the risks associated with prolonged holding;

v. Any captured bull trout shall be reported and, when practical, collect biometric data (size, weight), PIT-tag and take a genetic clip. If the number of bull trout encountered is locally abundant, a subsample of captured and handled fish shall be PIT tagged with associated genetic and biometric data collected. All data will be reported annually.

b. The Project Proponents shall enter data for any PIT tagged bull trout (as described in 20.a.iv above) into the PITAGIS database.

c. The Project Proponents shall provide genetic tissues collected during implementation of the Proposed Action. This will aid in determining the populations of origin, possible effective breeding size, and genetic variance for bull trout within the Action Area. These data may be used to determine population level impacts of the Proposed Action. Genetic samples (e.g. fin clips) shall be submitted for analysis to the Service's Abernathy Fish Technology Center in Longview, Washington, or a genetics lab with equivalent processing and analysis capabilities; and,

d. All incidental mortalities of bull trout must be preserved in a fashion to best provide maximum scientific information to the extent possible. Any specimen killed shall be kept whole and put on ice or frozen when feasible. Such specimens shall be wrapped in aluminum foil rather than plastic to facilitate contaminant analysis. The collector shall label the specimen with appropriate information and notify the Service for disposition.

2) To implement RPM 19(b), the Action Agencies shall:

a. No less than every two years by October 31, in combination with regular summary updates at regional forums, the Action Agencies shall provide a report of the above actions, as well as the extent of take of bull trout (RPM 19(b)), to the Columbia River System Coordinator, Pacific Regional Office.

The RPMs, with their implementing terms and conditions, are designed to minimize the impacts of take that might otherwise result from the Proposed Action. If, during the course of the action, the levels of authorized take of the bull trout are exceeded, such take represents new information requiring re-initiation of consultation and review of the RPMs provided herein. The Action Agencies must immediately provide an explanation of the causes of the taking and review with the Service need for possible modification of the RPMs.

The Service is to be notified within three working days if Action Agency staff or other authorized individuals locate a dead, injured or sick endangered or threatened species specimen. The initial notification shall be made to the nearest Service Law Enforcement Office. The notification shall include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care shall be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death, if that occurs. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Under such circumstances, the Action Agencies shall contact the Service's Law Enforcement Office at (425) 883-8122.

21 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA 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 plans, or to develop information.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

The Service recommends the following measures:

Freshwater Mussels

While no species of freshwater mussels are federally listed in the Pacific Northwest (the western ridged mussel (*Gonidea angulate*) is currently a candidate for federal listing), they are of high value (culturally, ecologically, and environmentally) to many entities. The Service recommends the Action Agencies consider the biological needs of all freshwater mussel species for all projects requiring instream or near-stream projects. There are six species of western freshwater mussels: the western pearlshell (*Margaritifera falcata*), the western ridged mussel, the winged floater (*Anodonta nuttalliana* and previously-recognized *A. californiensis*), the Oregon floater (includes both *Anodonta oregonensis* and previously-recognized *A. kennerlyi*), the Yukon floater (Anodonta beringiana), and woebegone floater (Anodonta dejecta). The Xerces Society for Invertebrate Conservation (Xerces Society) maintains a resource for western freshwater mussels at https://xerces.org/western-freshwater-mussels/

- The biological considerations of freshwater mussel species should be incorporated into project design, objectives, and best management practices for the protection and conservation of these species. The Xerces Society has developed a publication "Conserving the Gems of Our Waters: Best Management Practices for Protecting Native Western Freshwater Mussels during Aquatic and Riparian Restoration, Construction, and Land Management Projects and Activities, available on line at https://xerces.org/sites/default/files/2018-05/18-001_01_XercesSoc_Protecting-Native-Western-Freshwater-Mussels-BMPs_web.pdf (Blevins et al. 2017). This document includes information on determining if mussels are present at your site, project development and review, salvage and relocation, monitoring and practices for minimizing project impacts for several different activities (i.e. construction, vegetation management, flow management, restoration). The Xerces Society website also has an identification guide developed by the Xerces Society and Confederation Tribes of the Umatilla Indian

Reservation at https://pnwmussels.org/wp-content/uploads/2016/07/QuickMusselGuide_CTUIR.pdf

Invasive Species

Management or elimination of invasive species provides ecosystem benefits to both listed and non-listed species. Within the Action Area, invasive species of most concern include zebra and quagga mussels, Eurasian snails, northern pike, lake trout, and expanding populations of purple loosestrife, non-native watermilfoil, flowering rush, phragmites, and other plants. The following recommendations relate to management and monitoring of invasive species populations:

- The Action Agencies should continue to support and fund activities to minimize the spread of non-native predatory species within the Action Area, including northern pike, walleye, and lake trout that use habitat formed by operations.

- Reclamation should develop a plan to install boat wash stations at all Reclamation owned and operated boat launches within the Columbia River Basin.

- The Action Agencies should coordinate with, and implement, prioritized actions identified by interagency invasive species teams. The Aquatic Invasive Species Network and the Western Regional Panel can provide direction in regard to aquatic invasive species. Each state in the study area (i.e., Idaho, Montana, Oregon, and Washington) has an invasive species council that can also provide direction on focused actions to eradicate and reduce the spread of invasive species.

- The Action Agencies should work with local weed boards to manage, monitor, and eradicate non-native aquatic plants where possible.

22 REINITIATION NOTICE

This concludes formal consultation on the action outlined in the request for formal consultation. As provided in 50 CFR 402.16, reinitiation of formal consultation is required and shall be requested by the Federal agency where discretionary federal agency involvement or control over the action has been retained or is authorized by law and 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 not considered in this Opinion; or 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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APPENDIX A: BULL TROUT

4.1 Status of the Species

This section presents information about the regulatory, biological, and ecological status of bull trout at a rangewide scale that provides context for evaluating the significance of probable effects caused by the proposed action. This section provides information about the bull trout's life history, habitat preferences, geographic distribution, population trends, threats, and conservation needs. This includes description of the effects of past human activities and natural events that have led to the current status of the bull trout. This information provides the background for analyses in later sections of the biological opinion. The proposed and final listing rules contain a physical species description (63 FR 31647, June 10, 1998; 64 FR 58910). Additional information can be found at https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=E065.

4.1.1 Listing Status and Current Range

The coterminous United States population of the bull trout was listed as threatened on November 1, 1999 (64 FR 58910). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon; Jarbidge River in Nevada; Willamette River Basin in Oregon; Pacific Coast drainages of Washington, including Puget Sound; major rivers within the Columbia River Basin in Idaho, Oregon, Washington, and Montana; and Saint 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 in accordance with the requirements of section 7 of the Act relative to this species and established five interim RUs for each of these DPSs for the purposes of consultation and recovery (64 FR 58930).

The final Recovery Plan for the Coterminous Bull Trout Population (bull trout recovery plan) established six RUs (USFWS 2015f, pp. 36-43) (see Figure 3). These RUs are needed to ensure a resilient, redundant, and representative distribution of bull trout populations throughout the range of the listed entity.

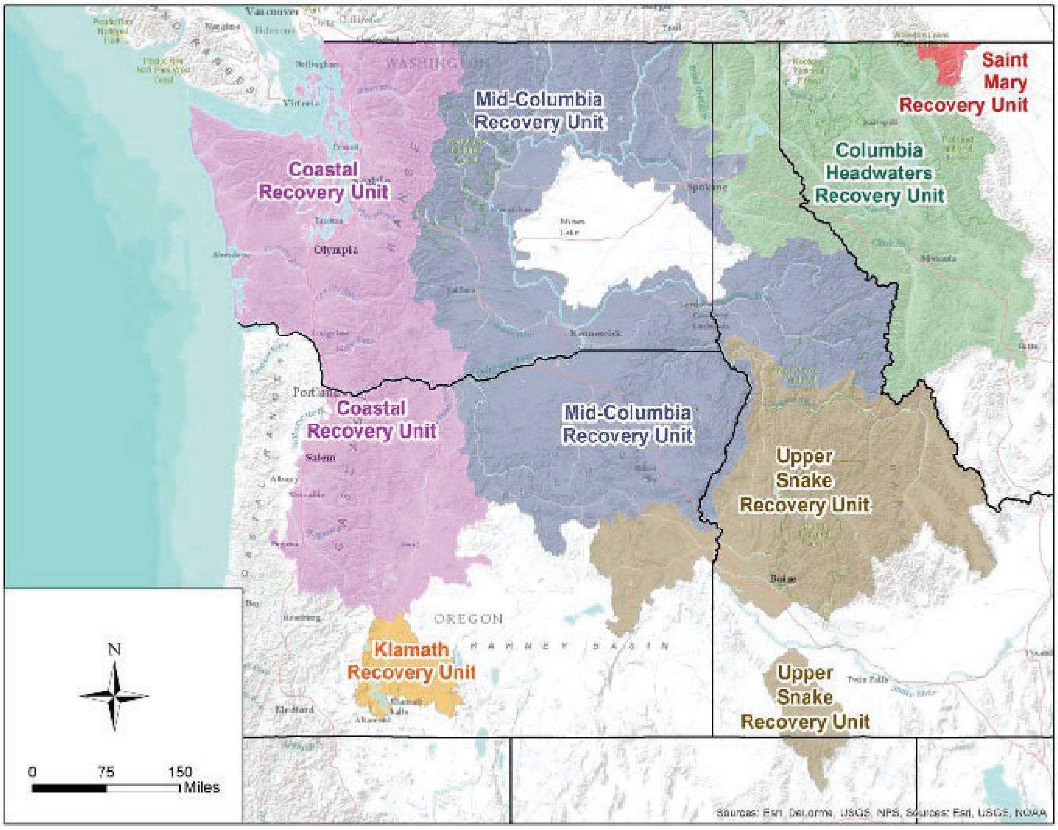


Figure A-1: Locations of the six bull trout Recovery Units in the coterminous United States.

4.1.2 Reasons for Listing and 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, and 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 (63 FR 31647; 64 FR 58910). Poaching and incidental mortality of bull trout during other targeted fisheries are identified and described in the bull trout recovery plan (see Threat Factors B and D) as additional threats (USFWS 2015a, p. 150). Since the time of coterminous listing of the species (64 FR 58910) and designation of its critical habitat (69 FR 59996, October 6, 2004; 70 FR 56212, September 26, 2005; 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; USFWS 2009a, entire), Conservation Status Assessment (USFWS 2005a, entire), and 5-year reviews (USFWS 2008, entire; USFWS 2015a, entire) have provided additional information about threats and status. The final recovery plan lists other documents and meetings that compiled information about the status of bull trout (USFWS 2015f, p. 3). The 2015 5-year status review also maintains the listing status as threatened based on the information compiled in the final bull trout recovery plan (USFWS 2015f, p. 3) and the Recovery Unit Implementation Plans (RUIPs) (USFWS 2015b; 2015c; 2015d; 2015e; 2015g; 2015h).

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; USFWS 2004a, entire; USFWS 2004b, entire) included detailed information on threats at the RU scale (i.e., similar to subbasin or regional watersheds), thus incorporating the metapopulation concept with core areas and local populations. In the 2008 5-year review, 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 wildfire) (USFWS 2008, entire). In the final recovery plan, threats and recovery actions are described for all 109 core areas for the species, forage/migration and overwintering areas, historical core areas, and research needs areas in each of the six RUs (USFWS 2015f, pp. 10-11). Primary threats are described in three broad categories—Habitat, Demographic, and Nonnative Fish—for all RUs and core areas within the listed range of the species. The 2015 5-year status review references the final recovery plan and the RUIPs and incorporates by reference the threats described therein (USFWS 2015a, entire). 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 2015a, entire).

New or Emerging Threats

The bull trout recovery plan describes new or emerging threats, climate change, and other threats (USFWS 2015f, entire). Climate change was not addressed as a known threat when bull trout was listed. The 2015 bull trout recovery plan and RUIPs (USFWS 2015b; 2015c; 2015d; 2015e; 2015g; 2015h) 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 small populations, isolation, and effects of climate change (USFWS 2015f, p. 48). The recovery plan 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 cold water habitats (USFWS 2015f, p. vii and pp. 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 (Koopman et al. 2009, entire; Poff et al. 2002, entire; Point Reyes Bird Observatory (PRBO) Conservation Science 2011, entire). 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 2015d, 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 cold water habitat (Isaak et al. 2015, p. 2549, Figure 7), and increase competition with other fish species [lake trout (*Salvelinus namaycush*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), and northern pike (*Esox lucius*)] 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 elevation shift in distribution) due to the effects from climate change (Isaak et al. 2014, p. 114; Wenger et al. 2011, p. 998, Figure 2a).

4.1.3 Life History and Population Dynamics

Distribution

The historical range of bull trout includes major river basins in the Pacific Northwest at about 41 to 60 degrees North latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Bond 1992, p. 2; Cavender 1978, pp. 165-166). To the west, the bull trout's range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992, p. 2). Bull trout occur in portions of the Columbia River and tributaries within the basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south-central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and Montana and in the MacKenzie River system in Alberta and British Columbia, Canada (Brewin and Brewin 1997, entire; Cavender 1978, pp. 165-166).

Reproductive Biology

The iteroparous reproductive strategy (fishes that spawn multiple times, and therefore require safe two-way passage upstream and downstream) of bull trout has important repercussions for the management of this species. Bull trout require passage both upstream and downstream, not only for repeat spawning but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous salmonids (fishes that spawn once and then die, and therefore require only one-way passage upstream). Therefore, even dams or other barriers with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route. Additionally, in some core areas, bull trout that migrate to marine waters must pass both upstream and downstream through areas with net fisheries at river mouths. This can increase the likelihood of mortality to bull trout during these spawning and foraging migrations.

Growth varies depending upon life-history strategy. Resident adults range from 15 to 30 centimeters (cm; 6 to 12 inches [in.]) total length, and migratory adults commonly reach 61 cm (24 in.) or more (Goetz 1989, p. 30; Pratt 1985, pp. 28-34). The largest verified bull trout is a 14.5-kilogram (32-pound) specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982, p. 95) .

Bull trout typically spawn from August through November during periods of increasing flows and decreasing water temperatures. Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989, p. 141). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989, pp. 15-

16; Pratt 1992, pp. 6-7; Rieman and McIntyre 1996, p. 133). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p. 1). After hatching, fry remain in the substrate, and time from egg deposition to emergence may surpass 220 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992, p. 1; Ratliff and Howell 1992, p. 10). Early life stages of fish, specifically the developing embryo, require the highest inter-gravel dissolved oxygen (IGDO) levels, and are the most sensitive life stage to reduced oxygen levels. The oxygen demand of embryos depends on temperature and on stage of development, with the greatest IGDO required just prior to hatching.

A literature review conducted by the Washington Department of Ecology (2002, p. 9) indicates that adverse effects of lower oxygen concentrations on embryo survival are magnified as temperatures increase above optimal (for incubation). Normal oxygen levels seen in rivers used by bull trout during spawning ranged from 8 to 12 milligrams/liter (mg/L;in the gravel), with corresponding instream levels of 10 to 11.5 mg/L (Stewart et al. 2007, p. 10). In addition, IGDO concentrations, water velocities in the water column, and especially the intergravel flow rate, are interrelated variables that affect the survival of incubating embryos (Oregon Department of Environmental Quality 1995, Ch. 2 pp. 23-24). Due to a long incubation period of 220+ days, bull trout are particularly sensitive to adequate IGDO levels. An IGDO level below 8 mg/L is likely to result in mortality of eggs, embryos, and fry.

Population Structure

Bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993, 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; Washington Department of Fish and Wildlife 1997, p. 16). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. They are iteroparous (they spawn more than once in a lifetime). Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Fraley and Shepard 1989, 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 (Swanberg 1997, entire; Brenkman and Corbett 2005, pp. 1075-1076; Goetz et al. 2004, p. 105; Starcevich et al. 2012, entire; Barrows et al. 2016a, p. 170). 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). Some river systems have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem rivers. In these areas with connectivity, bull trout can migrate between large rivers, lakes, and spawning tributaries. Other migrations in Central Washington have shown that fluvial and adfluvial life forms travel long distances, migrate between core areas, and mix together in many locations where there is connectivity (Ringel et al.2014, pp. 61-64; Nelson and Nelle 2008, pp. 88-93). 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; Montana Bull Trout Scientific Group, (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 Taylor and Costello (2006, p. 1165-1170), 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 Service identified additional genetic units within the coastal and interior lineages (Ardren et al. 2011, p. 18). Based on a recommendation in the Service's 5-year review of the species' status (USFWS 2008, p. 45), the Service reanalyzed the 27 RUs 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 Service applied relevant factors from the joint Service and NMFS DPS policy (61 FR 4722, February 7, 1996) and subsequently identified six draft RUs 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 RUs were used to inform designation of critical habitat for bull trout by providing a context for deciding what habitats are essential for recovery (75 FR 63898). These six RUs, which were identified in the final bull trout recovery plan (USFWS 2015f, entire) and described further in the RUIPs (USFWS 2015b; 2015c; 2015d; 2015e; 2015g; 2015h) include: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake. A number of additional genetic analyses within core areas have been completed to understand uniqueness of local populations (DeHann and Neibauer 2012, entire).

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; Burkey 1995, entire).

Metapopulation concepts of conservation biology theory have been suggested relative to the distribution and characteristics of bull trout, although empirical evidence is relatively scant (Dunham et al. 1999, entire; Rieman and McIntyre 1993, p. 15; Rieman and Dunham 2000, 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). 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 (Dunham and Rieman 1999, p. 645; Rieman and Clayton 1997, pp. 10-12; Rieman and Dunham 2000, p. 55; Spruell et al. 1999, pp. 118-120).

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. 5-57). 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), while Whitesel et al. (2004, pp. 18-21) summarizes metapopulation models and their applicability to bull trout.

Habitat Characteristics

The habitat requirements of bull trout are often generally expressed as the four “Cs”: cold, clean, complex, and connected habitat. Cold stream temperatures, clean water quality that is relatively free of sediment and contaminants, complex channel characteristics (including abundant large wood and undercut banks), and large patches of such habitat that are well connected by unobstructed migratory pathways are all needed to promote conservation of bull trout throughout all hierarchical levels.

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993, p. 4). Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors (Fraley and Shepard 1989, entire; Goetz 1989, pp. 23, 25; Hoelscher and Bjornn 1989, pp. 19, 25; Howell and Buchanan 1992, pp. 30, 32; Pratt 1992, entire; Rich 1996, p. 17; Rieman and McIntyre 1993, pp. 4-6; Rieman and McIntyre 1995, entire; Sedell and Everest 1991, entire; Watson and Hillman 1997, entire). Watson and Hillman (1997, pp. 247-250) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993, pp. 4-6), bull trout should not be expected to simultaneously occupy all available habitats.

Migratory corridors link seasonal habitats for all bull trout life histories. The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993, p. 2). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed or stray to nonnatal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants. However, it is important to note that the genetic structuring of bull trout indicates there is limited gene flow among bull trout populations, which may encourage local adaptation within individual populations, and that reestablishment of extirpated populations may take a long time (Rieman and McIntyre 1993, p. 2; Spruell et al. 1999, entire). Migration also allows bull trout to access more abundant or larger prey, which facilitates growth and reproduction. Additional benefits of migration and its relationship to foraging are discussed below under “Diet.”

Cold water temperatures play an important role in determining bull trout habitat quality, as these fish are primarily found in colder streams, and spawning habitats are generally characterized by temperatures that drop below 9 °C in the fall (Fraley and Shepard 1989, p. 137; Pratt 1992, p. 5; Rieman and McIntyre 1993, p. 2).

Thermal requirements for bull trout appear to differ at different life stages. Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, pp. 7-8; Rieman and McIntyre 1993, p. 7). Optimum incubation temperatures for bull trout eggs range from 2 °C to 6 °C, whereas optimum water temperatures for rearing range from about 6 °C to 10 °C (Buchanan and Gregory 1997, p. 4; Goetz 1989, p. 22). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996, entire) observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 °C to 9 °C, within a temperature gradient of 8 °C to 15 °C. In a landscape study relating bull trout distribution to maximum water temperatures, Dunham et al. (2003, p. 900) found that the probability of juvenile bull trout occurrence does not become high (i.e., greater than 0.75) until maximum temperatures decline to 11 °C to 12 °C.

Although bull trout are found primarily in cold streams, occasionally these fish are found in larger, warmer river systems throughout the Columbia River basin (Buchanan and Gregory 1997, p. 2; Fraley and Shepard 1989, pp. 133, 135; Rieman and McIntyre 1993, pp. 3-4; Rieman and McIntyre 1995, p. 287). Availability and proximity of cold water patches and food productivity can influence bull trout ability to survive in warmer rivers (Myrick et al. 2002, pp. 6, 13).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989, p. 137; Goetz 1989, p. 19; Hoelscher and Bjornn 1989, p. 38; Pratt 1992, entire; Rich 1996, pp. 4-5; Sedell and Everest 1991, entire; Sexauer and James 1997, entire; Thomas 1992, pp. 4-6; Watson and Hillman 1997, p. 238). Maintaining bull trout habitat requires stable and complex stream channels and stable stream flows (Rieman and McIntyre 1993, pp. 5-6). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997, p. 364). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989, p. 141; Pratt 1992, p. 6; Pratt and Huston 1993, p. 70). Pratt (1992, p. 6) indicated that increases in fine sediment reduce egg survival and emergence.

Diet

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Fish growth depends on the quantity and quality of food that is eaten, and as fish grow their foraging strategy changes as their food changes, in quantity, size, or other characteristics. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987, p. 58; Donald and Alger 1993, pp. 242-243; Goetz 1989, pp. 33-34). Subadult and adult migratory bull trout generally feed on various fish species (Donald and Alger 1993, pp. 241-243; Fraley and Shepard 1989, pp. 135, 138; Leathe and Graham 1982, pp. 13, 50-56). Bull trout of all sizes other than fry have been found to eat fish half their length (Beauchamp and Van Tassell 2001, p. 204). In nearshore marine areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) (Goetz et al. 2004, p. 105; Washington Department of Fish and Wildlife 1997, p. 23).

Bull trout migration and life history strategies are closely related to their feeding and foraging strategies and their environment. Migration allows bull trout to access optimal foraging areas and exploit a wider variety of prey resources both within and between core areas. Connectivity between the spawning, rearing, overwintering, and forage areas maintains this diversity. There have been recent studies documenting movement patterns in the Columbia River basin that document long distance migrations (Barrows et al. 2016b, entire; Schaller et al. 2014, entire). For example, a data report documented a juvenile bull trout from the Entiat made over a 322-km (200-mi) migration between spawning grounds in the Entiat River to foraging and overwintering areas in Columbia and Yakima River near Prosser Dam (PTAGIS 2015, Tag Code 3D9.1C2CCD42DD). In the Skagit River system, anadromous bull trout similarly make migrations as long as 195 km (121 mi) between marine foraging areas in Puget Sound and headwater spawning grounds, foraging on salmon eggs and juvenile salmon along their migration route (Washington Department of Fish and Wildlife 1997, p. 25). Anadromous bull trout also use marine waters as migration corridors to reach seasonal habitats in non-natal watersheds to forage and possibly overwinter (Brenkman and Corbett 2005, pp. 1078-1079; Goetz et al. 2004, entire).

4.1.4 Conservation Needs

The 2015 recovery plan 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 recovery units; (2) effectively manage and ameliorate the primary threats in each of six recovery units 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 2002, 2004a, 2004b) provided information that identified the original list of threats and recovery actions across the range of the species and provided 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 recovery plan in 2015.

The 2015 bull trout recovery plan (USFWS 2015f, 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 range of the coterminous bull trout listing.

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 2015f, pp. 45-46).

To implement the recovery strategy, the bull trout recovery plan establishes the recovery of bull trout will entail effectively managing threats to ensure the long-term persistence of populations and their habitats, ensuring the security of multiple interacting groups of bull trout, and providing habitat conditions and access to them that allow for the expression of various life history forms within each of six recovery units (USFWS 2015f, pp. 50-51)." The recovery plan defines four categories of recovery actions that, when implemented and effective, should:

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; and
4. Result in actively working 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 (USFWS 2015f, pp. 50-51).

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) Upper Snake Recovery Unit; (5) Columbia Headwaters Recovery Unit; and (6) Saint Mary Recovery Unit (USFWS 2015f, 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 2015f, p. 33).

Each of the six recovery units contain multiple bull trout recovery areas which are non-overlapping watershed-based polygons, and each core area includes one or more local population. Currently there are 109 occupied core areas, which comprise 611 local populations (USFWS 2015f, p. 3, 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 2015f, p. 3, Appendix F). Core areas can be further described as complex or simple (USFWS 2015f, pp. 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 (FMO) habitat. 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 2015f, 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.

4.1.5 Population Units

The final bull trout recovery plan (USFWS 2015f, entire) designates six bull trout recovery units as described above. The Service will address the conservation of these final recovery units in our section 7(a)(2) analysis for proposed Federal actions. The recovery plan (USFWS 2015f, entire), identified threats and factors affecting the bull trout within these units. A detailed description of recovery implementation for each recovery unit is provided in separate RUIPs (USFWS 2015b; 2015c; 2015d; 2015e; 2015g; 2015h), which identify recovery actions and conservation recommendations needed for each core area, FMO areas, historical core areas, and research needs areas. Each of the following recovery units (below) is necessary to maintain the bull trout's numbers and distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions. For more details on Federal, State, and tribal conservation actions in this unit see the actions since listing, contemporaneous actions, and environmental baseline discussions below.

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 geographic 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 historical Clackamas River core area where bull trout had been extirpated and were reintroduced in 2011. This RU also has four historically occupied core areas that could be re-established (USFWS 2015b, p. A-2; USFWS 2015f, p. 47).

Although population strongholds do exist across the three regions, populations in the Puget Sound region generally have better demographic status while the Lower Columbia River region exhibits the least robust demography (USFWS 2015f, p. A-6). Puget Sound and the Olympic Peninsula currently support the only anadromous local populations of bull trout. This recovery unit also contains 10 shared FMO habitats which allow for the continued natural population dynamics in which the core areas have evolved (USFWS 2015b, p. A-5). 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 2015b, p. A-3;

USFWS 2015f, p. 79). These are the most stable and abundant bull trout populations in the RU. The Puget Sound region supports at least two core areas containing a natural adfluvial life history.

The demographic status of the Puget Sound populations is better in northern areas. Barriers to migration in the Puget Sound region are few, and significant amounts of headwater habitat occur in protected areas (USFWS 2015b, p. A-7). 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 instream 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, instream 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 (USFWS 2015b, pp. A-1-A-25). Conservation measures or recovery actions implemented or ongoing 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 (USFWS 2015b, p. A33-A34).

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 2015d, entire). The Klamath 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 2015f, p. 39). This RU currently contains three core areas and eight local populations (USFWS 2015d, p. B-1; USFWS 2015f, p. 47). Nine historical local populations of bull trout have become extirpated (USFWS 2015d, p. B-1). All three core areas have been isolated from other bull trout populations for the past 10,000 years (USFWS 2015d, 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 (USFWS 2015d, pp. B13-B14). Conservation measures or recovery actions implemented include removing 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, replacing culverts, and restoring habitat (USFWS 2015d, pp. B10-B11).

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 2015e, 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, 2 historically occupied core areas, 1 research needs area, and 7 FMO habitats (USFWS 2015e, pp. C1-C4; USFWS 2015f, p. 47). 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 (USFWS 2015e, pp. C9-C34). 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 (USFWS 2015e, pp. C37-C40).

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 2015c, entire). The Columbia Headwaters RU is located in western Montana, northern Idaho, and the northeastern corner of Washington. The Columbia Headwaters RU is divided into five geographic regions: Upper Clark Fork, Lower Clark Fork, Flathead, Kootenai, and Coeur d'Alene geographic regions (USFWS 2015c, pp. D2-D4). 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 2015c, p. D-1). Fish passage improvements within the RU have reconnected some previously fragmented habitats (USFWS 2015c, p. D-42), while others remain fragmented. Unlike the other RUs in Washington, Idaho, and Oregon, the Columbia Headwaters RU does not have any anadromous fish overlap (USFWS 2015c, p. D-42). Therefore, bull trout within the Columbia Headwaters RU do not benefit from the recovery actions for salmon (USFWS 2015c, p. D-42). 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 (USFWS 2015c, pp. D10-D25). Conservation measures or recovery actions implemented include habitat improvement, fish passage, and removal of nonnative species (USFWS 2015c, pp. D42-D43).

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 2015h, 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 (the South Fork Boise River is part of the action area), Payette River, Little Lost River, Malheur River, Jarbidge River, and Weiser River. This RU contains 22 core areas and 207 local populations (USFWS 2015f, p. 47; USFWS 2015h, pp. E1-E2). 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) (USFWS 2015h, pp. E15-E18). Conservation measures or recovery actions implemented include in-stream habitat restoration, in-stream flow requirements, screening of irrigation diversions, and riparian restoration (USFWS 2015h, pp. E19-E20).

Saint Mary Recovery Unit

The Saint 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, entire). 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 Saint 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 and seven local populations (USFWS 2015g, p. F-1) in the U.S. headwaters. 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, instream flows), and, to a lesser extent habitat impacts from development and nonnative species (USFWS 2015g, pp. F7-F8). Conservation measures or recovery actions implemented or ongoing are not identified in the St. Mary RUIP; however, the Service is conducting interagency and tribal coordination to accomplish conservation goals for the bull trout (USFWS 2015g, p. F-9).

4.1.6 Federal, State, and Tribal Actions Since Listing

Since listing of the 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 affected 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 (BMPs) 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, it is necessary to continue ongoing fisheries management efforts to suppress the effects of nonnative fish competition, predation, or hybridization (particularly brown trout, brook trout, lake trout, and northern pike) (DeHaan and Godfrey 2009; Fredenberg et al. 2007). A more comprehensive overview of conservation successes from 1999-2013, described for each RU, is found in the Summary of Bull Trout Conservation Successes and Actions since 1999 (available at https://docslib.org/doc/2858051/usfws-u-s-fish-and-wildlife-service-2013-summary-of-bull-trout-conservation-successes-and-actions-since-1999).

Projects that have undergone section 7 consultation have occurred throughout the range of bull trout. Singly or in aggregate, these projects could affect the species' status. The Service has conducted periodic reviews of prior Federal "consulted-on" actions. A discussion of consulted-on effects in the proposed action area is provided in the environmental baseline section below.

APPENDIX B: BULL TROUT CRITICAL HABITAT

5.1 Status of Critical Habitat

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

5.1.1 Legal Status

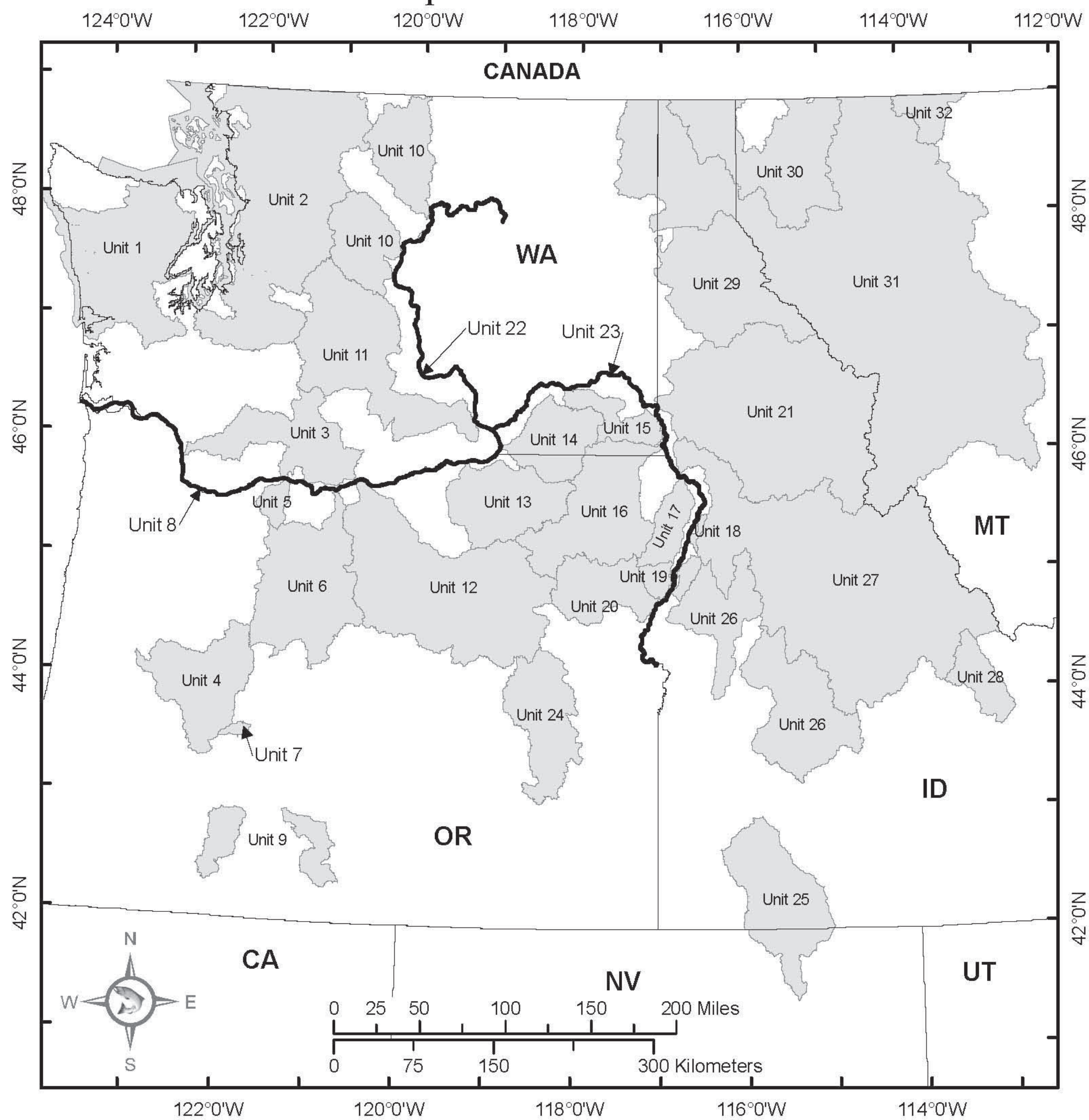
The Service published a final critical habitat designation for the coterminous United States population of the bull trout on October 18, 2010 (75 FR 63898); the rule became effective on November 17, 2010. Critical habitat is defined as the specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery. Designated critical habitat units (CHUs) for the bull trout are identified in Figure 8. A justification document that describes occupancy and the rationale for why these habitat areas are essential for the conservation of bull trout was developed to support the rule and is available on our website (https://www.regulations.gov/document/FWS-R1-ES-2009-0085-0425).

The scope of the designation involved the species' coterminous range. Rangewide, the Service designated reservoirs/lakes and stream/shoreline miles as bull trout critical habitat (Table 1). Designated bull trout critical habitat is of two primary use types: (1) spawning and rearing and (2) foraging, migration, and overwintering (FMO).

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

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

Index Map: Critical Habitat Units



1	Olympic Peninsula	11	Yakima River	22	Mainstem Upper Columbia River
2	Puget Sound	12	John Day River	23	Mainstem Snake River
3	Lower Columbia River Basins	13	Umatilla River	24	Malheur River Basin
4	Upper Willamette River	14	Walla Walla River Basin	25	Jarbidge River
5	Hood River	15	Lower Snake River Basins	26	Southwest Idaho River Basins
6	Lower Deschutes River	16	Grande Ronde River	27	Salmon River Basin
7	Odell Lake	17	Imnaha River	28	Little Lost River
8	Mainstem Lower Columbia River	18	Sheep / Granite Creeks	29	Coeur d'Alene River Basin
9	Klamath River Basin	19	Hells Canyon Complex	30	Kootenai River Basin
10	Upper Columbia River Basins	20	Powder River Basin	31	Clark Fork River Basin
		21	Clearwater River	32	Saint Mary River Basin

Figure B-1: Index map of bull trout designated critical habitat units.

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. 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 critical habitat 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 issued under section 10(a)(1)(B) of the Act, in which bull trout is a covered species on or before the publication of this final rule; (2) waters within or adjacent to Tribal lands subject to certain commitments to conserve bull trout or a conservation program that provides aquatic resource protection and restoration through collaborative efforts, and where the Tribes indicated that inclusion would impair their relationship with the Service; or (3) waters where impacts to national security have been identified (75 FR 63898). Excluded areas are approximately 10 percent of the stream/shoreline miles and 4 percent of the lakes and reservoir acreage of designated critical habitat. Each excluded area is identified in the relevant CHU text, as identified in paragraphs (e)(8) through (e)(41) of the final rule. Fewer than 3,220 stream kilometers (2,000 miles) and 8,100 hectares (20,000 acres) of lake and reservoir surface area were excluded from the designation of critical habitat. 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, nor reduce authorities that protect the species under the Act. Because exclusions reflect the often complex pattern of land ownership, designated critical habitat is often fragmented and interspersed with excluded stream segments.

5.1.2 Conservation Role and Description of Critical Habitat

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

As shown in Figure 8, 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 (PBFs) 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 associated with PBFs 5 and 6, which relate to breeding habitat.

The primary function of individual CHUs is to maintain and support core areas, which (1) contain bull trout populations with the demographic characteristics needed to ensure their persistence and contain the habitat needed to sustain those characteristics (Rieman and McIntyre 1993, p. 19); (2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); (3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (Hard 1995, pp. 314-315; Healey and Prince 1995, p. 182; MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); and (4) are distributed throughout the historical range of the species to preserve both genetic and phenotypic adaptations (Hard 1995, pp. 321-322; MBTSG 1998, pp. 13-16; Rieman and Allendorf 2001, p. 763; Rieman and McIntyre 1993, p. 23).

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, migration, and overwintering.

Physical or Biological Features for Bull Trout Critical Habitat

Within the designated critical habitat areas, the PBFs for bull trout are those components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. Based on our current knowledge of the life history, biology, and ecology of the bull trout and the characteristics of the habitat necessary to sustain its essential life-history functions, we determined in our final designation that the following PBFs are essential for the conservation of bull trout.

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 historical 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 (*Sander vitreus*), northern pike, smallmouth bass (*Micropterus dolomieu*)); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

PBF 9 addresses the presence of nonnative predatory or competitive fish species. Although this PBF applies to both the freshwater and marine environments, currently no non-native fish species are of concern in the marine environment, though this could change in the future.

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

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

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

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

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

5.1.3 Current Critical Habitat Condition Rangewide

The condition of bull trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historical range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (67 FR 71240, November 29, 2002). The condition of bull trout reflects the condition of bull trout habitat. The decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and the introduction of nonnative species (63 FR 31647, June 10, 1998; 64 FR 17112, April 8, 1999).

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded 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; and
5. Degradation of overwintering habitat resulting from reduced prey base, roads, agriculture, development, and dams.