# United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503

DEC - 3 2012

In Reply Refer To:
**01EWFW00-2013-F-0060**

Mr. Robert Turner, Assistant Regional Administrator
National Marine Fisheries Service; Northwest Region
Salmon Management Division
ATTN: Tim Tynan, Senior Fish Biologist
Production and Inland Fisheries Branch
7600 Sand Point Way N.E.; building 1
Seattle, Washington 98115

Dear Mr. Turner:

Subject: Elwha River Salmon and Steelhead Hatchery Programs.

This document transmits the U.S. Fish and Wildlife Service's (USFWS) Biological Opinion (Opinion) based on our review of the proposed determination that operation, maintenance, monitoring, and evaluation of the five Elwha River salmon and steelhead hatchery programs are consistent with provisions under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*)(ESA), and our review of the effects on bull trout (*Salvelinus confluentus*) and its designated critical habitat. Specifically, the National Marine Fisheries Service (NMFS) proposes to determine that the Elwha River salmon and steelhead hatchery programs are consistent with provisions under "Limit 6" of the ESA section 4(d) Special Rule for listed Puget Sound Chinook salmon and Puget Sound steelhead. The proposed action also includes related actions undertaken or funded by the Washington Department of Fish and Wildlife, the Lower Elwha Klallam Tribe, the National Park Service, the Bureau of Indian Affairs, and the USFWS. The enclosed Opinion addresses the adverse effects to bull trout associated with these and other operation-related activities. The Elwha River Basin and its tributaries are found in Clallam and Jefferson Counties, Washington, on the Olympic Peninsula. This consultation is being conducted in accordance with section 7 of the ESA. Your November 28, 2012, request for formal consultation was received on November 28, 2012.

Although the NMFS determined that the proposed action is not likely to adversely affect bull trout or critical habitat designated for bull trout, the USFWS has concluded that adverse effects are likely to occur and addresses those adverse effects in the enclosed Opinion.

You also requested concurrence with your determination that the proposed action "may affect, but is not likely to adversely affect": Taylor's Checkerspot Butterfly (*Euphydryas editha taylori*); (Olympic) Mazama pocket gopher (*Thomomys mazama* ssp. *melanops*); pacific fisher (*Martes pennanti pacifica*); northern spotted owl (*Strix occidentalis caurina*) and its designated critical habitat; marbled murrelet (*Brachyramphus marmoratus*) and its designated critical habitat; and whitebark pine (*Pinus albicaulis*). We hereby concur with your determinations for the reasons stated in the enclosed Opinion.

This Opinion is based on information provided in the November 20, 2012, Biological Assessment; discussions with technical staff from various Federal agencies and the Lower Elwha Klallam Tribe; and additional information. The enclosed Opinion addresses the adverse effects to bull trout associated with these and other operation- and maintenance-related activities. A complete record of this consultation is on file at the USFWS Office in Lacey, Washington

If you have any questions about this letter or our joint responsibilities under the ESA, please contact Bill Vogel at (360) 753-4367 or Carolyn Scafidi at (360) 753-4068, of this office.

Sincerely,

FOR Ken S. Berg, Manager
Washington Fish and Wildlife Office

Endangered Species Act – Section 7 Formal Consultation

# Biological Opinion

Determination that Operation, Maintenance, and Monitoring and Evaluation of Five Elwha River Salmon and Steelhead Hatchery Programs are Consistent with Provisions under Limit 6 of the ESA Section 4(d) Special Rule for Listed Puget Sound Chinook Salmon and Puget Sound Steelhead.

Clallam and Jefferson Counties, Washington

Project Location: Elwha River Basin

**USFWS Reference Number:**

**01EWFW00-2013-F-0060**

Agency:

National Marine Fisheries Service, U.S. Department of Commerce;
National Park Service, U.S. Department of Interior;
Bureau of Indian Affairs, U.S. Department of Interior; and
U.S. Fish and Wildlife Service, U.S. Department of Interior

Consultation Conducted by:

U.S. Fish and Wildlife Service
Washington Fish and Wildlife Office
Lacey, Washington

For Ken S. Berg, Manager
Washington Fish and Wildlife Office

3 December 2012
Date

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## LIST OF ABBREVIATIONS AND ACROYNMS

| | |
|---|---|
| BA | Biological Assessment |
| BIA | Bureau of Indian Affairs |
| BMPs | Best Management Practices |
| cfs | Cubic Feet per Second |
| EMG | Evaluation and Monitoring Group |
| ERFRP | Elwha River Fish Restoration Program |
| ESA | Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) |
| ffp | Fish Per Pound |
| FNU | Formazin Nephelometric Units |
| gpm | Gallons Per Minute |
| HGMP | Hatchery and Genetic Management Plan |
| HSRG | Hatchery Scientific Review Group |
| LEKT | Lower Elwha Klallam Tribe |
| NMFS | National Marine Fisheries Service |
| NPS | National Park Service |
| NTU | Nephelometric Turbidity Units |
| PCEs | Primary Constituent Element |
| USFWS | U.S. Fish & Wildlife Service |
| VSP | Viable Salmonid Population |
| WDFW | Washington Department of Fish and Wildlife |
| WDOE | Washington State Department of Ecology |
| WDNR | Washington State Department of Natural Resources |

## INTRODUCTION

The U. S. Fish and Wildlife Service's (USFWS) Biological Opinion (Opinion) is based on our review of the proposed determination by the National Marine Fisheries Service (NMFS) that operation, maintenance, monitoring, and evaluation of the five Elwha River salmon and steelhead hatchery programs are consistent with provisions under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*)(ESA), and of actions by the National Park Service (NPS), the Bureau of Indian Affairs (BIA), and the USFWS that are related to that determination. This Opinion is also based upon our review of the effects these actions will have upon bull trout (*Salvelinus confluentus*) and its designated critical habitat, in accordance with section 7 of the ESA. Specifically, the NMFS proposes to determine the programs are consistent with provisions under "Limit 6" of the ESA section 4(d) Special Rule for listed Puget Sound Chinook salmon and Puget Sound steelhead.

A 4(d) Special Rule establishes protective regulations that apply to a species listed as threatened under the ESA. These protective regulations for threatened species may include any or all of the ESA section 9 prohibitions against take (e.g., harming or killing) of a listed species that apply automatically to protect endangered species. In addition, they may contain specific proscriptions or limitations instead of, or in addition to, the general prohibitions against take of a listed species. Thus, a 4(d) Special Rule can "limit" or restrict the application of its own prohibitions so long as other proscriptions or protective programs adequately protect the listed species. Incorporating such "limits" into a 4(d) Special Rule can be advantageous to NMFS, state agencies, Tribes, government entities, and other parties. Activities carried out in accordance with 4(d) Special Rule limits can help protect threatened species and their habitats while relieving state agencies, government entities, tribes and other parties from liability for "take" that could result from those activities.

With regard to the 4(d) Special Rule for Puget Sound Chinook salmon and Puget Sound steelhead (50 CFR 223.203), NMFS included Limit No. 6 on the take prohibitions to accommodate any resource-management plan developed jointly by the States and the Tribes (joint plan) under the jurisdiction of *United States v. Washington* or *United States v. Oregon.* Such a joint plan would be developed and reviewed under the government-to-government processes.

If a joint plan involves artificial propagation, then it must comply with Limit 5 as well. Under Limit 5, a state or Federal hatchery-management agency can develop a Hatchery and Genetics Management Plan (HGMP) and seek NMFS' approval. Some of the benefits of the HGMP approach are long-term management planning, more public involvement, and less government paperwork. NMFS will use the same standard to evaluate HGMPs as those used for section 10 permits: the hatchery program must not jeopardize listed salmon and steelhead, nor lessen the protection they receive. In the HGMPs, hatcheries will be managed according to the listed fishes' status. This will be determined using the concept of "Viable Salmonid Populations" (VSP). An HGMP must address the specific criteria outlined in the 4(d) Special Rule (50 CFR 223.203(b)(5)).

The proposed determination also includes related actions undertaken or funded by Washington Department of Fish and Wildlife (WDFW), Lower Elwha Klallam Tribe (LEKT), National Park Service (NPS), Bureau of Indian Affairs (BIA), and USFWS. Therefore, the proposed actions analyzed in this opinion are: (1) NMFS's determination under limit 6 of the ESA 4(d) Special Rules for listed Puget Sound Chinook salmon and listed Puget Sound steelhead (50 CFR § 223.203(b)(6)) concerning the LEKT and WDFW hatchery programs on the Elwha River; (2) BIA's ongoing disbursement of funds for operation and maintenance of the LEKT hatchery; (3) NPS's participation in funding, authorizations, and other actions in support of the LEKT and WDFW hatchery programs on the Elwha River; and (4) USFWS's participation in funding and other actions in support of the LEKT and WDFW hatchery programs on the Elwha River. The enclosed Opinion addresses the adverse effects to bull trout associated with these and other operation-related activities.

## CONSULTATION HISTORY

In 1996, the NPS consulted with the USFWS (which prepared a Biological Assessment (BA) for the NPS in April 1996) concerning impacts resulting from the entire Elwha River Fish Restoration Project (Project)(ERFRP), including the construction of the water-supply facilities (i.e., Elwha Water Facilities), expansion of the tribal hatchery, and hatchery fish outplanting. The USFWS completed the initial Biological Opinion (Opinion) for the Project in 1996, covering effects of dam deconstruction and related actions on the bald eagle (*Haliaeetus leucocephalus*), marbled murrelet (*Brachyramphus marmoratus*), peregrine falcon (*Falco peregrines*), and northern spotted owl (*Strix occidentalis caurina*).

In approximately 1999, the NPS re-initiated consultation with the USFWS because of changes to the Elwha project. On February 24, 2000, the USFWS issued a revised Opinion which addressed potential impacts of the Project on the then recently listed bull trout. The revised Opinion was based upon information provided in a number of documents, including the project's environmental impact statements (EIS) (USDI 1995; USDI 1996), the USFWS's Opinion (USFWS 1996), and other relevant information. In its February 2000 Opinion, the USFWS found that that no new effects would result from project changes and that the project would not result in jeopardy for the listed populations in the Elwha River watershed, including bull trout, as they would benefit over the long term through dam removal (USFWS 1996; 2000).

In 2005, the NPS initiated consultation with the NMFS for the entire Elwha River Restoration Project, and submitted a BA concerning its impacts, including construction of the Elwha Water Facilities, relocation of the tribal hatchery, and hatchery fish outplanting. In 2006, the NMFS issued its Opinion (NMFS 2006) addressing all of these activities, as well as broodstock collection of Chinook required as mitigation for dam-removal effects.

The NPS reinitiated Section 7 consultation with the USFWS in 2006 based upon changes in actions that were evaluated in a supplemental environmental impact statement (USDI 2005), but the USFWS determined that the changes in the project did not require an update to the original Opinion. The NPS consultation documents included evaluations of the effects on listed species of the construction of municipal and industrial water intake and withdrawal facilities and construction of the Lower Elwha Fish Hatchery as a salmon and steelhead population loss mitigation measure. The NPS also included general descriptions of supportive breeding actions which were the same as those later proposed in the ERFRP (Ward et al. 2008) to mitigate for the effects of dam deconstruction activities. However, the consultations did not specifically evaluate the effects of the operation of breeding programs for Elwha River watershed salmon and steelhead (e.g., hatchery fish release effects) on the listed species under USFWS regulatory purview.

In 2009, the NPS re-initiated consultation with the USFWS concerning helicopter outplanting of salmon on listed terrestrial species. Other effects, such as use of blasting instead of diamond-wire saw cutting as a method for dam removal, were also analyzed. In 2010, the USFWS revised the previous letter of concurrence and three previous Opinions to incorporate changes to the project description, new information, and improved analysis (USFWS 2010). In February of 2011, the USFWS (2011) conducted a reinitiation of their previous Opinion concerning effects to bull trout critical habitat related to changes in the critical habitat designation.

In 2012, the NPS requested re-initiation of the consultation with the NMFS, and the NMFS's resulting Opinion (NMFS 2012) reanalyzed take for Chinook salmon and included an effect analysis and incidental take exemption for steelhead.

During the week of November 26, 2012, Andy Ritchie (NPS) and Richard Bauman (Bureau of Reclamation) provided additional information regarding the status of sediment movement within the Elwha River System. Preparation of this Opinion was also assisted by discussions with technical staff from various Federal agencies and the Lower Elwha Klallam Tribe. The consultation also includes electronic mail between USFWS staff, and other agencies with clarifying information.

A letter, dated November 28, 2012, requesting formal consultation and transmitting a November 20, 2012, biological Assessment (BA) was received in our office on November 28, 2012. Formal consultation was initiated on November 28, 2012. A complete record of this consultation is on file at the USFWS's Washington Fish and Wildlife Office in Lacey, Washington.

## CONCURRENCES/NO EFFECT DETERMINATIONS

For the reasons discussed below, and presented in the BA on pages 42 to 43,we concur that the proposed actions will have no effect or are not likely to adversely affect the following terrestrial species and will not adversely affect critical habitat designated for the bull trout, the marbled murrelet, and the northern spotted owl:

**Northern Spotted Owl** (*Strix occidentalis caurina*)

According to the NMFS, none of the proposed actions, with the exception of redd or spawner surveys, will occur within or adjacent to northern spotted owl nesting, roosting, and foraging habitat. Dispersal habitat is also unlikely to be present near these activities/facilities. The proposed actions are extremely unlikely to affect terrestrial habitats to a measurable degree. Any increases in nutrients provided to upland habitats from returning adult salmon and through various pathways of nutrient transport would be within the range of natural conditions and are unlikely to have adverse effects to habitats or species in upland forests.  Therefore, effects to the northern spotted owls are considered discountable.

**Critical Habitat for the Northern Spotted Owl**

According to the NMFS, none of the proposed actions, with the exception of redd or spawner surveys, will occur within or adjacent to designated critical habitat for the northern spotted owl. The proposed actions are extremely unlikely to affect terrestrial habitats to a measurable degree. Any increases in nutrients provided to upland habitats from returning adult salmon and through various pathways of nutrient transport would be within the range of natural conditions and are unlikely to have adverse effects to the primary constituent elements.  Therefore, effects to designated critical habitat for the northern spotted owl are considered discountable.

**Marbled Murrelet** (*Brachyramphus marmoratus*)

According to the NMFS, none of the proposed actions, with the exception of redd or spawner surveys, will occur within or adjacent to marbled murrelet nesting habitat.  The proposed actions are extremely unlikely to affect terrestrial habitats to a measurable degree.  Any increases in nutrients provided to upland habitats from returning adult salmon and through various pathways of nutrient transport would be within the range of natural conditions and are unlikely to have adverse effects to habitats or species in upland forests.  Therefore, effects to the marbled murrelets from the proposed action are considered discountable.

Foraging habitat is also unlikely to be present near these facilities and release sites.  Release of and resulting improvement in stocks of the five subject salmonid species may increase the predation of marine forage fish utilized by the marbled murrelet.  The potential for effects to marine forage fish is discussed later in this document.  There are a large number of factors affecting populations of marine forage fish and availability.  Many of these factors are complicated and beyond the scope of this action.  For instance, many predators of forage fish would also feed on young salmonids, thereby reducing predation pressure on forage fish.  We believe that any project-related decreases in the numbers or availability of marine forage fish would be speculative and not measurable.  Therefore, effects to prey availability and foraging marbled murrelets are considered to be insignificant.

**Critical Habitat for the Marbled Murrelet**

According to the NMFS, none of the proposed actions, with the exception of redd or spawner surveys, will occur within or adjacent to designated critical habitat for the marbled murrelet.  The proposed actions are extremely unlikely to affect terrestrial habitats to a measurable degree.  Any increases in nutrients provided to upland habitats from returning adult salmon and through various pathways of nutrient transport would be within the range of natural conditions and are unlikely to have adverse effects to the primary constituent elements.  Therefore, effects to designated critical habitat for the marbled murrelet are considered discountable.

## CANDIDATES AND PROPOSED SPECIES

**Pacific Fisher** (*Martes pennanti pacifica*)

The pacific fisher is a Federal candidate species. Proposed actions are not likely to occur within or adjacent to fisher denning habitat as most activities will occur in developed areas and at established facilities. The proposed actions are extremely unlikely to affect terrestrial habitats to a measurable degree. Any increases in nutrients provided to upland habitats from returning adult salmon and through various pathways of nutrient transport would be within the range of natural conditions and are unlikely to have adverse effects to habitats or species in upland forests. Based on the information provided, we do not anticipate any of the proposed actions to adversely affect the pacific fisher or its habitat or contribute to the need to list the species.

**Mazama Pocket Gopher** (*Thomomys mazama* ssp. *melanops*)

The Mazama pocket gopher is a Federal candidate species. Proposed actions are not likely to occur within or adjacent to gopher habitat as most activities will occur in developed areas and in established facilities. No degradation of subalpine meadows is anticipated as a result of the proposed actions. The proposed actions are extremely unlikely to affect terrestrial habitats to a measurable degree. Any increases in nutrients provided to upland habitats from returning adult salmon and through various pathways of nutrient transport would be within the range of natural conditions and are unlikely to have adverse effects to habitats or species in upland grasslands. Based on the information provided, we do not anticipate any of the proposed actions to affect the Olympic subspecies of the Mazama pocket gopher or its habitat or contribute to the need to list the species.

**Taylor’s Checkerspot Butterfly** (*Euphydryas editha taylori*)

The Taylor’s checkerspot butterfly is a proposed species. Proposed actions are not likely to occur within or adjacent to Taylor’s checkerspot habitat as most activities will occur in developed areas and in established facilities. No degradation of open meadow habitats or balds is anticipated as a result of the proposed actions. The proposed actions are extremely unlikely to affect terrestrial habitats to a measurable degree. Any increases in nutrients provided to upland habitats from returning adult salmon and through various pathways of nutrient transport would be within the range of natural conditions and are unlikely to have adverse effects to habitats or species in upland habitats. Based on the information provided, we do not anticipate any of the proposed actions to affect the Taylor’s Checkerspot butterfly or its habitat or contribute to the need to list the species.

**Whitebark Pine** (*Pinus albicaulis*)

The whitebark pine is a Federal candidate species. The proposed actions do not include any removal of forests or any adjustments in land use. None of the actions are anticipated to increase any of the threats to whitebark pine such as diseases. Based on the information provided, we do not anticipate any of the proposed actions to affect the whitebark pine or its habitat or contribute to the need to list the species.

# BIOLOGICAL OPINION

## DESCRIPTION OF THE PROPOSED ACTION

### Background

The proposed action is a NMFS determination whether hatchery programs jointly operated by WDFW and the LEKT in the Elwha River watershed adequately address the criteria established for Limit 6 of the ESA 4(d) Special Rule for the listed Puget Sound Chinook salmon Evolutionarily Significant Unit (ESU) and listed Puget Sound steelhead Distinct Population Segment (DPS). The proposed action also includes funding and ancillary activities by the NPS, BIA, and USFWS that are associated with these hatchery programs. The effects of these actions on bull trout are entirely encompassed by the effects of NMFS's determination. The NMFS's determination will be made for two on-going hatchery programs that release ESA-listed Chinook salmon and steelhead and three on-going programs that release non-ESA listed coho, fall chum, and pink salmon into the Elwha River watershed (Table 1). The determination would authorize the continued operation of the hatchery programs through the preservation and re-colonization phases of fish restoration in the Elwha River, commensurate with the complete removal of the Glines Canyon dam, and the watershed recovers from dam-removal effects (removal of both the Elwha and Glines Canyon dams). All activities necessary for brood stock collection; incubation; rearing; release; facility maintenance; and research, monitoring and evaluation of Elwha River salmon and steelhead at sites and facilities affiliated with these sites would be authorized through the NMFS determination.

Table 1. Joint State/Tribal Elwha River watershed Hatchery and Genetic Management Plans (HGMPs) and the primary program operators.

| Hatchery and Genetics Management Plan | Program Operator |
|---|---|
| Elwha Channel Hatchery Chinook Salmon | WDFW |
| Lower Elwha Hatchery Native Steelhead | LEKT |
| Lower Elwha Hatchery Coho Salmon | LEKT |
| Lower Elwha Hatchery Chum Salmon | LEKT |
| Elwha River Odd and Even Year Pink Salmon | LEKT and WDFW |

The WDFW and LEKT have operated salmon and steelhead hatchery programs in the lower portion of the Elwha River watershed for decades. Artificial propagation of the Elwha River Chinook salmon population commenced in 1914, with consistent, annual fish releases supported by WDFW's Dungeness Hatchery beginning in 1953. Initial juvenile Chinook salmon releases from WDFW's Elwha Channel Hatchery site began in 1974 and continue through the present. Consistent year-to-year releases of juvenile coho salmon, steelhead, and fall chum salmon from the LEKT's initial hatchery location on the lower Elwha River near the estuary began shortly after the Boldt Decision in 1976. The Tribe constructed a new hatchery (Lower Elwha Fish Hatchery) upstream of the initial site, and fish production and releases were moved entirely to the new location in 2010. On-station hatchery releases of steelhead by the Tribe were preceded by truck plants of the species by the Washington Department of Game (now included as part of WDFW) into the lower Elwha River for many years in the 1950s and 1960s (Ward et al. 2008; LEKT 2012a). Implemented for fisheries harvest-augmentation and stock-preservation purposes, the WDFW and LEKT hatchery programs were operated to partially mitigate for lost natural salmon and steelhead production resulting from the construction of the Elwha and Glines Canyon dams, which were built without upstream fish-passage capability at river miles (RM) 4.9 and 13.4, respectively, in the early part of the last century (1911 and 1927, respectively). Habitat loss and degradation resulting from construction of the dams greatly affected the distribution and abundance of all salmonid species native to the Elwha River, and played a major role in the decline in salmonid populations in the watershed (Ward et al. 2008; Pess et al. 2008).

In 1992, the U.S. Congress enacted the Elwha River Ecosystem and Fisheries Restoration Act (Public Law 102-495). The Elwha Act provided funding for the Federal acquisition of the two dams and required a specific plan to achieve full restoration of the Elwha River ecosystem and fisheries. The U.S. Department of the Interior and others subsequently published the Elwha Report, which found that only through removal of both dams could full restoration of native fish populations be achieved (USDI et al. 1994). Following the decision to remove the dams from the Elwha River were ESA listings by NMFS of two anadromous salmonid species present in the basin: the Puget Sound Chinook salmon (64 FR 14308, March 24, 1999) and the Puget Sound steelhead (72 FR 26722, May 11, 2007). Commensurate with the decision to remove the two Elwha dams, and following ESA listings of Chinook salmon and steelhead, the LEKT, NPS, WDFW, USFWS, and NMFS collaboratively developed a scientific framework for preserving and restoring anadromous fish populations in the Elwha River. Known as the Elwha River Fish Restoration Plan (ERFRP)(Ward et al. 2008), it identified the general multi-agency approach and scientific framework for preserving and restoring the remaining anadromous salmonid populations, including bull trout, for a 10-year period before, during, and after the process of dam removal using artificial propagation. The primary objective of the ERFRP is to provide information that can help reestablish self-sustaining anadromous salmonid populations and habitats. The ERFRP included suggested guidelines for implementing hatchery programs (see discussion on five HGMPs later in this document), and also suggested possible approaches to develop processes for monitoring and evaluating the effects and performance of the hatchery-based preservation and restoration efforts. The ERFRP is a working document that is subject to revision as appropriate and while it is not binding on NMFS' decision here it is informative on various hatchery issues.

The parties drafting the ERFRP recognized that restoration of anadromous fish populations would occur in the Elwha River in the absence of hatchery-based supportive breeding, although the time frame and fish population sources for natural recovery would be highly uncertain (Ward et al. 2008). The decision to use hatcheries was separate from the ERFRP. Hatchery use seemed prudent given the high risk that the release of stored sediments during dam removal could potentially cause extirpation of unique, threatened, or endangered native Elwha River salmon and steelhead populations that still persist in the watershed after blockage of the majority of the river and operation of the dams for 100 years. The desire to ensure that significant progress towards fish restoration occurred within a 20- to 30-year time frame also informed the decision to rely on supportive breeding programs for native fish species preservation and re-colonization. Identifying and developing the preferred role for the use of hatcheries in the recovery process resulted from extensive consultation with a wide range of scientists and managers in the region. Discussions focused on finding a balance between the goals of ecosystem restoration, preserving stocks of fish unique to the Elwha River, producing fish capable of successfully integrating into the natural environment, treaty obligations, and reducing the length of time necessary to preserve the remaining native stocks and achieve restoration of self-sustaining salmon and steelhead populations (Ward et al. 2008).

In 2012, the WDFW and the LEKT submitted revised versions of co-manager HGMPs for Elwha River Chinook, coho, fall chum, and pink salmon and steelhead populations (WDFW 2012; LEKT 2012a, 2012b, 2012c; LEKT and WDFW 2012) to the NMFS for ESA consultation. These revised versions of the plans were modified from previous draft HGMPs for the species originally submitted to the NMFS in 2005 and again in December 2011 in response to comments received in January 2012 from the Hatchery Scientific Review Group (HSRG 2102). The LEKT and WDFW requested a review of the plans by the HSRG prior to their submittal to the NMFS to help ensure that the plans would be scientifically defensible and meet program objectives. The hatchery plans submitted to NMFS for ESA review describe actions proposed for implementation for only the two earliest of the four phases of fish restoration – the preservation and re-colonization phases. The four phases of restoration were derived based on HSRG recommendations (HSRG 2012) and are defined for the purposes of the NMFS ESA-review processes as follows (from EMG 2012):

*Phase 1 - Preservation* – the period during dam removal when elevated suspended sediment concentrations are expected, at times, to be lethal to all fish in the river, resulting in a high probability of complete loss of native fish populations and their associated genetic and life history diversity if no protective measures are taken. Beginning with the start of dam removal in 2011, this phase is currently in progress. The goal of the Preservation Phase is to protect the existing genetic and life-history diversity of native salmonid populations until fish passage is restored and water turbidity is determined to be non-lethal to fish in the river.

*Phase 2 - Re-colonization*– the period after the dams are removed, passage is restored, and fish have access to refugia from lethal suspended-sediment concentrations, or suspended-sediment concentrations no longer reach lethal levels expected to negatively affect fish populations. The goal of the Re-colonization Phase is to ensure that salmonids are continually accessing habitats above the old dam sites with some fish spawning successfully and producing smolts.

*Phase 3 - Local Adaptation* – the period during which (1) sufficient numbers of spawning adults (e.g., meeting or exceeding minimum Viable Salmon Population (VSP) criteria [McElhaney et al. 2000, entire]) are accessing and using newly accessible habitats above the old dam sites and (2) fish are successfully spawning at a rate that allows for population growth. The goal of the Local Adaptation Phase is to maintain or increase life-history diversity of natural spawning populations through local adaptation to the Elwha River ecosystem until minimum levels of spawner abundance, productivity, and distribution are met.

*Phase 4 - Self-sustaining Exploitable Populations (full restoration)* – the period when all aspects of the previous stages are met, and viable, self-sustaining populations exist that can sustain fisheries harvest. The goal of the Self-sustaining Exploitable Population phase is to ensure that viable, self-sustaining and exploitable population levels continue once desired values for all VSP and habitat parameters have been met and hatchery programs are no longer needed to provide for protection, recovery, or exploitation.

The five 2012 co-manager HGMPs for the Elwha River basin (see Table 2) describe the proposed programs, actions, and effects evaluated in this Opinion for the span of the preservation and re-colonization phases of Elwha River fish restoration. Specific details regarding operation of each facet of the programs and estimated effects on listed fish species are included in the individual program HGMPs (LEKT 2012a, 2012b, 2012c; LEKT and WDFW 2012; WDFW 2012). Target annual juvenile fish production levels by species and life stage for each of the programs are summarized in Table 2. The immediate goal of the programs is to ensure that the extant salmon and steelhead populations in the Elwha River basin are not extirpated as a result of release of stored sediments behind the dams as they are removed. The goal after this preservation objective is to assist in the natural re-colonization of the species in the watershed as it recovers from dam removal effects and as properly functioning habitat conditions are restored.

Table 2. Proposed annual juvenile salmon and steelhead release levels by life stage and location for LEKT and WDFW hatchery programs located in the Elwha River watershed.

| Species | Program Operator | Location | Annual Release Number | Life Stage at Release |
|---|---|---|---|---|
| Native Winter-Run Steelhead | LEKT | Lower Elwha Fish Hatchery (RM 1.3) | 150,000 | 2-year-old smolts |
| Coho Salmon | LEKT | Lower Elwha Fish Hatchery (RM 1.3) | 425,000 | Yearling smolts |
| Fall Chum Salmon | LEKT | Lower Elwha Fish Hatchery (RM 1.3) | 450,000 | Fed fry |
| Pink Salmon | LEKT | Lower Elwha Fish Hatchery (RM 1.3) | 3,000,000 | Fed fry |
| Chinook Salmon | WDFW | Elwha Channel Hatchery (RM 3.5) | 2,100,000 | Sub-yearling smolts |
| | | | 200,000 | Yearling smolts |

**Assumptions**

<u>Actions</u>

The recovery and restoration of the Elwha River Watershed is an experiment in ecosystem restoration. Many aspects of habitat conditions and fish response are unknown. Monitoring and adaptive management will be critical components of this recovery. Adjustments to management actions, including discontinuation of some actions or initiation of other actions, are likely to occur. In this opinion, we consider whether certain categories of actions are relevant to bull trout in their native habitats. We also consider a broad range of potential effects or conditions to assess the potential adverse effects, including potential future scenarios regarding the population(s) of bull trout in the Elwha River Watershed.

1. Based on discussions with NMFS (Tim Tynan pers. comm. November 29, 2012), we do not anticipate that any redd surveys or other monitoring activities associated with the proposed actions will involve airplane or helicopter flights.
2. Based on discussions with USFWS (Roger Peters pers. comm. November 29, 2012), we do not anticipate the use of motorized boats for monitoring purposes.
3. Based on discussions with NMFS and USFWS (Tim Tynan pers. comm. November 29, 2012; Roger Peters pers. Comm. November 29, 2012), we do not anticipate the use of electrofishing as a method for broodstock collection or for monitoring.
4. Surface water use in the summer would be much lower than at other times because it is only needed for fish that will be held over to yearling or later stages and these fish are still small during the summer. Also, during the summer, surface water temperature will be warmer and use of well water will be important for temperature needs of fish as well as indirectly to reduce risk of pathogens.

Additional assumptions are listed in the analysis of direct and indirect effects of activity components later in this document.

<u>Time Period</u>

This consultation addresses actions that are initiated during the first two phases of the recovery process. These recovery phases are based upon measurable milestones that may also be subject to some interpretation. The first phase – *Preservation* - will continue until fish passage is restored and water turbidity is determined to be non-lethal to fish in the river.

The second phase – *Re-colonization* – follows the Preservation phase when passage is restored and fish have access. During this phase, salmonids are continually accessing habitats above the old dam sites with some fish spawning successfully and producing smolts. This phase will continue until: (1) sufficient numbers of spawning adults (e.g., meeting or exceeding minimum Viable Salmon Population (VSP) criteria (McElhaney et al. 2000, entire) are accessing and using newly accessible habitats above the old dam sites; and (2) fish are successfully spawning at a rate that allows for population growth.

Given that there are many uncertainties about how the habitat and natural processes in the Elwha Watershed will change as recovery occurs, and that the response of native fish is also uncertain, it is difficult to predict how long these phases may last. Clearly, the preservation phase is already underway. In terms of this consultation, the exact time period in which one phase transitions into another is less important. This consultation will assess effects to bull trout from the proposed actions that are initiated during the first two phases. When the second phase will end will be dependent on natural spawning of five species at a rate that allows for population growth. We do not know how long this will take. It may be as short as 5 years, but may take several decades. Hatchery activities that extend beyond phases 1 and 2 would require another determination by NMFS that extended activities are consistent with the 4(d) Special Rule for Puget Sound Chinook and steelhead. However, effects that occur due to actions conducted during this time period (i.e., the enhancement of anadromous salmonid populations) may continue into the future beyond the two phases and therefore are addressed in this opinion for as long as they may manifest themselves.

**Interrelated and Interdependent Actions**

The proposed actions analyzed in this opinion are: (1) the NMFS's determination under limit 6 of the ESA 4(d) rules for listed Puget Sound Chinook salmon and listed Puget Sound steelhead (50 CFR § 223.203(b)(6)) concerning the LEKT and WDFW hatchery programs on the Elwha River; (2) the BIA's ongoing disbursement of funds for operation and maintenance of the LEKT hatchery; (3) the USFWS's disbursement of funds for the operation and maintenance of the hatcheries; and (4) the NPS's participation in funding, authorizations, and other actions in support of the LEKT and WDFW hatchery programs on the Elwha River.

The act of funding various hatchery activities does not have an immediate direct effect on listed salmonids. However, there are indirect effects to listed salmonids from the various funding decisions that manifest through the proposed LEKT and WDFW hatchery operations. The indirect effects of Federal funding are entirely encompassed by the effects ofthe proposed HGMPs. The indirect effects from funding are evaluated and considered below in the context of the NMFS's determination under Limit 6.

The following is a list of actions we considered to determine if they would occur "but for" the NMFS proposed action. For a complete description of actions considered as part of the proposed action, see <u>Description of the Activities</u> below.

<u>Fish Propagation</u>
This would be directly enabled by the NMFS determinations and would include all aspects of brood collection, incubation, rearing, feeding, transport, acclimation, and release. These actions will be considered as part of the proposed action.

<u>Fish Hatchery Operation and Maintenance</u>
Following the NMFSs determinations, the NPS and the BIA are expected to continue funding hatchery operations and maintenance of the existing facilities. These actions will include water supply such as diversions of surface water and wells for groundwater, facilities repair and

maintenance, cleaning, disease control and treatment, and effluent management. The amount of the water diverted at the Elwha Water Facility will continue to be slightly greater than it would be if the proposed action did not occur. These actions will be considered as part of the proposed action.

Marking Salmon

This may include fin clips, radio-telemetry or sonic instruments, chemical markers, thermal marking of otoliths, PIT tags, or insertion of other material markers. These actions will be considered as part of the proposed action.

Monitoring Salmon

This may include monitoring numbers at facilities such as hatcheries or weirs, capture of salmon instream through a variety of methods such as stream surveys, redd counts, recording data including observations of marked salmon, and other more or less invasive measurements of salmon, tissue samples, and either release or collection of fish. These actions will be considered as part of the proposed action.

Harvesting Salmon

One of the primary objectives of the recovery effort is to improve salmonid populations to the point that they can support recreational, commercial, and subsistence harvest without negative effects at the population level. By definition, these levels of salmonid populations would not occur until after the second phase of the recovery process and, therefore, after the time period covered by this consultation.

However, genetic risk reduction (e.g., selective hook and line harvest) is being conducted to reduce the abundance of Chambers Creek stock steelhead in the Elwha River. Harvest of Chambers Creek steelhead was previously approved by the NMFS and take of bull trout was previously authorized by the 4(d) Special Rule for bull trout that exempts take associated with State and tribal fisheries. Additionally, this harvest is within the bounds of the level of fishing that occurred prior to the 5-year moratorium on fishing within the Elwha river Basin. While the take of bull trout associated with this directed fishery was authorized through the 4(d) Special Rule for bull trout, the effects of this directed fishery will be analyzed in this Opinion.

Following the completion of the second phase, there are expectations of future harvest of salmon and steelhead. However, this future harvest of native salmon and steelhead would require attaining the conditions required by the fourth phase – *Self-sustaining Exploitable Population* – the period when all aspects of the previous stages are met, and viable, self-sustaining populations exist that can endure exploitation by fisheries and hatchery programs are no longer needed to provide for protection, recovery, or exploitation. To initiate such exploitation, NMFS would have to approve harvest plans. Such approval would constitute a future Federal action. For these reasons, harvest of salmon is not an action that is interrelated or interdependent to the proposed determinations at this time. These actions will not be considered as part of the proposed action, and therefore will not be discussed further in this document.

Research and Monitoring
Some amount of research and monitoring of bull trout is anticipated to occur regardless of whether the NMFS makes the proposed determinations. Research and monitoring specifically directed at bull trout is therefore considered a separate action which would be the subject of separate section 7 consultations. These actions will not be considered as part of the proposed action.

A substantial and varied monitoring effort is anticipated with regard to native salmon and steelhead. These actions will be considered as part of the proposed.

Handling (including marking and other sampling) of Bull Trout
In general, the only capture of bull trout that would be anticipated would be capture incidental to other actions. Generally, this would consist of rescue situations with immediate release of bull trout to the most hospitable habitat available, or through monitoring or brood collection of salmon and steelhead. However, at the request of the USFWS, more-specific measurements or protocols may be conducted by other entities or the USFWS itself. For instance, length measurements and scale sampling is likely to continue. We do not anticipate lethal collection of bull trout, but retention of dead, dying, or severely injured bull trout for scientific purposes is anticipated. These actions will be considered as part of the proposed action.

Electrofishing
This consultation does not anticipate the use of electrofishing as a method for collection of fish for either brood collection or for population monitoring. These actions will not be considered as part of the proposed action.

## Description of the Primary Project Activities

All activities necessary for brood stock collection; fish propagation and release; facility operation and maintenance; and research, monitoring, and evaluation of Elwha River salmon and steelhead at sites and facilities affiliated with these facilities would be authorized through the NMFS determination.

Broodstock Collection

*Broodstock Collection Facilities Maintenance*
Maintenance of facilities for broodstock collection will include the installation, removal, maintenance (including repair and cleaning) of structures such as weirs, fish ladders, holding facilities, and piscalators. Use of these facilities to capture fish is discussed further below.

*Broodstock Collection*
In general, adult salmonids return voluntarily to facilities from where they originated, often entering tributaries or constructed channels leading to the hatchery facility. At the head of the outfall creek fish may ascend a fish ladder into a holding pond. Such ponds are usually constructed to allow the easy escapement of smaller fish. Once in the holding pond, fish are

sorted one to two times per week for species, sex, and state of sexual ripeness. Hatcheries usually collect and spawn fish throughout the run period to ensure representation of all portions of the run timing spectrum.

With populations of most of the salmonid stocks currently at very low abundance in the Elwha River, adults are captured using a variety of methods, including but not limited to: (1) gillnet or beach seining; (2) fish traps at the Elwha River weir and at the hatcheries; (3) hook-and-line capture, and (4) adults returning volitionally to the hatchery. Currently, less than 50 percent of the broodstock needs have been met with fish returning directly to the hatchery or WDFW Rearing Channel. Once populations increase, it is anticipated that most of the broodstock for most species will be from adults returning directly to the hatchery.

Incubation and Rearing

In-hatchery incubation and rearing are conducted within enclosed facilities. The Sol Duc, Hurd Creek, Morse Creek, and Manchester Research Station facilities all will contribute to either incubation or rearing various stages of juvenile fish. The Morse Creek facility was the subject of a separate section consultation with the USFWS (USFWS 2009). The Sol Duc, Hurd Creek, and Manchester Research Station facilities already exist and operate for propagation of other salmonids. Their contribution to egg incubation and fry rearing for the Elwha restoration project is a small increment of their operations.

Normal operation and maintenance and preventative maintenance of hatchery facility structures and equipment is necessary for proper functioning. Normal maintenance activities, such as pond cleaning, pump maintenance, and debris removal from intake and outfall structures, can cause brief periods of elevated matter-levels in effluent water. To minimize these effects, proper seasonal scheduling of maintenance activities is used to conduct activities during periods of the lowest effect.

*Water diversions*

Hatchery surface water intakes are screened to prevent fish injury from impingement or entrapment. To address and prevent these facility operation-related hazards, water rights issued for regional hatcheries are conditioned to maintain minimum flows in streams used by salmon for migration, rearing, or spawning and all hatchery screens must be in compliance with the NMFS screening criteria to minimize the risk of fish injury and mortality. In the case of the LEKT Hatchery and WDFW Rearing Channel, surface water is received from the Elwha Water Facility, which is already screened. Therefore, no screens are needed on either the LEKT or WDFW Facilities.

Up to 29 cfs (over 13,000 gallons per minute (gpm)) are delivered to the LEKT hatchery from the Elwha Water Facility. In addition to getting water from the Elwha Water Facility, the LEKT hatchery also has six wells which contribute up to of 4,000 gpm to the facility. The WDFW rearing channel uses up to 1,200 gpm of well water. Surface water from the Elwha Water Facility is used in for juvenile rearing (up to 16,000 gpm) and for adult attraction. Based on information provided by the NMFS, water diversions for operation of these facilities may be as high as 27 percent of natural summer low flows in the Elwha River.

*Discharge of Hatchery effluent*
Hatchery operations require the use and discharge of surface and well water into streams adjacent to the operating facilities. The Federal Water Pollution Control Act of 1948 (33 U.S.C. 1251-1376) as amended, (commonly known as the Clean Water Act) governs allowable discharges into waters of the United States. The purpose of the Clean Water Act is to restore the physical, biological, and chemical integrity of the waters of the United States. The States of Washington and Oregon are responsible for issuing and reporting on National Pollutant Discharge Elimination Systems (NPDES) permits. Both facilities discharge to the lower Elwha River.

*Disease / pathogen control and treatment*
Risk of introduction of fish pathogens through hatchery fish releases can be addressed through strict adherence to the fish health policies of Washington State and responsive risk reduction measures included in the HGMPs for the WDFW Rearing Channel and LEKT Hatchery. The proposed salmon and steelhead hatchery programs all adhere to fish disease pathogen control measures specified in the co-managers Fish Health Policy (NWIFC and WDFW 2006).

Fish health in the WDFW Rearing Channel is monitored on a daily basis by hatchery staff and at least monthly by a state Fish Health Specialist. Hatchery personnel carry out prescribed treatments and procedures are consistent with the Co-Manager's Fish Health Policy.

Fish health in the LEKT Hatchery is monitored throughout the rearing period. Staff from the Northwest Indian Fisheries Commission (NWIFC) Tribal Fish Health Center visit the hatchery monthly or more frequently as needed, and perform routine monitoring of juvenile fish, advise hatchery staff on disease findings, and recommend antibiotic or other treatment when appropriate.

*Acclimation, Outplanting, and Release*
All juvenile hatchery salmon and steelhead will be released as actively migrating smolts (Chinook salmon, coho salmon, steelhead) or fry (fall chum and pink salmon) directly from the hatcheries in the lower river at RM 3.5 and 1.25. At the tribal hatchery, juvenile fish leave the hatchery rearing ponds through a pipe, pass into the facility outfall, and travel 0.10 mile to the confluence of the outfall with a side channel of the Elwha River. The side channel enters the mainstem of the Elwha River at RM 1.3.

Chum eggs and fingerlings are not expected to be outplanted off-station. Returning adults may be transported upstream to appropriate spawning and rearing areas in mainstem areas above the affected areas and in tributary streams. Age 0 smolts are released volitionally directly from rearing ponds beginning in March or April. No additional acclimation facilities are used in the program. Pink salmon fry will also be volitionally released into the mainstem Elwha River from the LEKT Hatchery.

Steelhead smolts are released volitionally from the hatchery beginning in March or April as age-2 smolts. The extent of residualism is uncertain, but Peters (1996) did not observe residualized hatchery steelhead smolts in the lower river. The age 2+ smolt release strategy is expected to maintain a low rate of residualism (Berejikian, 2005).

Coho salmon are released volitionally from the hatchery beginning in March or April as yearling smolts. Smolts move quickly downstream to the mouth of the Elwha River, and enter the Strait of Juan de Fuca, or reside in estuarine beach lakes (RM 0.1) for a brief period prior entering the Strait. Surveys on the Elwha River during the release period indicate that following entry into the Elwha River, smolts do not move upstream (Peters 1996). Smolts that don't volitionally leave the hatchery will be removed from rearing units and disposed of to limit residualism.

*WDFW Rearing Channel*

Chinook are acclimated to Elwha River water. The juvenile Chinook are released directly from the channel through the adult holding area and into the Elwha River. The production and release of smolts through fish culture and volitional release practices fosters rapid seaward migration with minimal delay in the rivers, limiting interactions with wild fish. To minimize the risk of residualization and impact upon natural fish, hatchery fingerlings are released in June while yearling smolts are released in April. Hatchery Chinook will be liberated as sub-yearling smolts in June to minimize in-river residence and reduce potential competition and predation on native, wild salmonids. Yearlings will be released in April as smolts to speed their out-migration and reduce the potential predation on and competition with wild salmonids. The location of the hatchery and release of hatchery-produced fish in the lower river reduces the opportunity for interactions with fish in the upper portion of the drainage, including newly emerged fry. Chinook are currently reared at Morse Creek acclimation ponds which has already been consulted upon, as well as the WDFW Rearing Channel.

Transport of Adults

Both the WDFW and the Tribe have 500 gallon capacity tanker trucks which are used to transport and release adult fish. Returning adults may be transported upstream to appropriate spawning and rearing areas in mainstem areas above the affected areas and in tributary streams. Adult steelhead, coho, and Chinook that are not needed for hatchery production goals will be transported by truck to appropriate sites in the mid- and lower- river basin or above the dam sites to promote recolonization and natural spawning. Various monitoring needs may be fulfilled by these fish in the early phases of the restoration plan. Natural origin recruits encountered at the Elwha River weir will also be incorporated into the hatchery spawning population during the preservation phase of restoration.

Genetic Risk Reduction

The only harvest action proposed during this moratorium period would be a hook-and-line or LEKT fisheries management-sanctioned effort to remove the remaining two brood year (2012 and 2013) returns of Chambers Creek-lineage steelhead originating from the now-terminated tribal hatchery program for the stock (LEKT 2012a). This focused fishing activity to remove adipose fin-clipped, non-native steelhead would be conducted as an outbreeding depression risk reduction measure to further reduce threats to the genetic diversity of native Elwha River winter-run steelhead population.

Monitoring

Monitoring and evaluation programs for hatchery production are useful for adaptive management purposes and can help ensure that hatchery programs do not limit the recovery of listed populations. In-stream activities for monitoring hatchery program performance include, but are not limited to, various capture methods: rotary screw-traps, the Elwha River mainstem weir, in-river juvenile seining and fyke netting, and hook-and-line sampling for juveniles and adults. Salmonids will be monitored in the mainstem river via the weir which was initially installed in the lower river during the summer of 2010. The weir is operated by the WDFW with assistance from other agencies.

Other methods of monitoring include snorkel surveys, adult spawner surveys by foot and boat, side-scan sonar, hydroacoustic monitoring, and telemetry. In addition, various marking methods may be used including Coded Wire Tags, thermal marking of otoliths, chemical marking, and other methods. Though they help to monitor and evaluate impacts on listed populations from hatchery programs, monitoring and evaluation programs are designed in coordination with other plans to maximize the data collection while minimizing effects to non-target listed species.

Sites in upper river tributaries and in the mainstem Elwha River where suitable spawning habitat exists will be surveyed to determine the distribution of spawning, and estimate spawner abundance. Adult fish may also be tagged with telemetry transmitters at the weir to aid in determine spawning distribution and up-river migration timing. Telemetry of hatchery-produced smolts may also be used to determine their residence time in the river, and early marine survival rate. These capture methods may include netting, trapping, gaffing, and hooking.

Fish capture may be conducted at weirs and hatcheries or as a result of instream seining, angling, or other common methods of fish collection. Holding of fish within a container may occur following capture to facilitate release or to enable data collection. Anesthetics may be used on some fish to reduce stress, but will not be used on bull trout. Handling of bull trout would generally involve temporarily keeping the fish in a tray while measurements are taken. Handling is a prerequisite for the collection of certain data. Tissue sampling would be done in some cases at the request of USFWS. For instance, tissue sampling is an important source of genetic information. Tissue sampling may be conducted on salvaged carcasses of dead fish, or may be conducted on live fish following USFWS protocols. Marking of bull trout may be requested to understand their movements and other aspects of their life history. Marking could include a variety of methods currently employed for salmonids. Some forms of marking include telemetry implants and subsequent tracking. Following capture and any subsequent holding, handling, sampling, marking, or other procedures, bull trout would be released according to standard protocols. This consultation does not include the lethal collection of bull trout, but may include retention of dead, dying, or severely injured bull trout for scientific purposes.

## Conservation Measures

1. Release of hatchery-produced fish as smolts and fry in a way and location that will minimize interaction with juvenile bull trout.

2. Follow co-managers disease policy that will reduce or eliminate opportunity or transmission of diseases to bull trout.

3. Smolts that don't volitionally leave the hatchery will be removed from rearing units and disposed of to limit residualism.

**Term and Extent**

The USFWS has evaluated the effects of the proposed hatchery plans throughout these four phases to the best of its abilities. Particular emphasis has been given to the first and second phases as our ability to analyze these effects is more certain and definitive, and continuation of hatchery activities into latter phases will be contingent on approval by NMFS. The third and fourth phases are very speculative at this point in time and the agencies were not able to provide a specific biological analysis because the effects are too uncertain. While these latter two phases have been generally evaluated as effects of the entire proposed action, due to future uncertainty, consultation will need to be reinitiated for the local adaptation and full restoration phases to ensure full compliance with the ESA.

This consultation will address actions enabled by NMFS's determinations as discussed under Interrelated / Interdependent Actions discussed above. Effects that linger from those actions will be analyzed for the full period during which those effects may manifest themselves, even if they persist longer than the first two phases of the recovery process. Actions to be initiated in latter phases or portions of actions extending into latter phases, (*Phases 3 and 4 - Adaptation* and *Self-sustaining Exploitable Populations*) will be authorized only through subsequent Federal actions and therefore would be subject to future consultation under the ESA.

**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 the proposed Elwha River salmon and steelhead supportive breeding programs includes the Elwha River watershed and its tributaries, including the estuary and nearshore areas (Figure 1 depicts the Elwha River Basin only).

Some aspects of the proposed action are not limited to the boundaries of the Elwha River watershed. Portions of the proposed action that are being conducted in Morse Creek, an adjacent drainage to the Elwha, were already addressed by a consultation with the USFWS regarding bull trout (USFWS 2009). This includes the construction and operation of fiberglass acclimation (rearing) ponds about 1 mile up Morse Creek. For the first few years following dam removal, juvenile Chinook salmon will be released into Morse Creek to ensure that native Elwha River stock have a place to return if the mainstem is too turbid to permit their return to the Elwha. Eggs collected from returning Chinook are incubated and undergo early rearing at other facilities, and then are returned to the Morse Creek acclimation ponds where they are raised to the smolt stage for release. The August 27, 2009, consultation addressed other associated construction, operation, and maintenance activities at this facility. Therefore, activities conducted at Morse Creek will not be covered in this Opinion.

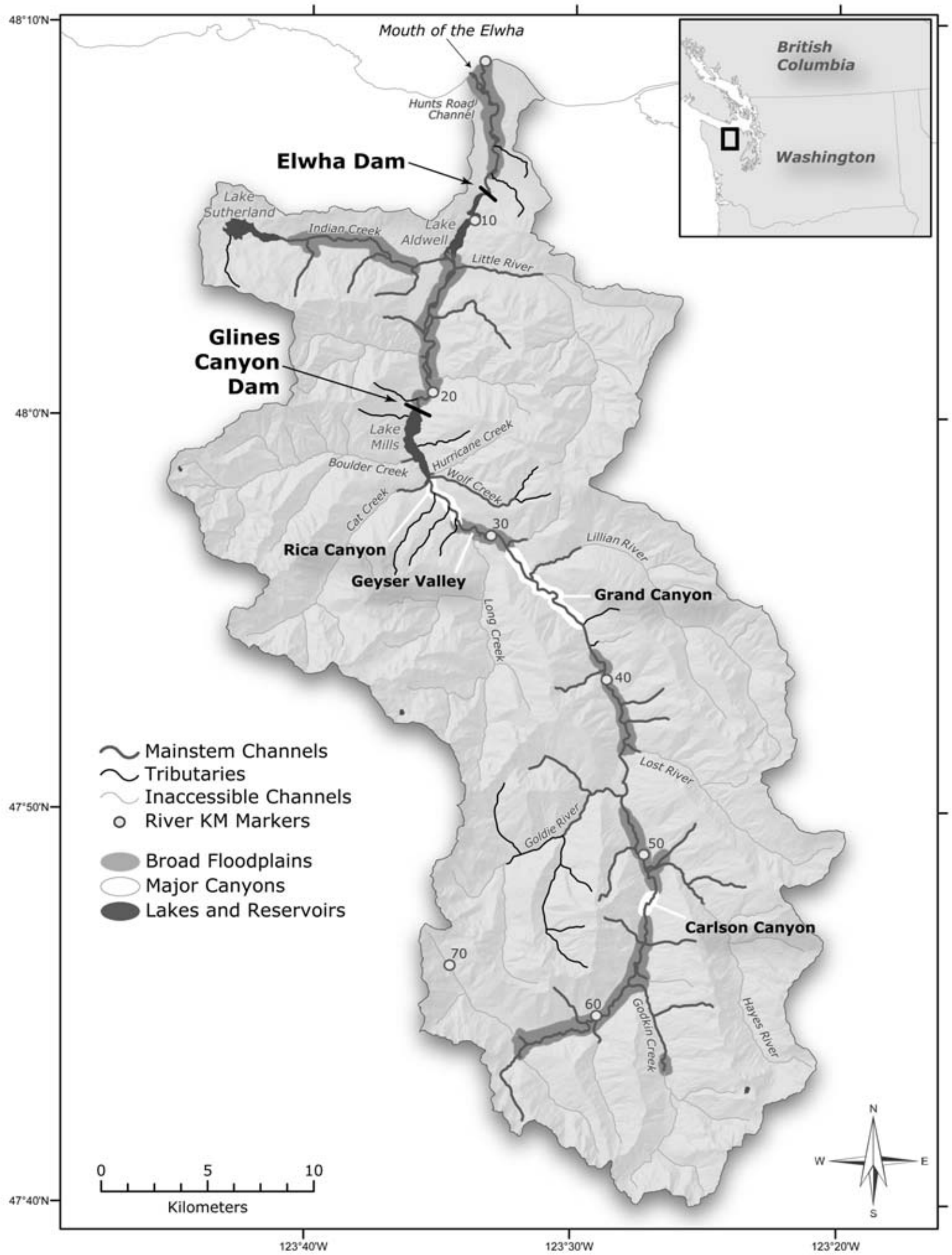


Figure 1. Elwha River Watershed. Used with permission by J. Duda (McHenry and Pess, Northwest Science 81(Special Issue):29-47.)

There are additional portions of the actions that occur outside of the Elwha River watershed. In addition to the Morse Creek Acclimation Ponds, other facilities such as the Hurd Creek Hatchery, Sol Duc Hatchery, and Manchester Research Station also support the Elwha River fish restoration /propagation effort (Figure 2.). These facilities are only used for rearing of Elwha River Chinook and Elwha River pink salmon in support of the core programs in the action area and no fish releases or other activities related to this action are conducted at the facilities. These facilities are maintained for other fish-propagation purposes, but contribute to the Elwha fish-restoration effort by providing capacity for incubation and rearing. Only a small marginal increase in existing operations is anticipated due to the proposed action and there are no physical or chemical effects that can be discerned in the natural environment in these locations. No further discussion of these facilities is included in this Opinion.

This Opinion addresses the effects of project-related activities conducted within the action area, which includes the Elwha River Basin and nearshore marine areas extending from the mouth of the Elwha to Ediz Hook and Crescent Bay and northward to the limits of the photic zone or a quarter mile, whichever is further. The USFWS anticipates that this is the area in which physical or chemical effects due to the proposed action, including interrelated and interdependent actions, may be measurable. We anticipate that young salmon and steelhead released from the hatcheries will distribute themselves in the marine environment in concert with local currents. Beyond this area and extending out into the Pacific Ocean, effects quickly become diluted and are no longer measurable even though individual salmon released as part of this program may venture widely.

The Elwha Rearing Channel, located at RM 3.5 on the Elwha River, and operated by WDFW, will be used in Elwha Chinook salmon population broodstock collection, spawning, juvenile fish rearing, and sub-yearling and yearling smolt release. The LEKT Hatchery, located at RM 1.3 on the Elwha River, and operated by the LEKT, will be used in Elwha River winter-run steelhead, coho salmon, fall chum salmon, and pink salmon broodstock collection, spawning, juvenile fish rearing, smolt/fry release, and for steelhead, captive broodstock production.

Water diversions may affect the instream flows from the Elwha Water Facility to the Rearing Channel Outlet and LEKT Hatchery outlet, and discharges may affect water quality and quantity from the point of those discharges to the mouth of the river. Released fish may have effects throughout the watershed, including the nearshore marine environment.

Other broodstock collection actions implemented for all hatchery programs in the action area are WDFW’s operation of a mainstem resistance-board weir located at RM 3.7 on the Elwha River and opportunistic capture of adult fish using gill nets, seines, and other methods throughout the lower river. The NPS is required as a term and condition regarding dam-deconstruction effects (NMFS 2006; NMFS 2012) to transport by truck surplus adult fish upstream to areas that are unaffected by dam-removal activities (upstream of RM 5.0).

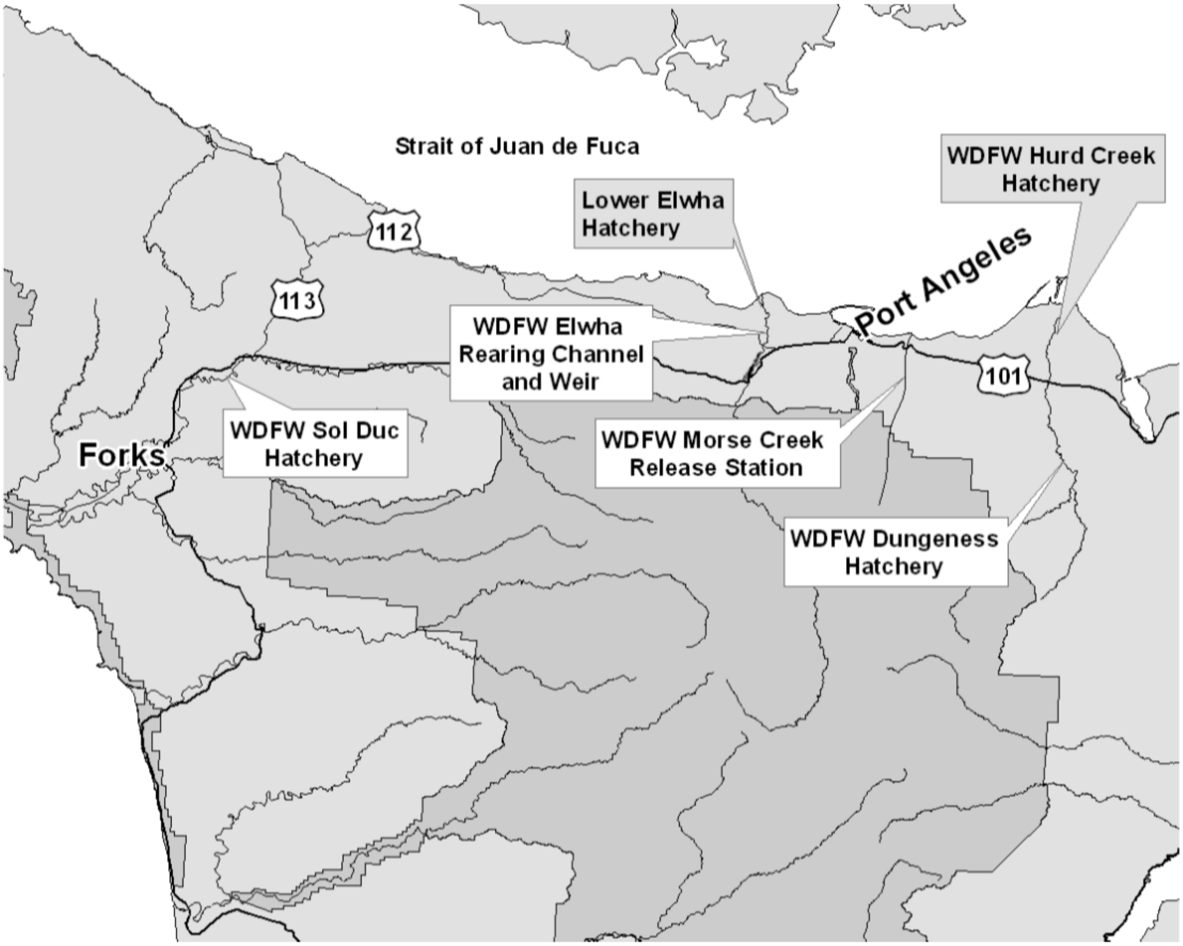


Figure 2. Proposed salmon and steelhead supportive breeding programs in the Elwha River watershed and the location of satellite support facilities for the core programs on the Olympic Peninsula. (Source: Ward et al. 2008).

## ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATION

Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this Biological Opinion relies on four components: (1) the *Status of the Species*, which evaluates the bull trout's range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the bull trout in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the bull trout; (3) the *Effects of the Action*, which assesses the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on the bull trout; and (4) *Cumulative Effects*, which evaluates the effects of future, nonfederal activities in the action area on the bull trout.

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

Interim recovery units were defined in the final listing rule for the bull trout for use in completing jeopardy analyses. Pursuant to USFWS policy, when an action impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. When using this type of analysis, the Opinion describes how the action affects not only the recovery unit's capability, but the relationship of the recovery unit to both the survival and recovery of the listed species as a whole.

The jeopardy analysis for the bull trout in this Opinion uses the above approach and considers the relationship of the action area and core area (discussed below under the *Status of the Species* section) to the recovery unit and the relationship of the recovery unit to both the survival and recovery of the bull trout as a whole. It is within this context that we evaluate the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

### Adverse Modification Determination

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

In accordance with policy and regulation, the adverse modification analysis in this Opinion relies on four components: 1) the *Status of Critical Habitat*, which evaluates the range-wide condition of designated critical habitat for the bull trout in terms of primary constituent elements (PCEs), the factors responsible for that condition, and the intended recovery function of the critical habitat overall; 2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; 3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units; and 4) *Cumulative Effects*, which evaluates the effects of future, nonfederal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units.

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

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

## STATUS OF THE SPECIES

### Status of Species Range-wide

Discussion of the range-wide status of bull trout is provided in Appendix A.

### Status of the Species in the Core Area and Foraging, Migration, and Overwintering Area

Core areas represent the closest approximation of a biologically functioning unit for bull trout and consist of habitat that could supply all of the necessary elements for every life stage of bull trout (e.g., spawning, rearing, migration, overwintering, foraging). Core areas have one or more local populations of bull trout, and are also the basic units upon which to gauge recovery within a bull trout interim recovery unit (IRU).

The project is located in the Elwha River core area of the Olympic Peninsula Management Unit, which supports two local populations of bull trout. We anticipate that fluvial and/or anadromous bull trout[1] from one or both of these local populations will be present in the action area during and after construction.

[1] As each fluvial individual bull trout has the potential to become anadromous in the future and vice versa, we assume that any individual bull trout in the Elwha River may be anadromous for a portion of its life history.

Elwha Core Area

The Elwha core area includes the Elwha River and its tributaries including Boulder, Cat, Prescott, Stony, Hayes Godkin, Buckinghorse, and Delabarre Creeks; Lake Mills and Lake Aldwell; and the estuary of the Elwha River. Although the Elwha Dam has been removed and Glines Canyon Dam is in the process of being removed, steelhead and Chinook salmon have been documented to have moved above the former Elwha Dam (Mapes 2012, The Seattle Times website, accessed July 18, 2012)(Crain in litt. 2012). The Elwha River core area is one of two core areas on the Olympic Peninsula Management Unit that drain to the Strait of Juan de Fuca.

Anadromous, fluvial, adfluvial, and resident life-history forms all likely occupy the Elwha core area. With the removal of the Elwha dams and resulting elimination of the reservoirs, the adfluvial life-history form will revert back to the historical fluvial and anadromous forms (Crain and Brenkman 2010, p. 16; DeHaan et al. 2011, p. 472). Until the recent Olympic National Park bull trout tracking and telemetry project (Crain and Brenkman 2009, pp. 3-4), there was little available information on fish movement and life-history expression. Spawning has now been documented in the area directly above Lake Mills (Crain and Brenkman 2009, p. 7). Dam removal is likely to alter this known spawning site as the reservoir returns to a natural stream channel configuration (Crain and Brenkman 2010, pp. 16-19, 22). However, it is anticipated that new spawning habitat/sites for bull trout will develop over time in the restored reaches. There are additional spawning sites above Lake Mills and likely between the two dams, although this has not yet been confirmed (Crain and Brenkman 2009, p. 7). There is little habitat suitable for bull trout spawning and incubation downstream of the dams. Elevated stream temperatures in the mainstem Elwha River and the lack of suitable tributary habitat, has likely limited success of reproducing bull trout in both the lower and middle reaches of the Elwha River (Brenkman, pers. comm. 2007).

The status of a bull trout core area population is based on four key elements necessary for long-term viability: 1) number and distribution of local populations, 2) adult abundance, 3) productivity, and 4) connectivity (USFWS 2004, Vol. II, p. 135).

Number and Distribution of Local Populations

Recent genetic data indicate there are two local populations within the Elwha core area. One local population is located in the Elwha headwaters (upstream of Carlson Canyon) and appears to primarily consist of the resident life-history form (DeHaan et al. 2011, pp. 471-472). The other local population occupies the area downstream of Carlson Canyon and primarily contains the migratory life-history form. The Little River tributary has been identified as a potential local population, based on the availability of suitable habitat and the likelihood that this high quality spawning habitat will be utilized by migratory bull trout once the dams are removed. With only two local populations, bull trout in the Elwha core area are considered at increased risk of extirpation and adverse effects from random naturally occurring events.

Adult Abundance

Bull trout occur in moderately low numbers between the two dams. Both juvenile and adult bull trout have been captured in the upper and middle Elwha River and in Lake Aldwell below Glines Canyon Dam (USFWS 2004, p. 59). Prior to listing, bull trout observations were limited in the Elwha River below the Elwha Dam at the WDFW Chinook rearing channel (Travers, in litt. 2002; Greg Travers, WDFW, pers. comm. in WDFW 2004, p. 149). Thirty-one bull trout, ranging in size from 250 to 620 millimeters, were documented in this section of the river during snorkel surveys in 2003 (Pess, in litt. 2003). This number is likely related to increased survey effort rather than to an increase in numbers of bull trout in the lower Elwha River (Brenkman, pers. comm. 2007). Surveys conducted in 2007 and 2008 provide information on distribution and abundance of bull trout throughout most of the mainstem Elwha River from the headwaters to the Strait of Juan de Fuca (Brenkman et al. 2012, p. 40). Although several canyon reaches and the reservoirs could not be effectively surveyed nor were tributaries surveyed, bull trout counts were 215 and 118 in 2007 and 2008, respectively (Brenkman et al. 2012, pp. 42-43). Highest counts and relative abundances were in the headwaters and between Lake Mills and Rica Canyon. There is no information on trends in abundance of Elwha River bull trout.

The bull trout population in the Elwha core area may be at risk of genetic drift based on the low number of individuals detected in the more recent surveys. Although the Elwha core area showed reduced levels of within population genetic variation when compared to larger populations from other core areas, there was no indication that the fragmentation caused by the Elwha dams has led to the evolution of genetically distinct spawning populations within the Elwha core area (DeHaan et al. 2011, pp. 471-472).

Productivity

There has been only limited monitoring of the bull trout in the Elwha River, so no trend data is currently available. Low bull trout abundances in the Elwha core area would suggest this population is at risk of extirpation.

Connectivity

The Elwha and Glines Canyon Dams in the Elwha River have fragmented the populations of bull trout in the Elwha core area for nearly 100 years. Bull trout were found downstream of both dams. Dam removal was initiated in September 2011 and is currently in progress. The possibility of upstream passage did not occur until May 2012, after the Elwha Dam was fully removed and turbidity levels dropped. However, turbidity levels are expected to rise again when removal of the Glines Canyon Dam is complete. Restoration of connectivity within the Elwha River is ongoing and will be required to allow full expression of the bull trout's migratory life-history forms, including anadromy. Full restoration of fish passage is anticipated in 2013 following full removal of the Glines Canyon Dam (Olympic National Park 2012, p. 1).

Changes in Environmental Conditions and Population Status

Since the bull trout listing, Federal actions occurring in the Elwha River core area have resulted in harm to, or harassment of, bull trout. These actions include statewide Federal restoration programs that include riparian restoration, replacement of fish passage barriers, and fish habitat improvement projects; federally funded transportation projects involving repair and protection of roads and bridges; and Section 10(a)(1)(B) permits for HCPs addressing forest-management practices. The removal of Elwha and Glines Canyon Dams as part of the Elwha River Restoration Project represents a recent Federal action with the opportunity for long-term improvement of bull trout habitat and core population. Capture and handling during implementation of section 6 and section 10(a)(1)(A) permits have also directly affected bull trout in the Elwha core area (e.g., Crain and Hugunin 2012, pp. 3-4).

The number of nonfederal actions occurring in the Elwha River core area since the bull trout listing is unknown. However, because most of the core area is in Federal ownership, few nonfederal actions likely have occurred in this core area.

Threats

Threats to bull trout in the Elwha core area include:

- Two dams in the Elwha River have prevented connectivity, increased injury and mortality of bull trout attempting to navigate through the dams, reduced spawning gravel recruitment, prevented recruitment of fluvially transported sediment to the estuary, reduced prey abundance by preventing other salmonids from accessing historic habitat, affected the beach and eelgrass beds in the estuary, and increased water temperatures below the dams. However, current dam removal efforts are in the process of eliminating these ongoing threats (Olympic National Park 2012, p. 1).

- Past logging on private lands in the Elwha core area, outside of the Olympic National Park, has affected water quality through the release of fine sediment, which potentially affects bull trout egg incubation success and juvenile rearing.

- Impacts from residential and urban development occur mainly in the lower Elwha River. Dike construction has constricted the channel and severely affected nearshore and estuary habitat and processes.

- Bull trout are susceptible to incidental mortality associated with fisheries that target commercially desirable species such as coho and steelhead in the lower river and recreational fishing in Olympic National Park. There is currently a 5-year moratorium on all fishing in the Elwha River to assist with the recovery and colonization of this watershed following dam removal.

- Climate change was anticipated to have minimal impact on this bull trout population as 85 percent of watershed is in the Olympic National Park and there are few stressors to the bull trout or its habitat (USFWS 2008, p. 1774). However, based on more recent information, future changes to stream temperature and stream flow due to climate change may result in the decline of the quality and quantity of bull trout habitat. The watershed is currently identified as a “transient” watershed with regard to it being rain dominated versus a snowmelt dominated system. It is projected to become a rain dominated system due to climate change (Halofsky et al. 2011, p. 45). This change will result in modifications to stream flow and temperature. Simulations of the monthly and average total baseflow based on global climate models indicate that average total runoff and base flow depths will increase during the fall through early spring, and decrease in the summer compared to simulated historical (Halofsky et al. 2011, p. 24). The lower summer flows will allow streams to be more influenced by increased air temperatures (ISAB 2007 in Halofsky et al. 2011, p. 44). With projected increases in air temperature, especially in the lower elevations of this core area (Halofsky et al. 2011, p. 44), water temperatures are also anticipated to increase.

**Strait of Juan de Fuca**

The nearshore marine areas of the Straits of Juan de Fuca are designated foraging, migration and overwintering (FMO) habitat for bull trout. The area includes nearshore waters between the northwestern tip of the Olympic Peninsula (Cape Flattery) east to Point Wilson at Port Townsend, and several small independent tributaries flowing into this area. It is located in the northern region of the Olympic Peninsula Management Unit

The Dungeness and Elwha watersheds are the only bull trout core areas connected to the Strait of Juan de Fuca FMO. Coastal and marine tributaries to the Strait of Juan de Fuca used by bull trout adults and subadults, but where habitat is likely unsuitable for spawning or early rearing, include Morse, Ennis, and Siebert Creeks. Bell and Valley Creeks may also be used occasionally by bull trout (Freudenthal, in litt. 2001; Ogg, in litt. 2006).

There are a number of small independent drainages to the strait, some of which originate in Olympic National Park. The frequency of bull trout use of these tributaries is poorly understood. Bull trout have been documented in the Strait of Juan de Fuca drainages of Bell, Siebert, Morse, and Ennis Creeks (Mongillo 1993; WDFW 1998; Freudenthal, in litt. 2000 and 2001a; R. Cooper, in litt. 2003). Based on current or historical habitat conditions, and the experience and professional judgment of members of the bull trout recovery team, most of these rivers and streams located between Bell and Ennis Creeks on the Strait of Juan de Fuca are unlikely to support spawning populations, but do provide important foraging and overwintering opportunities for bull trout (Olympic Peninsula Recovery Team, in litt. 2003c).

Numerous forage fish (e.g., herring, surf smelt) spawning sites are found throughout the Strait of Juan de Fuca (Shaffer et al. 2003; WDFW 2000). Thus, the Strait of Juan de Fuca provides essential and biologically important foraging and migration habitats for bull trout.

Adult Abundance

No studies on the abundance of bull trout in the Straits of Juan de Fuca FMO have been conducted to date. However, with the removal of the dams on the Elwha River, it is anticipated that more bull trout may use these nearshore waters as a result of the improved downstream access for the anadromous life history form.

Connectivity

The Strait of Juan de Fuca connects Puget Sound and Hood Canal to the Pacific Ocean. Currently, a portion of the migratory bull trout on the Olympic Peninsula appears to migrate into the Strait of San Juan de Fuca. Strait of Juan de Fuca provides the only accessible marine habitat for the anadromous life history form in the Dungeness and Elwha core areas

The preliminary results of acoustic telemetry work in the Puget Sound (F. Goetz, pers. comm. 2002b) and the Hoh River (Brenkman and Corbett in litt. 2003a,b) indicate that bull trout from more than one river intermingle in nearshore marine and estuarine waters. Recent radio telemetry studies have demonstrated that anadromous bull trout spend significant time outside their core area (OPRT, in litt. 2003b; Brenkman and Corbett 2005).

Morse, Ennis, and Siebert Creeks have been identified as part of the Straits of Juan de Fuca FMO habitat, and are identified in the recovery plan as providing an important contribution to foraging habitat for anadromous bull trout. Morse, Ennis, and Siebert Creeks represent the few freshwater streams outside of the Elwha River and Dungeness River core areas known to be used by bull trout. This habitat is identified in the recovery plan as providing an important contribution to the forage base and connectivity of anadromous bull trout in the Strait of Juan de Fuca. Morse, Ennis, and Siebert Creeks are considered essential for maintaining overall distribution and abundance of anadromous bull trout in the Dungeness and Elwha core areas.

Valley Creek's use by bull trout has only recently been identified. Bull trout use was recently detected using radio telemetry. Subadult bull trout observed in May 2006 (Ogg, in litt. 2006). It is part of the Straits of Juan de Fuca FMO habitat, and is identified in the recovery plan as providing an important contribution to foraging habitat for anadromous bull trout. The lower reach of this stream and its associated riparian area has been severely degraded as a result of residential and urban development so there is some uncertainty regarding the level of use by anadromous bull trout and degree of importance for recovery. However, it is considered essential for recovery at this time because of the connectivity it provides among Straits of Juan de Fuca FMO habitat between the Dungeness and Elwha core areas.

Changes in Environmental Conditions and Population Status

Development impacts in tributaries to the Strait of Juan de Fuca have resulted in significant habitat loss for anadromous salmonids, including bull trout. Morse Creek was a significant producer of several species of salmon, which provide an important seasonal prey base for bull trout. The Morse Creek channel has been altered by development, channelization, and forest practices. Floodplain function has been severely altered by constrictions resulting from diking, development encroachment, and transportation corridors. Historical estuary conditions, thought to be largely responsible for Morse Creek's productivity, have been basically eliminated by development; however, Morse Creek habitat within the Olympic National Park boundary is in excellent condition (WSCC 2000a). Habitat outside of Olympic National Park has been significantly impacted by suburban development.

Siebert and Ennis Creeks drain directly to the Strait of Juan de Fuca. The lower reaches of these creeks are relatively intact, but habitat in the upper stream reaches is adversely affected by recent rural development, agricultural practices, and forest practices.

Streams that have their headwaters in the foothills, such as Bell and Siebert Creeks (and other streams draining into the Strait of Juan de Fuca) are subject to hydrologic/stormwater effects as a result of the permanent loss of forest cover due to conversion to residential development and from forestry activities. During severe rain storms or rain-on-snow events these forest cover changes have resulted in increased erosion in the small headwater streams as well as increased stream power to transport sediment and erode streambanks lower in the system (WSCC 2000a).

The nearshore environment provides important habitat for bull trout prey species, including spawning surf smelt, herring, and salmon smolts. Significant portions of nearshore habitat in the Strait of Juan de Fuca have been altered by bulkheads placed to protect various developments. The marine shoreline is armored from the mouth of Morse Creek west through Port Angeles to the end of Ediz Hook at the mouth of the Elwha River. This armoring effectively eliminates most, if not all, natural nearshore habitat function (WSCC 2000a).

Stormwater runoff from residential development and urbanization contributes to nonpoint source water pollution from the transport of toxic metals and organic contaminants, such as petroleum hydrocarbons. Other sources of toxic contaminants are discharges of municipal and industrial wastewater, pesticide runoff from residential lands, leaching contaminants from shoreline structures (i.e., treated wood), and channel dredging. The Port Angeles Rayonier pulp mill is part of a clean-up action for contaminants (including dioxins and polychlorinated biphenyls) associated with the former mill.

Anadromous bull trout seasonally enter marine waters to prey on surf smelt or Pacific herring where they school or spawn (Kraemer 1994). These forage fish species depend on the nearshore marine environment and spawn in the intertidal or shallow subtidal waters at specific locations (WDFW 2000). These locations are very vulnerable to destruction or modification through human activities, especially urban and rural development.

Forage fish, bottom fish, and wild salmon have declined in the Puget Sound (PSWQAT 2000). Part of this decline has been attributed to human encroachment and development of the nearshore areas throughout the Strait of Juan de Fuca that has resulted in the loss of nearshore[3] habitat. It is likely that anadromous bull trout have been impacted by the decline in forage base and loss of habitat in this marine environment.

Threats

Threats to bull trout in the Straits of Juan de Fuca FMO include:

- Ongoing habitat degradation from development and shoreline protection measures.
- Climate change is anticipated to modify the ocean chemistry.
- Bull trout are susceptible to incidental mortality associated with fisheries that target commercially desirable species.

## ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR §402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation in progress.

### Habitat Conditions in the Action Area

Land use and Physical Setting

The Elwha River flows in a northerly direction, entering the Strait of Juan de Fuca west of the City of Port Angeles. The river is about 45 miles long, has more than 100 miles of tributaries, and drains 321 square miles. About 83 percent (267 square miles) of the drainage lies within Olympic National Park and is further protected from intensive development through wilderness designation.

The 6th-order (Strahler 1957) river basin constitutes 19 percent of the area of Olympic National Park. The Elwha River flows easterly and then northerly from glaciers and ice fields and descends from 4,500 feet at the headwaters to its confluence (at sea level) with the Strait of Juan de Fuca in the Pacific Ocean. The uppermost portions of the Elwha River are remote, and only a walking trail parallels the upper 28 miles of river. There is road access from Glines Canyon Dam to the river mouth, a distance of 14 miles (Brenkman et al. 2012). Within the Elwha River Basin, there are approximately 190,000 acres (92 percent) in Federal ownership (Forest Service and National Park Service); 6,400 acres (3 percent) in State ownership; 9,100 acres (4 percent) in private ownership (includes City and County lands); and 400 acres (< 1 percent) in tribal ownership (USGS 1996).

From 1911 to 2012, the 108-foot-tall Elwha Dam, located at RM 4.9 on the Elwha River, blocked anadromous fish passage to more than 70 miles of mainstem and tributary habitat in the watershed (USDI et al. 1994). In 1927, the 210-foot Glines Canyon Dam was constructed 8.5 miles upstream of the Elwha Dam. Like the Elwha Dam, the Glines Canyon Dam was built without fish passage capability. The two Elwha River dams not only blocked passage of anadromous fish but also interrupted the natural function of the river ecosystem. Nearly 18 million cubic yards of sediment were captured in the two reservoirs (USDI et al 1995), affecting not only the lower river system but also the estuarine and nearshore environment to the east and west of the river mouth—an area that extends from Ediz Hook to Crescent Bay (Clallam County MRC 2004). While these effects are being addressed through dam removal, it will take many decades for the watershed and nearshore environments to return to more-stable, natural conditions. In the meantime, the watershed will be subject to drastic and rapidly changing conditions.

The geomorphology of the Elwha River Basin is a series of alternating canyons and floodplains (Pess et al. 2008). The major canyons of the Elwha River from mouth to headwaters include Elwha Canyon (1.1 RM in length), Glines Canyon (0.5 RM in length), Rica Canyon (1.2 RM in length), Grand Canyon (3.4 RM in length), an unnamed canyon (0.8 RM in length) and Carlson Canyon (1.4 RM in length) (Duda et al. 2008). Rica Canyon consists of bedrock, large boulders and high-velocity water with several cascades and waterfalls up to 6 feet in height. The upstream portion of Grand Canyon contains 15 cascades and falls, and Carlson Canyon has a bedrock cataract 328 feet in length with a 6.6-foot waterfall (Washington Department of Fisheries 1971; Brenkman et al. 2008a). Floodplain reaches occur between the alternating canyons. These depositional reaches are generally lower in gradient, contain wide gravel bars and are anastomosing channels with pool/riffle morphology. There are 34 named tributaries that flow into the Elwha River and 33 occur upstream of the dams and are not accessible to anadromous salmonids.

Facilities

Prior to the beginning of dam removal (September 2011), a new intake structure was constructed slightly upstream from an existing diversion structure at RM 2.8. Water collected from this intake is treated during spikes of turbidity at the Elwha Water Treatment Plant. The treatment plant is designed to strip sediment from the surface water, to maintain a maximum turbidity of 20 Nephelometric Turbidity Units (NTUs). The new plant (completed in 2010) supplies treated water to the LEKT Hatchery, the WDFW Rearing Channel, and acts as a back-up to a new Water Treatment Plant for the city of Port Angeles during and following dam removal. It also supplies industrial water to several mills. In addition, the diversion structure and sediment treatment facility were subject to previous consultation (USFWS 2000). The Water Treatment Plant facility is designed to treat water diverted from the Elwha River through an intake structure by removing suspended sediments. It is designed for a maximum treated water capacity of 37,000 gallons per minute (gpm). The facility consists of an influent pump station, influent/chemical mix tanks, sedimentation tanks, chemical feed and storage building, effluent flow distribution structure, slurry pump stations, office/laboratory building, and associated pipelines. The plant will continue to be operated during periods of high sediment release resulting from the removal of Elwha Dam and Glines Canyon Dam. The intake includes a concrete control weir, intake structure, supplemental diversion pump structure, fish-screen structure; tunnel; piping; electrical; mechanical; utilities and site work (NPS 2010). According to NMFS (Zach Hughes pers. comm. November 30, 2012) the facility may withdraw as much as 80 cfs at certain times.

As mentioned earlier, the WDFW rearing channel is located at approximately RM 3.5 on the mainstem Elwha River immediately downstream of the Port Angeles industrial water-supply diversion structure. The LEKT Fish Hatchery is located at RM 1.3 on the Elwha River. A mainstem resistance-board weir is operated just upstream of the water diversion structure.

Several bridges cross the Elwha River including U.S. Highway 101. The bridges are few thereby providing only limited access to the river. There are no commercial or industrial developments in most of the watershed and residences are few as well.

Dikes on the lower portion of the river isolate the mainstem and portions of the floodplain from the historic delta and remaining floodplain of the Elwha River. There are a number of structures, offices, and residences within the delta of the river that are protected by the dikes.

Riparian and Aquatic Condition

Elwha River habitat downstream of the dams was significantly altered relative to historic conditions because of the near cessation of fluvial gravel recruitment caused by construction of the two dams, the chronic loss of functional large wood, and channel alterations such as dike construction, meander truncation, and large wood removal. Armoring of feeder (gravel recruitment) bluffs on the east of the river mouth and climatic changes that altered the flow profile also affected the Elwha River habitat (Ward et al. 2008).

Current habitat conditions in the lower, middle, and upper Elwha River for temperature, large wood levels, side channels per mile, and spawning habitat vary but are significantly degraded in the lower reach. The dam removal has already resulted in increased sediment loads, especially in the lower reach. Within the first 5 years after both dams are removed, approximately 5 million cubic yards of sediment will reach the marine nearshore. Within 10 years, it is anticipated that sediment loading in the lower reaches of the river and the marine nearshore area will decline to natural background levels as the river system stabilizes (Ward et al. 2008).

The LEKT Fisheries Department initiated small-scale habitat restoration efforts in the 1990s, including side-channel restoration, use of logjams, and reforestation. The goals of the restoration process include strategies to add large wood, reforest the floodplain, remove or modify floodplain dikes, acquire floodplain habitat for long-term conservation, and establish instream flows that conserve fish-recovery needs. Accelerating the restoration of nearshore habitat will be critical to the recovery of habitat-forming processes in the Elwha River (Ward et al. 2008).

Riparian and aquatic habitat conditions are influenced by several interacting factors, including hydrology, bank stability, large wood recruitment, nutrient cycling, detritus, sediment filtering, shade, stream temperature, water quality, and sediment/substrate. These factors all combine with the geology and topography to form aspects of complex habitat and influence connectivity for aquatic species.

*Hydrology*

Mean winter flows average approximately 2,000 cubic feet per second (cfs), while mean summer flows average approximately 600 cfs. Peak flood events have exceeded 40,000 cfs, while base summer low flows may be as low as 200 cfs. Annual precipitation in the basin ranges from 220 inches near the headwaters of the watershed to 56 inches at the river mouth. Substantial snow accumulates in the upper elevations during the winter creating a bimodal flow pattern, with peak flows seen in November (associated with rain or snow events) and June (associated with snowmelt) (Elwha-Dungeness Planning Unit 2005). Over the period of record, the average size of the peak annual flow events has nearly doubled (Ward et al. 2008, Figure 2, pg. 6), while the frequency of high-flow events is also increasing.

*Bank Stability*

Bank stability will remain an issue as large amounts of bedload move downstream from the previously dammed waterbodies. Eventually, this will stabilize to natural background levels. Initially, loss of bank stability will increase recruitment of large wood, increase recruitment of additional substrate, and will impact complex habitats such as further reducing pool depth. Increased bank stability over time will reduce the current level of recruitment of large wood and substrate, but it will assist in the reduction of very high turbidity and filling of pools.

*Large Wood*

In the lower reaches of the Elwha, recruitment of large wood from further above in the watershed was virtually eliminated due to the dams. The size of large wood accumulations is important as the larger accumulations have a greater and longer-lasting influence on fish habitat, retain higher amounts of organic debris and sediment, and exert greater hydrological control by creating larger, longer-lasting scour pools (Abbe and Montgomery 1996). Smaller pieces, on the other hand, lead to finer scale and temporally transient effects during low flows and are transported downstream during larger flows (Hyatt and Naiman 2001). The absence of large wood in the lower Elwha resulted in simplification of fish habitat. In an effort to address this problem, over 20 engineered log jams have been installed since 1999.

*Nutrients and Sediment Filtering*

Nutrient cycling, detritus inputs, and sediment filtering have all been affected by construction of the dams and now will also be affected by dam removal. Removal of the dams will expose 684 acres of the 715 acres that were covered by reservoirs; the remainder being wetted channel. Even if this 684 acres is replanted, it will take decades to restore natural vegetation to riparian and wetland areas. The lack of established riparian vegetation along much of the river length will result in limited detritus types and levels for many years. The nutrient cycling provided by riparian areas and associated wetlands will not be restored for decades as downed logs of substantial size are also required within the riparian areas. Riparian vegetation will more quickly begin to provide sediment filtering functions, and will function more fully as the riparian forest develops.

*Stream Temperature*

As the riparian forest develops in the newly drained reservoir, young trees will begin to provide shade. Smaller trees may be effective at providing shade to braided portions of the river when these portions are narrow. However, as the segments of the river remain dynamic, smaller trees may be lost to bank erosion and gravel-bar movement. This may begin a cycle of tree loss and re-establishment that may continue for decades.

Water temperatures were elevated by the solar warming that occurred in the two reservoirs. Water temperature data collected by the Lower Elwha Klallam Tribe showed about a 7 °F increase between the Elwha River upstream of Lake Mills and the lower river below Elwha Dam (Orsborn and Orsborn 1999). Temperatures in the lower river exceeded 65 °F for several weeks during the summer low-flow period. Now with the removal of the reservoirs, this situation may not improve for decades. Shallow and braided sections of the river will pass through an area with young forest. Bank dynamics may result in the loss of some trees to erosion. Some trees may not survive in the silt-laden soils. It may take many decades of dynamic changes before stream dynamics return to near normal levels and riparian forests provide shade and help contribute to cooler stream temperatures.

*Water Quality*

Water quality parameters of sediment load and turbidity load are discussed below. Water quality with regard to contaminants should remain good to excellent in the Elwha River. The majority of the basin is in wilderness managed by the National Park Service. Only the lower 14 miles are subject to road access. Several bridges cross the Elwha River including U.S. Highway 101. Stormwater from these bridges and other roadways likely enters the Elwha River and its tributaries. The amount of water quality treatment associated with these roadways prior to discharge into the Elwha River or its tributaries is unknown. The bridges are few thereby providing only limited access to the river. There are no commercial or industrial developments in most of the watershed and residences are few as well.

*Substrate and Sediment*

Nearly 18 million cubic yards of sediment were stored in the two Elwha River reservoirs. Drawdown studies conducted several years ago predicted a relatively rapid reworking of the delta materials, with the main channel of the river migrating from one valley wall to the other over a period of a day or two (Crain and Brenkman 2010). Lake Aldwell contained less sediment than Lake Mills and most of the export of materials from that reservoir has already occurred, except for what might occur at extremely high flows. Fine materials were being carried downstream from that reservoir all last year and coarse materials were moving since the spring. The Elwha dam has already been removed and little additional erosion is anticipated with flows below 5,000 cfs due to the entrenchment of the channel. Lake Mills still has 50 feet of dam remaining and the river is still reworking sediment. Dam removal is scheduled to resume in January, 2013.

On October 15 there was only 80,000 square yards of reservoir remaining with water only 3 to 6 feet deep. As dam removal occurred, fine sediments became suspended in the reservoirs and were transported downstream. During the initial phases of removal, turbidity levels were exceedingly high; exceeding lethal levels for salmonids for extended periods of time. The highest turbidity reading has been about 1,800 Formazin Nephelometric Units (FNUs)(USGS various dates) at the city diversion. The river flows have been relatively low, less than 8000 cfs. Turbidity will increase with higher flows if they occur. As of November 16, 2012, about 7 to 10 percent of the material present behind Glines Dam has eroded since the start of dam removal (Richard Bauman pers. comm. November 27, 2012).

Based on differences between the November 16, 2012, and November 8, 2012, images, about 315,000 cubic yards of material was eroded during that period, compared to about 735,000 cubic yards between November 8 and October 29, and about 200,000 cubic yards, between October 29 and October 15 (first rains). The total volume of material exported is about 1.0 million to 1.25 million cubic yards (Bauman pers. comm. November 27, 2012). By November 27, 2012, another 900,000 cubic yards had been exported from Lake Mills.

As of the writing of this document, November 27, 2012, the river flow is about 3500 cfs with 1350 FNU's (Bauman pers. comm. November 27, 2012). Side channels previously considered to be able to provide refugia are also turbid, presumably from turbid groundwater inputs. It is anticipated that various screens on surface diversions will also be overwhelmed by the level of suspended and transported sediments (Tim Tynan pers. comm. November 28, 2012). As massive export of materials continues, deeper pools in the mainstem river will fill with sediment impacting riverine dynamics and fish habitat. Movement of sediment and bank erosion will not only affect the ability of stream gauges to accurately measure flow and turbidity, but may cause damage or loss of gauges.

Following dam removal, suspended sediment levels may exceed 30,000 ppm for short durations (BOR 1996). Fish exposed to sediment loads between 50 and 100 ppm for an extended period of time may stop feeding, suffer gill abrasion, and experience loss of fitness due to the associated stress (Cook-Tabor 1995). At turbidity levels above 1,000 ppm, direct mortality may result simply from the elevated sediment loads (Cook- Tabor 1995). With sediment loads expected to exceed 10,000 ppm, it was assumed for planning purposes that most or all fish rearing naturally in the Elwha River below Glines Canyon Dam will die during dam removal. These potentially lethal conditions are a part of the current baseline.

In addition to fine sediment loading, coarser sediments are being released into the lower watershed following dam removal, elevating the bedload above natural background levels for up to 10 years (BOR 1996). As the dynamic recovery of the river continues, additional bedload movement may accelerate the natural erosion rate of the bluffs and terraces in the lower Elwha River, further increasing the recruitment of sediment to the river system in the short term. It is anticipated that the stream channel below the dams may destabilize during this time, with a resultant temporary decrease in quality of the natural fish habitat.

Prior to dam removal, substrate composition also varied naturally along the longitudinal profile of the river. Above the upper dam, gravel showed a nearly monotonic decrease, with an inverse increase in boulder cover. However, there were also impacts of the dams, especially in the middle reaches of the Elwha River, as the dominance of boulders and paucity of gravel below the Glines Canyon Dam demonstrated. In the lower Elwha River below Elwha Dam, there was a less dramatic decrease in gravel, as this section of river still received sand and gravel inputs from eroding bluffs and terraces, as well as interactions with the floodplain (Brenkman et al. 2012).

It was anticipated that streams such as Griff Creek, Hughes Creek, the Little River, and Indian Creek (along with other smaller tributaries) would provide clean water refugia for bull trout when conditions in the main stem river are poor. However, many such tributaries are also very turbid, presumably from the impacts of suspended solids on turbidity of hyporheic or groundwater influences.

Like the middle river, the primary effect of dam removal in the lower river will be elevated turbidity. Off-channel, groundwater fed habitat will provide limited freshwater refugium in the lower river. The estuary slough on the east bank of the river near the mouth is also currently utilized by bull trout and will be accessible. Saltwater may also be utilized during periods of high turbidity.

The nearshore marine substrates are primarily coarse (sand to boulder). Mud (silt and clay grain-size fractions) does not dominate the sea floor in the area analyzed by Warrick et al. 2008). Data suggest that the nearshore of the western delta and Freshwater Bay are dominated by coarse sediment (sand, gravel, cobble, and boulders) and bedrock outcrops; no fine-grained sediment (mud or silt) was identified within the survey limits. The substrate is generally coarser in Freshwater Bay and on the western flank of the delta, where boulders and bedrock outcrops occur, than directly offshore and east of the river mouth. High variation in substrate was observed within much of the study area, however, and distinct boulder fields, gravel beds and sand waves were observed. Bull kelp (*Nereocystis spp.)* beds were preferentially located along the boulder and bedrock substrates of Freshwater Bay. Although kelp has also been mapped in areas dominated by gravel and sand substrate, it typically has smaller canopy areas and lower temporal persistence in these regions.

High turbidity levels have occurred out into the Strait of Juan de Fuca to a distance of about 6 miles as the turbidity plume moves east and west with the strong tides. The plume extends approximately 2 to 3 miles offshore. The area affected by the plume generally extends from Ediz Hook to Freshwater Bay – but the area is not static as the plume changes shape and direction with the changing tides. It extends to the east approximately 50 percent of the time and to the west approximately 25 percent of the time. The plume is comprised of a lens of turbid freshwater floating on the more-dense saltwater. The turbid water is estimated to be approximately 2 to 6 feet in depth from the surface, with water beneath the plume being clear. Sediment settles out eventually and the plume gets deeper and less concentrated as the distance from the delta increases. Turbid water near the delta may contain 100's of mg/l of material as it exists the delta, but measurements farther from the delta may only be several mg/l and turbidity only in 10's of NTUs. Deposition near the delta has been ephemeral. No fine sediment (silt and clay grain-size fractions) deposition has been documented, although some deposition of sand has been observed. Most of the finer sand deposits are remobilized by the strong currents. In this area of the straits, currents are strong enough to regularly move gravel-sized particles and are particularly strong during the spring (Jonathan Warrick pers. comm. November 30, 2012).

*Complex Habitat Features*

Instream habitat was influenced by the effects of both natural (fluvial and geomorphic) and anthropogenic (dams and reservoirs) sources. Prior to dam removal, river width and depth increased steadily from the headwaters to the mouth because of increasing drainage basin size.

This resulted in channel units having, on average, greater area, depth, and width in the lower portions of the watershed, which has a role in structuring fish-assemblage patterns (Gorman and Karr 1978).

The removal of the bulk of Glines Canyon Dam has resulted in the draining of Lake Mills (Crain and Brenkman 2010), which is being replaced with additional fluvial habitat, but the river is still in the process of defining its channel.

Available habitat for anadromous fish in the lower Elwha River includes the 5 miles of the Elwha River mainstem downstream from Elwha Dam and three small low-gradient tributaries (Bosco, Boston, and Charley Creeks). Suitable salmonid spawning habitat in the lower mainstem is limited because of the predominance of large substrate (mostly cobbles and boulders) and high water temperatures. The three tributaries that enter the lower river are unlikely to provide suitable spawning conditions for bull trout because of their low gradient and expected high water temperatures. With the exception of one reported redd, the location of any spawning habitat used by bull trout in the lower river is unknown (USFWS 2000) and is not anticipated to occur for many years even with dam removal.

The habitat upstream of Lake Mills (more than 50 miles of mainstem and tributary habitat) exhibits the conditions (clear and cold water, substrate with few fines, substantial amounts of large wood) that are typical of good bull trout habitat. Habitat between the dams was impacted by: (1) the interception and trapping of nutrients, gravels, and large wood by Lake Mills and (2) the solar warming that occurred because of the longer retention time and the large surface area (415 acres) of the upper reservoir. The reduction of nutrients from upstream sources as well as the elimination of anadromous fish from this reach likely resulted in a decrease in production of benthic invertebrates. Munn (1999) concluded that the Elwha River and its tributaries were oligotrophic and that restoring salmon runs would affect the ecosystem profoundly, increasing both primary and secondary productivity. Li (1990) found fewer taxa of benthic invertebrates downstream of the dams than he found upstream of Lake Mills. Substrate below Glines Canyon Dam consisted mainly of large cobbles and boulders and was generally too large to be considered suitable salmonid spawning habitat. Water temperatures could exceed 15 degrees C° (daily average) for several weeks during the summer low flow period (Crain 2000).

*Connectivity*
Construction of the mainstem dams isolated populations of bull trout in both the middle and upper Elwha River. The dam removal is being conducted partially to restore this connectivity. Full connectivity may not occur immediately because steep reaches may remain a barrier or partial barrier to upstream movement of salmonids. Also, reaches with high temperatures or high turbidity may not be as conductive to movement of all fish.

*Biotic Community*
Historically, the Elwha had a rich assemblage of fish stocks. There were at least 10 native anadromous salmonid stocks of the Elwha River (Ward et al. 2008). Species using the Elwha basin include Chinook salmon (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), chum (*O. keta*), pink (*O. gorbuscha*), and sockeye (*O. nerka*) salmon; steelhead (*O. mykiss*); coastal cutthroat (*O. clarkii clarkii*), Dolly Varden (*S. malma*); brook trout (*Salvelinus fontinalis*); and western brook lamprey (*Lampetra richardsoni*) and Pacific lamprey (*L. tridentata*). Rainbow trout (the non-

anadromous form of steelhead) and cutthroat trout were observed to be the dominant fish species in the waters surveyed, comprising 89 percent and 88 percent of the total fish assemblage in 2007 and 2008, respectively. Bull trout comprised approximately 3 percent of the fish assemblage in both years, with Chinook salmon making up 8 percent in 2007 and 9 percent in 2008 and pink salmon making up less than 1 percent of the fish assemblage (2007 only) ( Brenkman et al. 2012). Brenkman et al (2012, p 46) stated that trout were ubiquitous from the headwaters to the mouth and dominated the fish assemblage in both years. The high numbers of steelhead throughout the Elwha River have important implications for steelhead restoration and recolonization, particularly because wild residents can contribute substantially to steelhead populations (Christie et al. 2011). It is anticipated that steelhead from the upper river will resume anadromy, contribute to re-colonization and interact with returning populations of summer and winter steelhead after dam removal (Brenkman et al. 2008a).

Hatchery releases of salmon and steelhead have occurred in the lower Elwha River; the interaction between native char and these hatchery origin fish has not been examined (WDFW 1997a). Brook trout have been planted in ONP, and are known to occur in tributaries both upstream and downstream of Glines Canyon Dam (USFWS 2000).

Non-salmonid taxa below Elwha Dam include sculpin (*Cottus spp*.), three-spine stickleback (*Gasterosteus aculeatus*), Pacific lamprey, redside shiner (*Richardsonius balteatus*), eulachon (*Thaleichthys pacificusn*), starry flounder (*Platichthys stellatus*) and surf smelt (*Hypomesus pretiosus*) (Brenkman et al. 2012).

Transplanted, Chambers Creek Hatchery lineage (early-timed) steelhead produced through the tribal hatchery program from 1976 through 2011 (LEKT 2012b) are not part of the listed DPS (73 FR 55451, September 25, 2008). Early-timed hatchery steelhead in the Elwha River therefore cannot contribute to recovery of that listed species.

Genetic analyses indicate that “early-returning” winter-run steelhead are largely derived from transplanted Chambers Creek Hatchery stock originating from a now-terminated harvest augmentation program. Later returning native stocks of winter-run steelhead are significantly different from the early returning, hatchery-origin stock (Winans et al. 2008), but also different from some collections of resident O. mykiss from the upper Elwha River (Winans et al. 2008).

Early-returning hatchery steelhead spawning ends prior to mid-March. Later-timed, natural-origin Elwha River winter-run steelhead are believed to enter freshwater and spawn from February through June. Natural steelhead spawning currently occurs (to the extent that any spawning is possible under current high turbidity conditions) throughout the mainstem and tributaries below Elwha Dam, whereas the Chamber Creek stock primarily return to the hatchery. One trait of the species is that some adult steelhead do not die after spawning and can undergo multiple spawning cycles. Not all adults return during their predicted return years as some adults may remain at sea for additional years.

The LEKT terminated the Chambers Creek steelhead release program in 2012. In addition, a targeted genetic risk-reduction fisheries on Chambers Creek steelhead (return years 2012-13 and 2013-14) would occur to reduce the risk that the last remaining adult returns of Chambers lineage stock would escape into natural spawning areas and interbreed with native late-retuning winter-run steelhead. The impacts of fisheries in the Elwha River directed at the harvest of Chambers Creek lineage steelhead on native winter-run Elwha River steelhead were previously evaluated and authorized by NMFS through a separate ESA consultation (NMFS 2011b). The co-managers will also maintain hatchery weirs and traps open, and operate the mainstem Elwha River weir at RM 3.7 if feasible, to collect and cull any adipose fin-clipped (Chambers Creek lineage) steelhead encountered (LEKT 2012a). In spite of these efforts, it may not be possible to remove all of the Chambers Creek stock. The return years of 2012 to 2013 and 2013 to 2014 are anticipated to be the most inhospitable to spawning anticipated in the foreseeable future, which will further limit the ability of these stocks to survive in great numbers. Because the numbers of this stock are anticipated to be few and they are not well adapted (compared to native stocks), we anticipate that the stock will eventually be extirpated.

Changes are expected to occur in fish assemblage structure after dam removal, including: (1) upstream and downstream re-colonization by salmonids; (2) resumption of anadromy by upper river bull trout, rainbow trout, and cutthroat trout populations; and (3) increased species richness in portions of the river upstream of the dams (Brenkman et al. 2012).

Summary of Habitat Conditions

The recruitment of large wood from the upper watershed had been virtually eliminated and the two reservoirs (when they existed) served as "heat sinks" during the summer, dramatically increasing water temperature. Consequently, the combined effects of the two dams caused the freshwater and nearshore marine habitat available to salmon below the Elwha Dam to be severely degraded. The presence of the two dams was identified as the single largest factor limiting Elwha River salmon production, including bull trout. The removal of the dams has now initiated a time of recovery that will bring short-term uncertainty and short-term effects. The Elwha River will remain dynamic for many years, especially in areas once occupied by the reservoirs and in downstream reaches.

## Status of the Species in the Action Area

Genetics

Although Dolly Varden are present in other Olympic Peninsula watersheds, limited genetic and morphological analysis of a few specimens collected in the Elwha River indicates that only bull trout are present (Leary and Allendorf 1997).

Fish collected from the upper river (Lake Mills to Hayes River) (n=25), middle river between the two dams (n = 36), and lower river (n=21; excluding headwater fish) were genetically indistinguishable from each other (DeHaan et al. 2010). Analysis of tissue samples collected from the char which inhabit the headwaters confirmed that they were bull trout and not the closely related Dolly Varden. However, it was found that the headwater fish, though similar to the remainder of the basin, were identifiable as a discrete sub-population (DeHaan et al. 2010).

There was no evidence of depressed allelic richness or gene diversity (Winans et al. 2008). Evidence from the radio-telemetry study suggested that current genetic exchange between different sub-areas of the river may be a “one-way street”, as no migration was observed upstream through several canyons or, obviously, over the two dams. This is largely supported by the genetic data, although it does appear that some upstream gene flow through Carlson Canyon does occur. Six of 17 bull trout collected in the Elwha headwaters were more similar to bull trout from the lower river than they were to other bull trout in the headwaters (DeHaan et al. 2010). This lack of upstream migration may be due to the poor condition of Elwha River bull trout relative to other Olympic Peninsula bull trout populations.

Elwha River bull trout were compared to Dungeness River bull trout, as well as other bull trout populations in western Washington State, and found to be genetically distinct (Winans et al. 2008; DeHaan 2010). However, all of these bull trout populations are components of a single distinct population segment (DPS), which consists of bull trout throughout the lower 48 states.

Distribution

Bull trout are distributed in the Elwha River watershed from the mouth to near the headwaters (Crain and Brenkman 2010). Bull trout have also been observed in 12 tributaries to the river (Brenkman et al. 2008a) and may be present in others. WDFW researchers reported that at least one bull trout has been captured in the estuary at the mouth of the Elwha River (NMFS 2012b).

The NPS has identified one bull trout spawning area in the main stem Elwha River. This apparent bull trout spawning aggregation is located in the lower reaches of Rica Canyon, immediately upstream from Lake Mills, based on redd surveys. A second presumed spawning location may be located near the confluence of Hayes River. Spawning has not actually been observed near Hayes River, but an individual radio-tagged fish was observed to make two upstream migrations to the area during the spawning season (October) in successive years. Bull trout are known to spawn in the Hughes Creek, a tributary between the Glines Canyon Dam and Lake Aldwell, while young-of-the-year bull trout have been observed in Boulder Creek (Lake Mills tributary), and juveniles have been seen in Cat Creek (Lake Mills tributary) and Griff Creek (middle river tributary) (Brenkman et al. 2008a).

It has been difficult to assess the reproductive success of bull trout in the Elwha River, as juvenile bull trout tend to be difficult to detect. Systematic snorkel surveys conducted in 2009 (Dunham et al. 2009) identified small bull trout in only 1 of 41 sites (2 percent). Juvenile bull trout were collected in higher numbers via electro-fishing (22 percent of the sampled sites) and yet larger bull trout were observed in 34 percent of the snorkel sites. Brenkman et al. (2008a) documented young-of-the-year bull trout in only two tributaries below Rica Canyon (Hughes Creek and Boulder Creek) while juveniles (50-200 mm) were reported in Hughes, Griff, Boulder, Cat, Long, Stony, Godkin, and Buckinghorse Creeks and Lake Mills.

The largest single aggregation of bull trout in the Elwha watershed is found around Lake Mills, which will be gone when the Glines Canyon Dam is fully removed. These fish exhibited an adfluvial life-history, spending a large portion of the year in the lake before migrating upstream into Rica Canyon to spawn in the early fall (September/October). Adult and juvenile bull trout have also been observed in two other tributaries to the lake - Cat Creek and Boulder Creek. It is believed that juvenile bull trout move into the lake to rear at a relatively young age. However, no information exists to verify this assumption (Crain and Brenkman 2010).

Life-History

Bull trout populations in the Elwha River may exhibit fluvial, adfluvial, and anadromous life-history strategies. The creation of lakes Aldwell and Mills modified habitat features, resulting in the establishment of adfluvial populations in these lakes. Fish found in the lower Elwha River basin (below Elwha Dam) are thought to be anadromous, while adfluvial and fluvial populations inhabit the basin above Elwha Dam (this and following from Ward et al. 2008; Crain and Brenkman 2010).

To gather data regarding bull trout life-history and behavior in the Elwha River watershed, from 2005 to 2008, NPS researchers captured and tagged 53 adult (>400 mm) and 46 subadult bull trout (<400 mm) in the Elwha watershed with Lotek radio tags. Fish were tagged in a number of locations in the watershed, including areas above Grand Canyon, between Rica Canyon and Grand Canyon, Lake Mills, the area of the river between the dams, and below Elwha Dam. Fish movement was tracked using a combination of fixed telemetry stations, aerial surveys, and foot surveys.

The NPS found that tagged bull trout exhibited a diversity of migration patterns, depending upon their location in the watershed. A few tagged fish located above Grand Canyon and a few between the two dams tended to display a fluvial migration, moving upstream in the fall in an apparent spawning migration. Fish located in Lake Mills displayed a clear adfluvial migration, moving out of the lake and upstream into the lower reaches of Rica Canyon to spawn in the fall. These fish then moved back down into the lake to rear. Several fish tagged above Rica Canyon were observed to move downstream through the canyon and into the lake, but did not appear to migrate back upstream. A total of 23 (of 96) bull trout were observed to pass over a dam. Thirteen adult and seven subadults were observed to pass over the Glines Canyon Dam while one adult and two subadults passed over Elwha Dam. One subadult fish was observed to pass over both dams. Movement over the dams corresponded with winter high-flow events. Fish below Elwha Dam moved short distances in the lower river. No upstream movements of bull trout through Rica Canyon, Grand Canyon, or Carlson Canyon were observed; although habitat assessments conducted in 1987 (Hosey and Associates 1988) did not identify the canyons as barriers to salmonid migrations. Four adult bull trout were captured and tagged in early September (2007) below Glines Canyon Dam and relocated into Lake Mills. All of the relocated fish appeared to stay in Lake Mills into the spawning season (October). Two fish then fell back over the dam while the other two remained in the Rica Canyon area.

Although anadromy has not been specifically observed in the Elwha River, it is believed that such a life-history strategy is present and will be expressed/re-expressed when regular access to saltwater is provided. Multiple radio-tagged bull trout were observed to pass over the Elwha Dam or Glines Canyon Dam, and at least one fish passed over both dams, indicating that significant downstream migration still occurs in the river. One bull trout has been captured in a beach-seine sampling in the estuary (Shaffer, pers. com. – in Crain and Brenkman 2010).

Size and Condition

Native char seen at the old tribal facility have been about 1 to 2 pounds in weight (Crain 1999). Char observed in the WDFW rearing channel have been about 300 to 380 millimeters (12 to 15 inches) in length (WDFW 1997a). Bull trout that were caught in a scoop trap downstream of Glines Canyon Dam between late April and early June were mostly between 100 and 120 millimeters (Hiss and Wunderlich l994, FWS 1998). Hiss and Wunderlich (1994) captured 7 bull trout (118 mm to 404 mm) in Lake Mills, with a relatively low level of sampling effort.

Both the snorkel surveys and the radio telemetry project provided an opportunity to observe size characteristics of the Elwha bull trout population. The headwaters population had a noticeably reduced body size in relationship to the rest of the river, and may represent a "resident" population. Throughout the watershed, Elwha River bull trout were found to be of poor fitness, being uniformly lighter at any given length than populations found in other Washington coast river systems. This poor fitness is likely the result of a limited food supply due to the elimination of anadromous salmonids from the watershed (Crain and Brenkman 2010).

Abundance

Few abundance data are currently available for bull trout in the Elwha River watershed. Many areas are too deep, extensive (reservoirs), or hazardous (canyons) to snorkel. Therefore many of the surveys for bull trout were incomplete and should only be considered as minimum numbers rather than estimates. Snorkel surveys by fish resource managers have shown low numbers, averaging less than 1 bull trout per 100m of river from 1995 to 2004 (Brenkman et al. 2008a). However, NPS snorkel surveys have shown that bull trout are found throughout the Elwha River watershed (Brenkman et al. 2012).

*Lower Elwha River*: Only limited information exists on the abundance and use of the Elwha River mainstem and tributaries located downstream from Elwha Dam by native char. A few native char are occasionally observed in the State rearing channel or at the tribal hatchery holding pond in the fall (WDFW 1997a, Crain 1999). No native char spawning has been documented for the lower river. In general, native char are present in the river below Elwha Dam in low numbers (USDI 1994). Brenkman et al. (2012) found 17 bull trout in the lower Elwha River.

*Middle Elwha River*: Bull trout have been reported to occur in low numbers between the two dams, in Lake Aldwell, and in three tributaries (Griff Creek, Hughes Creek and the Little River) within this reach (Hiss and Wunderlich l994, FWS 1998, Morrill and McHenry 1996). No bull trout were found in the tributaries or in the mainstem during the snorkel surveys of this area by the U.S. Geological Survey in 1995 (Reisenbichler 1999). In contrast, nearly 200 bull trout were observed upstream of Lake Mills. Bull trout utilize Lake Mills as foraging habitat. Hiss and Wunderlich (1994) captured 7 bull trout with a relatively low level of sampling effort. Sixty rainbow trout and numerous crayfish were also caught during this sampling effort, indicating that a forage base exists in the reservoir for bull trout. Brenkman et al. (2012) found 51 bull trout in the middle Elwha River.

*Upper Elwha River*: According to Reisenbichler (1999), bull trout have been observed in the Elwha River mainstem between river miles 16 and 42, and in a number of the tributaries (Cat, Godkin, and Delabarre Creeks and the Hayes River), in the upper basin. Reisenbichler (1999) observed 160 and

39 bull trout in the mainstem and tributaries, respectively. In contrast, no bull trout were observed by Reisenbichler in the Elwha River mainstem and tributaries between the two dams. Population size in the upper basin is unknown, although bull trout appear to be relatively prevalent throughout the upper watershed and have been observed as high as RM 43.9. Bull trout are also found in at least seven of the mainstem tributaries. Brenkman et al. (2012) found 137 bull trout in the upper Elwha River.

The highest abundances of bull trout (50) were observed immediately upstream of Lake Mills and near the headwaters of the river in 2007 and 2008 (Brenkman et al. 2012). Of the total numbers of bull trout observed in 2007 and 2008, 60 percent and 69 percent respectively were observed from Rica Canyon downstream to the river mouth in the area that will be influenced by dam removal. A number of fish were also found to reside in Lake Mills and Lake Aldwell, which, as of 2012 are no longer in existence. NPS bull trout abundance estimates ( for fish >25 cm) in 2010 for Lake Mills ranged from a low of 62 fish to a high of 711 fish while estimates from Lake Aldwell ranged from 42 to 365 fish (Crain and Brenkman 2010).

<u>Productivity and Mortality</u>
There are no estimates of productivity or mortality available for bull trout in the Elwha River basin.

## Factors Affecting the Species in the Action Area

<u>Non-native Eastern Brook Trout</u>
Eastern brook trout have been introduced to and documented in many portions of the Elwha watershed. They are known to occur below Elwha Dam, in Lake Aldwell, between Lake Aldwell and Glines Canyon Dam, and above Lake Mills. Bull trout are known to be sympatric with brook trout in many of these locations (USFWS 2011).

Brook trout grow faster than bull trout do as water temperature increases (Rodtka and Volpe 2007: 1714; McMahon et al. 2007:1313). Brook trout in many study areas have displaced bull trout in lower-elevation areas that have higher temperatures (MBTSG 1996:6; Rieman et al. 2006:63). In central Idaho, average displacement of bull trout by brook trout took place in the lower 100~200 m of elevation (Rieman et al. 2006:73). The two species are more likely to coexist in larger streams, whereas brook trout can eliminate bull trout from smaller streams (Rieman et al. 2006). Sympatric distributions of these two species place brook trout in the lower reaches, bull trout in the upper reaches, and hybrids in the area of overlap (DeHaan et al. 2009:935), unless high-elevation lakes have introduced populations of brook trout, which reverses the thermal gradient and direction of invasion from that of streams without lakes (Rieman et al. 2006:64). Most hybrids are first-generation ($F^1$) individuals, indicating reduced fertility of $F^1$ hybrids and reduced survival of their progeny (Kanda et al. 2002:772). Upstream movement of brook trout evidently can be limited by water temperature rather than stream gradient and swimming ability (Adams 1999 in Rieman et al. 2006:64). However, researchers in western Montana found occurrence of bull trout to be positively associated with channel width, large wood, and the presence of a “strong” neighboring main-stem population and negatively associated with channel gradient and the presence of brook trout, and they suggested that bull trout have increased resistance to invasion by brook trout in streams with high habitat complexity and connectivity" (Rich et al. 2003:1053).

During the short term, we do not anticipate any competitive advantage being given to brook trout over bull trout by removal of the dams. Over the long term, we anticipate that the effect of removal of the dams would be insignificant, neutral, or beneficial to the persistence of bull trout in the presence of brook trout due to lowering of water temperatures in the lower river to natural levels during late summer and early fall, production of large amounts of large wood, and increases in habitat complexity and connectivity in the new sections of river. However, we do anticipate that brook trout will continue to exert negative pressures on bull trout in the Elwha Watershed.

Native Salmonids

The dams have drastically affected the number and size of anadromous salmonids using the river. Much of the watershed no longer received nutrients from returning salmon and the forage base is no longer as robust as it otherwise would be. With removal of the dams, anadromous salmonids are anticipated to eventually recover and return to natural levels. This process may take many decades. The process can be accelerated through assisted restoration of anadromous stocks using the hatchery programs proposed and analyzed in this consultation.

Fishing and Incidental Mortality

The Lower Elwha River outside of Olympic National Park has been closed to fishing for native char for some time (WDFW 1997a). The park had catch-and-release regulations for native char in all ONP waters until recent years. There was likely some mortality from incidental hook-and-release of bull trout in past fisheries targeting other species. Since 2011, there has been a 5-year moratorium on fishing in the Elwha, except for remaining capture efforts in 2012 and 2013 for Chambers Creek steelhead. While the moratorium will end in 2016, the status of returning salmon and steelhead are not anticipated to support a fishery until after that time and through the first two phases of fish recovery.

Temperature

The reservoirs have resulted in elevated temperatures in downstream reaches. With removal of the dams, the river will be in a dynamic flux for many years. Eventually stream temperatures are anticipated to return to natural levels. However, in the interim, heavy sediment loads may fill pools and reduce pool depth and increase stream surface area thereby resulting in increased warming in the summer.

Timber Harvest

Relatively small amounts of the watershed are subject to industrial forestry. The lands managed for industrial forestry are either State trust lands managed under the State lands HCP (WDNR 1997) or are private forest lands managed under the Washington State Forest Practices Rules and Washington forest Practices HCP (WDNR 2006). The contribution of those plans to the recovery of salmonid populations is fully described in those plans and the respective section 7 consultations (USFWS 1997; 2006). The combination of riparian buffers, unstable slope strategies, and proper road management and remediation will provide for properly functioning riparian and aquatic conditions that should contribute to the attainment of harvestable surplus of salmonids.

Elwha River Estuary

The Elwha delta is developed and is protected from flooding by a system of dikes. These dikes disconnect the lower Elwha River and its riparian zone from the floodplain and delta. This reduces the amount of salmonid habitat and influences nutrient cycling. In addition, the dikes contribute to faster flows during peak flows and have a strong influence on the estuary and nearshore environment. Restoration of the Delta and Estuary, as well as other components of the restoration of the Elwha river system for salmonids and other fish and wildlife, will influence the future of bull trout in the watershed. This restoration will take many decades to accomplish. The altered state of the delta is now subject to different currents and depositional regimes than it would have been naturally.

Port Angeles Water-Supply Operations

The Port Angeles industrial water supply, which supplies several mills, hatchery operations, and the Federal water-treatment facility, periodically requires maintenance and repair, and might result in stranding and/or crushing of fish or entrainment. In contrast, the drinking-water supply is located under the river and is unlikely to require maintenance other than some back flushing. This system will be used by the City when turbidity levels are not excessive. In the meantime, during periods of high turbidity, the City drinking water supply treatment facility will use water derived from the Federal treatment facility which reduces the level of sediment in the water.

Climate Change

Although climate change is further discussed in Cumulative Effects, it should be noted here that may already be a factor affecting the action area with respect to bull trout. Temperature has been a concern due to the actions of the reservoirs in raising instream temperatures. Now, exposure of previously submerged reaches will also be reduced to some level of warming until streambank vegetation becomes established and provides shade. Climate change may also exacerbate revegetation efforts more than it will influence existing forests, especially where revegetation may be occurring on hostile sediments. Peak flows and summer low flows may be amplified in the Elwha by a transition from a snow or rain-on-snow zone to a rain dominated system. Potential sea-level rise may have particularly severe impacts in the Elwha estuary since it is so badly degraded and will not be as resilient as places where estuary and delta habitats are still intact. It may take many decades to re-establish delta and estuary habitat, during which time major changes may occur to climate and flow regimes, as well as sea levels.

Connectivity

The level of connectivity is currently degraded in the Elwha, but will be changing rapidly. While full potential connectivity may not be reached immediately, much of the connectivity will be restored in a relatively short time period (5 to 10 years).

Short-term Risks of Restoration

The condition and trend of the Elwha Watershed is dynamic and therefore hard to describe. During the drawdown of the reservoirs and for several years after, conditions will be changing rapidly and will place unusual stressors on fish species, including bull trout. During these early restoration and recovery years, bull trout will be subject to an additional set of risks:

1. Mortality associated with increased turbidity from Lake Mills to the mouth during and shortly following dam removal;
2. Mortality associated with entrainment at each dam site;
3. Mortality following dam removal associated with redistribution of course sediment below Glines Canyon Dam (stranding or mechanical grinding of eggs).
4. Stranding of multiple life-history stages during reservoir draw down;
5. Loss of current bull trout spawning and rearing habitat in impacted reaches;
6. Threats associated with re-colonization of anadromous salmonids (e.g. introduction of pathogens, predation, competition, etc.);
7. Risk of barriers/loss of connectivity upstream of Lake Mills during reservoir drawdown; and
8. Genetic introgression with non-native Eastern brook trout accelerating due to stresses of dynamic environment.

Long-term Benefits of Restoration.
Some of the benefits of restoration will begin following dam removal, while others will take a substantial number of years to realize. Bull trout will eventually benefit from the following factors:

1. Normal size and distribution of substrates between dams and in lower river;
2. Recruitment and transport of large wood between dams and in lower river;
3. More-complex habitat between dams and in lower river;
4. Natural temperature regimes between dams and in lower river;
5. Improvement in connectivity in the mainstem, although some connectivity may be permanently exacerbated by dropping reservoir levels; and
6. Increased import of prey and marine-derived nutrients via anadromous fish

**Conservation Role of the Action Area for the Species**

Spawning may occur in the Elwha River mainstem and in tributaries that enter the Elwha River between the two dams, as well as the headwaters. The two reservoirs were probably used mainly for foraging, but will now be drained. The Elwha River will likely support anadromous, fluvial, resident, and adfluvial life-forms, and provides habitat for foraging, migration, and overwintering. USFWS set interim recovery goals of two viable populations in the Core Area identified for bull trout in the Elwha River basin, with at least 500 spawners. It is currently unclear whether there were two, three, or even four local populations prior to dam removal. With removal of the dams, it is uncertain whether full connectivity will be restored (some natural barriers might exist) and whether there will be fewer or more local populations. It is presumed that connecting the local populations into a single complex of populations will result in a more-resilient complex of bull trout. The Elwha represents a genetically unique portion of the species and plays an important role in maintaining that genetic diversity and in maintaining the geographic range of the species.

## STATUS OF BULL TROUT CRITICAL HABITAT

Discussion of the Status of Bull Trout Critical Habitat is described in Appendix B

### Status of the Critical Habitat in the Elwha River Critical Habitat Subunit and Environmental Baseline in the Action Area

We have combined these two sections for the proposed action due to their complete overlap. However, some portions of the Elwha River watershed are excluded from the critical habitat designation.

Critical habitat does not include the manmade structures such as the outfall channels from the facilities. Also excluded from critical habitat are waters adjacent to nonfederal lands covered by legally operative incidental take permits for habitat conservation plans (HCPs) issued under section 10(a)(1)(B) of the ESA, in which bull trout is a covered species on or before the publication of this final rule such as the Washington State Department of Natural Resources HCP for State Trust Lands and the Washington Forest Practices HCP.

Also excluded are waters within or adjacent to lands subject to certain tribal management plans. For example, 2.8 miles of river and shoreline were excluded from designation adjacent to the Lower Elwha Klallam Tribe. The nearshore marine closest to the Elwha River Delta is also excluded where it is adjacent to tribal lands. The majority of the critical habitat designated for bull trout in the Elwha River Basin lies within Olympic National Park.

Critical habitat not only includes designated freshwater habitats, but also extends offshore to the depth of minus 33 feet relative to the mean low low-water line, which is the photic zone and is considered to be the habitat most consistently used by bull trout in marine waters. Although the action area includes critical habitat within the Straits of Juan de Fuca, effects to critical habitat from the proposed action (effects from fish-weir installation and use and water withdrawal) are extremely unlikely to occur outside of the Elwha River. Therefore, we will focus our description of the critical habitat to that within the Elwha River.

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area of each project. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action areas that have undergone section 7 consultation and the impacts of State and private actions which are contemporaneous with the consultation in progress.

Within the critical habitat, the primary constituent elements (PCEs) of critical habitat for bull trout are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. The PCEs and their baselines are as follows:

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

State authorized groundwater rights in the Elwha River valley are approximately 56 cfs[2]. Current use is less than this, with the major groundwater purveyors using approximately 22 cfs (NPS 2005, p. 67). Currently, wells are used to provide some of the water need for use by the LEKT and WDFW fish facilities, as well as local land owners.

Springs or seeps also occur in the basin, for example near the water treatment facility in the lower Elwha River basin. Groundwater fed off-channel habitats occur in the lower river (Crain and Brenkman 2010). The effect of groundwater withdrawal on the function of this PCE is not fully known. Withdrawal of groundwater occurs, in some instances, using shallow wells (e.g., 25 ft deep), thereby having a potential greater influence on the quantity and temperature of the river. These effects are most likely a potential for concern during the low-flow periods of the summer and fall when water temperatures are higher and instream flows lower.

We anticipate that this PCE may be negatively affected seasonally by the groundwater withdrawals; however, the function of this PCE is not precluded.

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

The Elwha Dam and the Glines Canyon Dam were built without fish-passage capability, blocking passage of anadromous and fluvial bull trout. With the removal of the dams, which should be completed in 2013, major barriers to bull trout migration will no longer be present. Currently, passage above the previous location of the Elwha Dam is possible, based on the movement of other salmonids noted above this location (Crain in litt. 2012; McMillan et al 2012, p. 19). During periods of high water temperatures in the summer and fall, bull trout

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

Abundant forage is available in the Elwha River due to the presence of anadromous (Chinook salmon) and non-anadromous (e.g., resident cutthroat) fish. Their production of eggs and the eventual fry and juveniles, which are consumed by bull trout. The Elwha River was (as of 2005) the largest producer of Chinook salmon and steelhead, and second largest for coho on the Strait of Juan de Fuca. The majority of Chinook, coho, and steelhead are hatchery-produced (NPS 2005, p.iv). With the removal of the dams and input of significant levels of sediment, the number of individuals and species composition of invertebrates may temporarily change in these

[2] The state does not authorize water rights for the LEKT.

lower reaches. However, more than 70 miles of usable habitat in the middle and upper Elwha River are in the process of being made accessible to bull trout and other fish species for foraging and spawning. Increased areas for spawning for bull trout prey species, such as Chinook salmon, are anticipated to be benefit bull trout in the long term.

Riparian vegetation and its attendant macroinvertebrates, while still present along the Elwha River, are much further from the water in the middle and lower river following dam removal. Thus its contribution in the reaches where the lakes were is less. New vegetation is emerging in the old lake beds but will be limited for many years as the river moves. In the lower Elwha River, the amount of overhanging vegetation is more limited than in the upper river, thereby reducing the availability of terrestrial insects available to bull trout in this lower reach.

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

The Elwha Dam and the Glines Canyon Dam have precluded the movement of large wood and gravels downstream of the dams. With the removal of the dams, as well as restoration actions that have been carried out and that are planned to install large wood in the lower river, the amount of complexity in the river is likely to improve in the long term.

The condition of pools below the dam are unknown, but likely are in transition as they fill with sediment and bedload released during flows through the material stored behind the dams.

*PCE 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 Elwha River flows from glaciers and ice fields, providing cold river flows. However, until recently, the reservoirs behind the dams affected downstream water temperatures by increasing them between 4°C to 8°C (McHenry 2002 1993 in NPS 2005, p. 114) more than normal during some parts of the late summer and early fall (FERC 1993 in NPS 2005, p. 114). With dam removal, water temperatures are anticipated to improve below the former dam sites. However, the current lack of overhanging riparian vegetation will limit the cooling effect provided by shading. In time, we anticipate that the riparian conditions will improve to assist in maintaining cool water temperatures in the downstream areas.

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

Spawning and rearing habitat for bull trout occurs primarily within the Olympic National Park boundaries. Little River has been designated as a potential local population and may support spawning, but none has been identified to date. The Little River has over 7 miles of accessible habitat and the habitat, including temperature conditions in the river, are suitable for bull trout spawning and juvenile rearing based on temperature data collected in 1996 by the LEKT

(McHenry, in litt. 2003). The temperature profile is similar to other systems where very cold groundwater is the major factor influencing stream temperatures in late summer, with very little diurnal variation (McHenry, in litt. 2003). Morrill and McHenry (1995) also reported the presence of bull trout in this river.

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

River discharge is influenced by winter storms, spring snowmelt, and base flow conditions during summer and fall. Mean annual discharge is approximately 1,500 cfs at the McDonald Bridge stream gage (USGS gage #12045500) and 1,650 cfs at the river mouth (NPS 2005, p. 63). Mean winter flow is about 2,000 cubic feet per second (cfs) and mean summer flows is about 600 cfs (Elwha-Dungeness Planning Unit 2005). Peak flood events have exceeded 40,000 cfs, while base summer low flows may be as low as 200 cfs. Even with the dams in place, the flows within the action area maintained a nearly natural regime as the dams were operated as run-of-the-river (NPS 2005, p.64).

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

WDOE has classified the Elwha River and its tributaries as a “salmon and trout spawning, core rearing, and migration” area, which signifies “extraordinary” quality (NPS 2005, p. 64). There are no industrial discharges into the river. Discharges that may negatively affect the water quality of the river are associated with stormwater run-off from roads, treated effluent from the hatchery and fish rearing facilities, and septic systems. .

During dam removal, large quantities of sediment are being released and will continue to enter the Elwha River for many years. Within 10 years, it is anticipated that sediment loading in the lower reaches of the river and the marine nearshore area will decline to natural background levels as the river system stabilizes (Ward et al. 2008).

As described above, water withdrawals for domestic and hatchery related facilities may reduce the instream flows to some extent.

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

Hatchery releases of salmon and steelhead have occurred in the lower Elwha River; the interaction between native char and these hatchery origin fish has not been examined (WDFW 1997a). Brook trout have been planted in ONP, and are known to occur in tributaries both upstream and downstream of Glines Canyon Dam (USFWS 2000).

Brook trout are present in the middle Elwha River, with the highest abundances apparently in Indian Creek and a small groundwater-fed channel in the Elwha Campground (Crain and Brenkman 2010, p.24). Removal of eastern brook trout from Elwha tributaries has been proposed by the NPS to prevent hybridization with bull trout. Specifically, removal of brook trout from the Elwha campground tributary will be conducted (Crain and Brenkman 2010, p.24).

## EFFECTS OF THE ACTION

Direct effects are those effects from the project that immediately affect bull trout. Indirect effects are those impacts from the projects that are later in time and may occur outside of the areas directly affected by the actions. Indirect effects must be reasonably certain to occur before they can be considered as an effect of the actions. Indirect effects may occur from changes in habitat that affect bull trout ability to use habitat or through other changes such as decreased prey abundance and availability. 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, the core population, and the Interim Recovery Unit. First we examine the exposure to which bull trout will be subject. Then we assess which actions will result in only insignificant and/or discountable effects, as well as those components that may be beneficial to bull trout. Lastly, we consider both the direct and indirect effects of actions which will result in adverse effects to bull trout.

### Exposure Analysis

Bull trout are found throughout the Elwha River watershed including the nearshore marine environment. The timing of their use of various parts of the watershed is not well understood and neither is the function of the various parts of the watershed for bull trout. The location of spawning areas is known or suspected in only a few cases. Parts of the watershed are used for spawning, rearing, foraging, migrating, and overwintering. We assume that bull trout may occur anywhere in the watershed including the mainstem and its tributaries. We assume that spawning and rearing of juveniles can occur within the mainstem and tributaries, with the exception of the mainstem Elwha River below the Elwha Dam. Habitat conditions in this reach of the river are not very conducive to spawning and are not anticipated to become suitable for the foreseeable future. This exposure analysis is based on information provided in the <u>Status of the Species</u>, <u>Status of the Species in the Core Area and Foraging, Migration, and Overwintering Area</u>, and the <u>Environmental Baseline</u>.

### Actions Resulting in Insignificant and/or Discountable Effects

The following actions are anticipated to result in only insignificant and/or discountable effects for the following reasons. Additional information can be found in the November 28, 2012, biological assessment provided by the NMFS.

<u>Control of Disease and Parasites</u>
Hatcheries may potentially introduce diseases into the natural environment either by direct contact or through contaminated wastes. Free-living fish may be exposed to increased levels of pathogens and may contract diseases when they come in contact with pathogen-bearing water. However, the extent of disease transmission from hatchery to non-hatchery fish is believed to be low since the pathogens responsible are already present in both groups of fish, and environmental conditions generally do not favor outbreaks of disease in the wild.

Due to the confined nature of the hatchery environment (i.e. high rearing density), salmon and steelhead in culture facilities are more susceptible to pathogenic bacteria, fungi, and viruses, so there is potential for fish released from hatcheries to transmit these diseases to fish in receiving waters. Protocols for monitoring the health of fish in hatcheries, specified in the co-managers Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State (1996), have proven successful in containing disease outbreaks in the hatchery, minimizing the release of diseased fish, and reducing the risk to wild populations. Although artificial production of salmon brings with it the risk of fish pathogen amplification and has the potential to spread to the fish populations in the river system, this risk is thought to be low and minimized by following all applicable co-manager accepted fish health guidelines.

The NPS proposed that hatchery fish should be released at life stages and in areas where residence in freshwater is reduced to the extent possible (Crain and Brenkman 2010). The WDFW and LEKT adjusted the final proposed salmon and steelhead supportive breeding program actions submitted to NMFS for ESA review so that outplanting of hatchery-origin juvenile salmon and steelhead into the headwater and upper river areas important for bull trout production in the watershed is no longer proposed. All juvenile hatchery salmon and steelhead will be released as actively migrating smolts (Chinook salmon, coho salmon, steelhead) or fry (fall chum and pink salmon) directly from the hatcheries in the lower river at RM 3.5 and 1.25. These release locations and life history at release strategies will ensure that the hatchery fish emigrate from the river and seaward rapidly, and within a matter of hours or a few days. For these reasons, the opportunity for any interactions with bull trout regarding transmission of disease or parasites by the hatchery smolts is considered insignificant. The potential for their interaction is expected to be low, due to the typically rapid emigration of juvenile salmonids from the river, and due to inter-species niche separation in the nearshore marine zone. Due to the fish-health guidelines to be followed, the short residence time of released fish, the local origin of broodstock, the presence of similar pathogens in the natural environment, and the natural separation between salmon and steelhead species and bull trout in the wild, the effects from disease transmission are discountable. There have been no direct disease impacts noted across the range of bull trout and it is assumed that measures described above would avoid the release of diseased fish. Additional discussion of this issue can be found in the biological assessment (NMFS 2012, pp 27-37).

Use of Satellite Facilities

Eggs are incubated and early rearing of fry occurs at several satellite facilities as discussed earlier. Because these facilities operate for other purposes, the effects of this action are the incremental change in those operations. We anticipate that the increment of change in factors such as water use and the discharge of hatchery effluent will remain small and that the effects of the support that occurs at these facilities will remain insignificant. In addition, the Morse Creek facility and its operations are considered part of the environmental baseline for bull trout.

Transport

The actual transport (not including release) of adult fish or transport of eggs and fry between facilities is not likely to result in any measurable effects to the environment. Roads used for transport between facilities already receive high volumes of traffic, to which the proposed action would add a very small amount.

**Direct and Indirect Effects of Instream Infrastructure**

<u>Assumptions</u>
Surveys to determine if adult fish are being delayed or spawning downstream of the structures will be part of normal operations.

<u>Description of Specific Factors Considered</u>
Hatchery broodstock collection activities include operation of the mainstem weir and operation of hatchery traps at WDFW Rearing Channel and LEKT Hatchery. Maintenance of facilities for broodstock collection and for monitoring will include the installation, removal, maintenance (including repair and cleaning) of structures such as weirs, rotary screw traps, fish ladders, holding facilities, and piscalators. The mainstem Elwha River weir will be seasonally installed beginning in about June or July when flows are generally below 2,000 cfs. It will remain in place through September or later unless flows increase above 2,000 cfs. The weir is managed by WDFW with assistance from other agencies.

Impacts on non-target fish populations can occur as a result of hatchery broodstock-collection activities. Of these collection methods, full river-spanning weirs/traps located in the mainstem river or tributary migration areas may have the greatest impact on fish, as they effectively block upstream migration, and force adult fish to enter a trap and holding area.

*Mainstem Elwha River Weir* – The mainstem Elwha River weir at RM 3.5 will be installed annually between June 1 and December 1 each year and when feasible during this period, pending flow and debris conditions in the river. This is a seasonal, removable picket-style weir, which will not result in any permanent physical alteration of instream habitat in the lower Elwha. In the first full year of operation, about 36 bull trout were captured and released at the weir. The feasibility of continuing to effectively operate the mainstem weir is currently under review. High spring and early summer flows carry high debris loads, limiting its operation and capture efficiency which calls to question its continued operation beyond 2013.

*WDFW Rearing Channel* – Structures used for broodstock collection at the WDFW Rearing Channel are already constructed and no new construction is proposed. The hatchery weir and trap site are located in an outlet channel constructed for the discharge of hatchery water from Chinook salmon rearing ponds. Personnel at the WDFW Rearing Channel have observed 5 to 10 bull trout in the outlet channel each year, mainly from 1986 to 1996 (WDFW 2012, citing G. Travers, pers. comm. 2002).

*LEKT Hatchery* –These structures are already constructed and were previously evaluated through ESA consultations. No new construction is proposed. Water released into the constructed channel is used to attract returning hatchery-origin adults for use as broodstock. No natural-origin fish, including bull trout, are propagated at this facility. The hatchery is relatively new (operational in 2010), and no bull trout have been encountered at the hatchery weir and trap thus far. Larry Ward (pers. comm. November 20, 2012,) reported that only about a dozen bull trout were observed at the old hatchery over a period of about 25 years. The lower river, off-channel location of the hatchery weir and trap makes it less likely that bull trout would encounter the facility. Roger Peters (pers. comm. November 21, 2012) reports that the spacing on the bars of the holding facility are large enough to allow bull trout to easily exit the holding facility and return to the river.

Species Response

Maintenance of the LEKT Hatchery and WDFW Rearing Channel facilities is not anticipated to measurably alter habitat conditions or water quality for bull trout and, other than delaying movements, is not anticipated to affect bull trout directly beyond the capture and handling that may result from “rescue” discussed later in the sections entitled **Direct and Indirect Effects of Capture and Handling** and **Direct and Indirect Effects of Effluent**. The installation and operation of adult traps and fish weirs in the mainstem may block, delay, or otherwise disrupt the upstream and downstream movements and distribution of fish, resulting in a significant disruption of normal behavior, or in some cases a significant impairment of essential behaviors.

The *physical presence* of a weir or trap in migratory corridors, such as the mainstem Elwha River can affect salmonids by:

- Delaying upstream migration which can result in spawning in less than optimum locations;
- Inducing spawning in less favorable habitats downstream of the blockage;
- Contributing to impingement, injury, or mortality as fish attempt to pass through or over the weir
- Injuring or killing fish that attempt to jump;
- Injuring or killing fish during confinement; and
- Increasing fish vulnerability to predation through corralling effects at the weir or traps.

Risk of Injury or Mortality

Risks associated with capture and handling are addressed separately. Though the effects described below are unlikely to occur in each year, the extended term of this consultation (years to decades) makes it reasonably certain that such effects would occur. Weirs and other structures, such as rotary screw traps, that impair passage can interfere with and disrupt normal behaviors such as feeding, sheltering, and moving within the river. They can cause delayed or displaced spawning which could kill eggs or fry. They can also cause stress and could injure or kill adult or subadult fish, or cause fish to be concentrated or confined. Concentration, confinement, and injury may subject bull trout to potential predation from mammalian and avian predators.

Based on available data and anticipated future use of the river by bull trout, the USFWS anticipates that operation and maintenance of instream fish-capture structures could disrupt normal behaviors of up to 100 adult and subadult bull trout annually, resulting in non-lethal effects. Through delayed or displaced spawning, we anticipate that the eggs and fry associated with 2 adult female bull trout may be injured or killed. Female bull trout that spawn downstream of the weir or in suboptimal locations due to delays in migration may subject their offspring to redd displacement or other effects resulting in injury or death of eggs and fry. Also, 2 adults and subadults may be directly injured, killed during confinement or attempting to avoid the structure, or as a result of predation caused by delay or injury at the weir.

The effects of the holding facilities at LEKT Hatchery and WDFW Rearing Channel are further discussed under the section entitled **Direct and Indirect Effects of Effluent.**

## Direct and Indirect Effects of Surface Withdrawal/Diversion

Assumptions
Increased use of well water at hatchery will reduce the amount of surface water needed during summer low flow periods.

Bull trout will forage in and/or utilize nearshore marine areas and cold water refugia during periods when low flows and temperatures in the mainstem are high.

Description of Specific Factors Considered
The combined use of water for both hatchery facilities could be as high as 60 cfs, although it is likely to be much less during the summer. During summer low flows, it is anticipated that facilities will rely on supplemental well water due to its colder temperatures compared to surface water. However, 60 cfs would be a substantial portion of the base flow if the river were running at 200 cfs. Summer low flows may be as low as 200 cfs, but generally average about 600 cfs. The NMFS (Zach Hughes pers. comm. November 30, 2012) analyzed the removal of up to 80 cfs during periods when flows are 300 cfs. They considered that the ramp down would be at the natural rate as the season progresses. Low flows below 300cfs would only affect the thalweg and would not affect side channels as they would already be dry. The highest demand for surface water is during the period when eggs and fry are being nurtured which is primarily in the fall and winter when flows in the river are high and withdrawals would not have a significant impact. Juvenile fish that are held over to yearlings and beyond need less water, especially when they are small in summer, because there are fewer fish and water needs are assessed based on total weight of fish. Later, as these fish become larger, they will need more water, but this will increase slowly over time and into the following season. The facilities are also likely to supplement with a larger percentage of well water in the summer because it is cooler than surface water and will therefore meet the thermal needs of young fish better as well as help reduce the probability of pathogens. However, supplementation with well water has the potential to reduce the amount of cold water delivered to the lower river through delivery of groundwater. Once well water is used at the facilities, it may warm slightly as it is being delivered to the river as it will have additional solar exposure.

Species Response
Surface water withdrawals for hatcheries within migration areas can reduce instream flows and, if low enough, this could impede migration. Water withdrawals also have the potential to affect other stream-dwelling organisms that serve as food for bull trout by reducing the amount of quality habitat and through displacement and physical injury. Low flows can result in depressed

dissolved oxygen levels, increased stream temperatures, reduced amounts of habitat, and susceptibility to predation and other effects. It is uncertain what effect removal of well water will have on groundwater supply to the river. Average summer low flows are reported to be 600 cfs, with extreme conditions resulting in low flows as low as 200 to 300 cfs. Given the duration of the recovery phases and documented reduction in glaciers and permanent snowfields in the Olympic Mountains attributed to climate change, it is reasonably certain that the frequency and duration of low flow conditions increase in the future.

Risk of Injury or Mortality
Though the effects described below are unlikely to occur in each year, the extended term of this consultation (years to decades) makes it reasonably certain that such effects would occur. Bull trout present in the lower river may be subject to significant disruption of their normal behaviors caused by reduced flows that will impede movements, result in increased stream temperatures and decreased dissolved oxygen levels which may depress feeding. We anticipate that diversion of water and reduced flows may disrupt the normal behaviors of as many as 30 adult and subadult bull trout and result in non-lethal effects. To estimate the number of bull trout that would be affected by water withdrawals for hatchery operations during low flow conditions, we used the most recent encounters at the mainstem weir as an indicator of bull trout moving through the lower river during summer months.

**Direct and Indirect Effects Related to Discharge of Hatchery Effluent**

Assumptions

Water-quality changes resulting from operation and maintenance of the proposed facilities are anticipated to be minor because the effluent is mostly water from the rearing areas of the facilities which just prior to being discharged must be clean enough to support hatchery fish. However, we note that these fish are maintained at concentrations much higher than would occur in natural conditions.

Additive inputs of nutrients from facility discharges are anticipated to be minor in the Elwha River due to low concentrations of discharge and rapid dilution.

Description of Specific Factors Considered
Hatchery operations require the use and discharge of surface and well water into streams adjacent to the operating facilities. Hatchery production could affect several water-quality parameters in the aquatic system. Hatchery facility waste products include uneaten food, fecal matter, soluble metabolites (e.g., ammonia), algae, parasitic microorganisms, drugs and antibiotics, Formalin, and other chemicals such as cleaning solvents. Fish hatchery facility wastewater commonly includes suspended solids and settleable solids, as well as nutrients, such as various forms of nitrogen (e.g., ammonia) and phosphorus. Chemicals such as chlorine are used in cleaning hatchery raceways. Some of the chemical or physical parameters having the greatest potential to impact receiving waters are temperature, dissolved oxygen, pH, and sediment levels.

The Federal Water Pollution Control Act of 1948 (33 U.S.C. 1251-1376) as amended, (commonly known as the Clean Water Act) governs allowable discharges into waters of the United States. The purpose of the Clean Water Act is to restore the physical, biological, and chemical integrity of the waters of the United States. The State of Washington is responsible for issuing and reporting on National Pollutant Discharge Elimination Systems permits. We do not rely on these Clean Water Act requirements to ensure ESA compliance.

Species Response

Bull trout are opportunistic predators that feed on the eggs and juveniles of anadromous salmon and resident fish. They likely locate profitable feeding areas using chemical cues left in the water by their prey. Effluent from the hatchery likely contains relatively high concentrations of these cues, and could serve as a feeding attractant to bull trout which is rewarded during the time when smolts are released, but may not be rewarded at other times. This "attractive nuisance" effect may keep bull trout from feeding as efficiently as they might if they were responding to feeding cues from naturally spawning salmonids. Bull trout are regularly documented below facilities during the time of year when hatchery fish are released.

Exposure to effluent would be greatest for bull trout that enter artificial outfall channels and become confined in the holding ponds before being captured, netted, and relocated. Bull trout could be exposed to water treated with a variety of chemotherapeutic agents (such as Formalin), low levels of dissolved oxygen, or build-up of toxins/waste products (i.e., mucus excretion, proteins, fish excrements, etc.), associated with high densities of fish in a confined space and under stress from overcrowding. For instance, adult Chinook may be treated frequently with Formalin, at concentrations of up to 25 parts per million (ppm) at the pond outfall, as a precaution against fungus infection.

Hatchery effluent is anticipated to be rapidly diluted at the point of discharge to the river, but bull trout may detect and be attracted to the effluent. The likelihood of injury to bull trout from exposure to effluent is likely related to the frequency of occurrence, length of time they are exposed (e.g., how long bull trout remain in the holding ponds), and concentration of substances within the effluent water. Information from the LEKT (Larry Ward pers. comm. November 21, 2012) suggests that bull trout were only occasionally (about once per every 2 years) observed at the old Elwha hatchery and have not yet been observed at the new hatchery. The holding pond is designed to allow smaller fish such as bull trout leave volitionally. While the frequency of bull trout ascending the ladder into the holding ponds has been relatively low in the past, we anticipate the frequency of bull trout occurrences at hatcheries to increase following removal of the dams and anticipated increases of fish populations in the Elwha River with full recovery.

Risk of Injury or Mortality

For the purposes of this Opinion, assuming an indefinite term of the proposed action, we anticipate some bull trout will ascend the ladders each year and be held in the holding ponds for some period of time. While most bull trout likely would depart volitionally due to the spacing of the bars, a few may be captured and released during removal of broodstock or to rescue the bull trout. In these cases, capture and release may benefit the bull trout. Capturing and releasing bull trout can also have adverse effects (See **Direct and Indirect Effects of Capture and Handling** Below).

Bull trout may be incidentally encountered voluntarily entering the LEKT Hatchery or WDFW Rearing Channel and may be delayed in migration as a consequence. Based on historic observations and anticipated future populations, we expect the non-lethal disruption of normal behaviors of 1 to 2 adult bull trout annually in the holding ponds at the LEKT Hatchery and 5 to 10 annually at the WDFW Rearing Channel.

**Direct and Indirect Effects of Genetic Risk Reduction (Removal of Remaining Chambers Creek Steelhead Stock)**

<u>Assumptions</u>
Chambers Creek steelhead removal activities would occur in 2012 and 2013.

Removal will be timed and designed to avoid impacts to non-target fish species. This includes targeting harvest at or near the hatchery where this stock would likely return.

Gill nets used for capture of adult steelhead has a mesh size that is larger than would effectively capture bull trout given their average size in the Elwha River. Thus, we do not anticipate adult or subadult bull trout to be injured or killed during gill-net removal of Chambers Creek steelhead stock.

Hook-and-line angling would be limited in effectiveness due to turbidity and visibility, and therefore is far less likely to be used.

If hook-and-line angling is used, we assume hook-and-line equipment will be used with selective gear (i.e., barbless hooks).

Removal will not be complete and some Chambers Creek stock will persist for several years in the future.

<u>Description of Specific Factors Considered</u>
The lone harvest action proposed during this moratorium period would be a LEKT fisheries management-sanctioned effort to remove the remaining two brood year (2012 and 2013) returns of Chambers Creek-lineage steelhead originating from the now-terminated tribal hatchery program for the stock (LEKT 2012a)(LEKT letter dated November 28, 2012). This focused fishing activity to remove escaping adipose fin-clipped, non-native steelhead would be conducted as an outbreeding depression risk-reduction measure to further reduce genetic-diversity threats to the native Elwha River winter-run steelhead population.

<u>Species Response</u>
The probability of encountering bull trout in this fishery is low. Adult steelhead are substantially larger than adult bull trout in the Elwha River. Thus we expect gill-net mesh size to be too large to hold most adult bull trout. Angling is not likely to be used to any substantial degree. Bull trout appear to recover readily from hook-and-line sampling and catch-and-release fisheries. If a bull trout is incidentally captured during this targeted fishery, capture would be most likely occur during angling activities.

In spite of these efforts, it is possible that some Chambers Creek stock will persist into future years. Those fish that escape capture may attempt to spawn or may spawn successfully. However, we anticipate the control actions will reduce their numbers and the probability that those fish will adversely affect bull trout. In the event that such interactions (e.g., redd displacement) occur, they would be consistent with the effects described below under Direct and Indirect Effects of Interspecies Interactions.

Risk of Injury or Mortality
We anticipate that 1 adult bull trout would be captured annually for 2 years during efforts to control/remove adult Chambers Creek steelhead. Up to 1 adult bull trout could be injured or killed at the time of capture or release, or would be injured and would suffer from latent effects following release. Estimates of injury and mortality from remaining Chambers Creek stock affecting bull trout are discussed under Direct and Indirect Effects of Interspecies Interactions.

**Direct and Indirect Effects of Capture and Handling**

Assumptions

Capture and handling can result from monitoring efforts, broodstock collection, and rescue efforts (e.g., at hatchery and rearing channel holding ponds).

Prior to conducting activities that may involve handling fish, personnel would ensure that hands are free of sunscreen, lotion, and insect repellent.

Effects to bull trout from capture and handling can be reduced by: maintaining fish in water at all times after capture; immediately releasing incidentally captured fish; holding fish in areas and using equipment that maintains their health and safety; and holding fish for minimal durations prior to release.

The estimate of 50 to 100 bull trout captured at the weir (NMFS 2012) represents a reasonable estimate of future capture rates with a potential increase in bull trout populations and possible re-establishment of anadromy.

Description of Specific Factors Considered
Although there is significant overlap, the types of capture are described below by purpose and location. In some cases, fish may be captured for different purposes at the same time.

*Capture for Broodstock*
Hatchery broodstock collection activities include operation of the mainstem weir located at RM 3.7 of the Elwha River, operation of hatchery traps (including ladders, holding ponds, and piscalators) at WDFW Rearing Channel and LEKT Hatchery, and opportunistic capture of salmon and native steelhead using seines, gill nets, rotary screw traps, hook-and-line angling, and gaffing.

*Mainstem Elwha River Weir* – Current plans are for the mainstem weir to continue operations annually at RM 3.5 primarily as a means to monitor migrating adult salmonid abundances by species in the river, to collect broodstock, or to capture and transport upstream into areas unaffected by dam removal actions any fish surplus to hatchery program needs. The feasibility of effectively operating the mainstem weir to meet these objectives is under review. High spring-early summer river flows, high river debris loads, and the inability thus far to keep upstream migrating fish from escaping capture call into question its continued operation beyond 2013.

Any bull trout captured will be measured and then passed over the weir in the direction of travel. It is not anticipated at this time that bull trout captured at the weir would be relocated higher within the watershed, although that option could be reconsidered in the event that a number of bull trout were being captured at the weir. Any relocation higher into the watershed (e.g., above Carlson Canyon) should be limited to bull trout genetically determined to be a part of the upper Elwha population, and would need to be approved by the USFWS.

*WDFW Rearing Channel* – Structures used for broodstock collection at the Elwha Channel Hatchery are existing, and no new construction is proposed. The WDFW minimizes the risk of adverse effects on any bull trout encountered at the hatchery site through measures that would reduce the likelihood for incidental injury and mortality prior to release of the fish back into the natural environment. The weir and trap are monitored on a regular basis by trained hatchery staff at consistent, short intervals. All efforts are made to minimize any holding time for any bull trout trapped prior to their release (WDFW 2012).

*LEKT Hatchery* - The ladder, weir, and trap at the Lower Elwha fish Hatchery are existing structures. Operation and maintenance of this facility was evaluated under separate ESA consultations. No new construction is proposed. Although the lower river, off-channel location of the hatchery weir and trap makes recruitment of bull trout to the facility unlikely, the LEKT would minimize the risk of adverse effects on any bull trout encountered at the site through implementation of appropriate measures that would reduce the likelihood for incidental injury and mortality prior to release of the fish back into the natural environment. The weir and trap will be monitored on a regular basis, more than twice daily, by trained hatchery staff living on-site (LEKT 2012a).

*Capture for Monitoring*
Monitoring and evaluation programs for hatchery production are useful for adaptive management purposes and can help hatchery programs attain recovery of listed populations. Instream activities for monitoring hatchery-program performance include, but are not limited to: rotary screw-traps, mainstem resistance-board weir, in-river juvenile seining and fyke netting, adult spawner surveys by foot and boat, side-scan sonar, telemetry, hydroacoustic monitoring, and hook-and-line sampling for juveniles and adults. In addition, various marking methods may be used including Coded Wire Tags, thermal marking of otoliths, chemical marking, and other methods. Though they help to monitor and evaluate hatchery programs, monitoring and evaluation programs are designed in coordination with other plans to maximize the data collection while minimizing effects to listed fish. Sites in upper river tributaries and in the mainstem Elwha River where suitable spawning habitat exists will be surveyed to determine the

distribution of spawning, and estimate spawner abundance. Telemetry of adults tagged at the weir may also be used to determine spawning distribution and up-river migration timing. Telemetry of hatchery-produced smolts may also be used to determine their residence time in the river, and early marine survival rate. These capture methods can be categorized as follows: netting, trapping, gaffing, and hooking.

*Handling*

Capture may occur at weirs and hatcheries or as a result of instream seining, angling, or other common methods of fish collection. Regardless of method of capture, fish captured for monitoring purposes will need to be handled to collected information. The processing of such fish generally follows a similar series of steps. Holding of fish within a container may occur following capture to facilitate release or to enable measurements and data collection. Anesthetics may be used on some fish to reduce stress, but will not be used on bull trout. Handling of bull trout would generally involve temporarily keeping the fish in a tray or partially submerged sling while measurements are taken. Handling is a prerequisite for the collection of certain data. Tissue sampling from bull trout would be done in some cases at the request of USFWS. For instance, tissue sampling is an important source of genetic information. Tissue sampling may be conducted on salvaged carcasses of dead fish, or may be conducted on live fish following USFWS protocols. Marking of bull trout may be necessary to understand their movements and other aspects of their life history. Marking could include a variety of methods currently employed for salmonids. Some forms of marking include telemetry implants and subsequent tracking, and Coded Wire Tags. Following capture and any subsequent holding, handling, sampling, marking, or other procedures, bull trout would be released according to standard protocols. The actions under consultation do not include the lethal collection of bull trout, but may include retention of dead, dying, or severely injured bull trout for scientific purposes.

Measures are applied to reduce the risk that fish collected at the weir, including bull trout, will be injured or killed. For fish not retained for broodstock use, protocols call for their immediate removal from weir traps, biological sampling, and release back into the river in their direction of travel. Fish captured in weir traps are handled using a cradle hung on the inside of the trap that is partially submerged in the river to keep fish wet and oxygenated (Mayer and Zimmerman 2012). Any sampling to collect biological data (species, length, scales for age class analysis, or tissue sample for genetic analysis) occurs while the fish are maintained in the water, a process that generally takes 3 to 4 minutes. Following any sampling, fish are either held for transfer as broodstock to the hatcheries or placed back into the river in the same direction that the fish was traveling when captured.

The number of bull trout incidentally captured, handled and released during salmon and steelhead broodstock collection by the LEKT will be closely monitored (LEKT and WDFW 2012). Under the pending ESA determination for the hatchery programs, bull trout encounters and any incidental mortality during handling will be reported annually to NMFS. Broodstock collection actions at the hatchery will be modified to further limit incidental capture of listed bull trout if encountered. All efforts will be made to minimize any holding time for any bull trout trapped prior to their release back into the hatchery outfall channel, where the fish may return to the Elwha River.

Species Response

*Mainstem Elwha River Weir* – With near-continuous operation of the weir during certain times of the year (June through September), for broodstock collection and other monitoring purposes, handling of bull trout is likely, but mortality is expected to be very low, not exceeding 1 percent of the number captured (which we estimate to be up to 100 fish per year). As the program transitions to supplementation only, broodstock will be predominately collected from adult fish returning to the hatcheries, and incidental trapping and holding effects on bull trout will be reduced, unless the weir continues to be used for monitoring. In its first year of full operation in 2012, WDFW reported that between July 30 and October 21, 30 upstream-migrating bull trout and 6 downstream-migrating bull trout were captured, handled, and released in their direction of travel.

*WDFW Rearing Channel* – Handling of salmonids at the off-channel weir and trap is almost entirely confined to hatchery-origin adult Chinook salmon homing back to their site of release as juveniles. Encounters with bull trout that entered the hatchery outfall weir and trap have been rare at this facility but could increase in the future. Elwha Channel Hatchery personnel have observed 5 to 10 bull trout in the outlet channel each year, mainly from 1986 to 1996 (WDFW 2012, citing G. Travers, Washington Department of Fish and Wildlife, pers. comm. 2002).

*LEKT Hatchery* –Handling of fish at the Lower Elwha Fish Hatchery off-channel weir and trap is almost entirely confined to hatchery-origin adult steelhead and coho salmon homing back to their site of release as juveniles. In 2011 and 2012, mainly hatchery-origin Chinook salmon and some natural-origin coho salmon and steelhead strayed into the hatchery outfall and trap. These fish appear to be escaping high turbidity levels in the river associated with release of stored sediments behind the dams as they are removed. Water used for adult fish attraction water and fish rearing at the facility is filtered, and much less turbid that river water. The LEKT hatchery is relatively new (operational in 2010), and no bull trout have been encountered at the hatchery weir and trap thus far. Larry Ward (pers. Comm. November 20, 2012,) reported that only about a dozen bull trout were observed at the old hatchery over a period of about 25 years. Roger Peters (pers. comm. November 21, 2012, reports that the spacing on the bars of the holding facility is such that bull trout could easily exit the holding facility and return to the river.

There is a small potential that bull trout in the lower Elwha River could be incidentally captured, handled and released through collection activities designed to procure hatchery salmon and steelhead broodstock volunteering to the LEKT hatchery weir and trap. The number of bull trout captured at this facility would likely be few, given the location of the hatchery on the lower, and the documented low use of the lower Elwha River by bull trout under current habitat conditions (Brenkman et al. 2008).

*Other Methods of Broodstock Collection* –These broodstock collection methods (seining, gill-netting, and gaffing) are conducted in a manner that does not result in any substantial alteration of riverine habitat. Net gear used to capture Chinook salmon is deployed in areas where Chinook salmon congregate, and the mesh is sized is specific for the purpose of catching 15 pound average sized fish. Adult bull trout are much smaller in size (generally 2 to 3 pounds) and not likely to be captured in this size of collection gear. Gaffing is directed at adult Chinook salmon only, and fish targeted are specifically selected by sight as broodstock. Bull trout are not expected to be affected by this method of Chinook broodstock collection. Other broodstock-collection actions, including gill-netting may also lead to effects on fish movement and distribution.

All weir and adult trapping and collection actions can stress, injure, or kill fish if improperly designed and implemented. Measures can be implemented to minimize these types of impacts. The netting or capturing, handling, and releasing of the bull trout can result in injury by increasing the potential for disease by removing the protective mucus coating on the skin, as well as increasing stress in affected individuals which can cause it to become susceptible to disease (and predators and competitors when released), and it can cause potential direct injury. Death can result if fish are handled roughly or kept out of water for extended periods of time (Nielsen and Johnson 1983). Bull trout protocols for handling stipulate ways to minimize harm associated with handling fish, which include timing handling (as applicable), using clean hands free of sunscreen and insect repellent, and stipulating types of containers for transferring the bull trout.

*Fish Handling and Release*: Handling of fish 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 and loss of their protective 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 et al. 1994; Mesa and Schreck 1989).

The actual numbers of fish affected adversely by handling is difficult to anticipate. In most cases, the handled fish would be released shortly after their capture, minimizing stress. Depending on the number of fish that need to be handled during the operation, some injury or even deaths may occur during the handling and/or transfer process. If bull trout are present during capture operations, the most likely stages would be adult and subadults. These larger fish would be more visible and less susceptible to injury or mortality than smaller species or life stages.

Risk of Injury or Mortality

Impacts that may be associated with capture:

- Physically harming the fish during their capture and retention;
- Harming fish by holding them improperly or for long durations;
- Physically harming fish during handling and biological sampling;
- Increasing fish susceptibility to displacement downstream following release;

- Increasing fish susceptibility to predation following release; and
- Latent effects associated with stress.

Incidental handling of migrating bull trout may result from implementation of broodstock collection actions. Bull trout may be incidentally captured, handled, and released at the mainstem weir and off-channel ladders and traps. Other broodstock collections and monitor may also result in capture and handling.

Bull trout caught during risk reduction activities were already addressed and should be released immediately following hook-and-line angling due to the stress of capture.

Up to 2 bull trout may be captured annually during hook-and-line angling for broodstock collection and should be released immediately following hook-and-line angling due to the stress of capture. We anticipate that up to 1 of these fish may be injured or killed as a result of this capture.

An additional 116 bull trout may be captured annually (100 weir, 10 seine and net, and 6 at holding ponds) incidentally during broodstock collection and/or monitoring. The 100 fish captured at the weir may be handled and marked according to USFWS instructions. It is unlikely that any handling for processing will occur from other capture methods as personnel will not be prepared and thus bull trout will generally be released into the best available habitat as quickly as possible with minimal holding times. We anticipate that up to 1 bull trout may be injured as a result of capture at the weir annually and 1 bull trout may be injured or killed as a result of capture during seining and netting annually.

We previously discussed the disruption of normal behaviors that may occur at holding ponds and estimated that 2 bull trout may enter holding ponds at the LEKT Hatchery each year and 10 may enter the WDFW Rearing Channel. Of these fish, half may be rescued resulting in 1 bull trout capture at the LEKT Hatchery and 5 at the WDFW Rearing Channel. In each case, we anticipate that up to 1 of these bull trout may be injured or killed annually as a result of capture.

Added to the 1 bull trout anticipated to be captured (1 injured or killed) during the Chambers Creek control, an additional 118 captures are discussed above (including 116 bull trout at the weir, nets, or holding ponds and 2 bull trout from hook-and-line broodstock collection). Therefore, we have thus far discussed the capture of 119 bull trout. Although each of these may result in some level of injury or death, we do anticipate that each of these causes will occur each year. We anticipate that in total, only 2 bull trout will be injured or killed as a result of the capture and handling associated with monitoring, broodstock collection, and the risk reduction harvest, combined, on an annual basis.

**Direct and Indirect Effects of Inter-specific Relationships**

Description of Specific Actions

*Transport*
Both WDFW and the Tribe each have 500 gallon capacity tanker trucks appropriate for this transport activity. If the managers determine that flow and channel conditions are significantly inhibiting upstream migration, returning salmon and steelhead in excess of hatchery broodstock needs may be transported upstream to appropriate spawning and rearing areas in mainstem areas above the affected areas or in tributary streams. Various monitoring needs may be fulfilled by these fish, in the early phases of the restoration plan. Effects associated with transport of adult fish are the same as the effects of naturally returning fish, except that the effects of transport may occur earlier in the recovery period.

*Rearing / Acclimation / Release*
To avoid potential predation of young-of-the-year bull trout by hatchery-origin salmon and steelhead releases, the NPS proposed that fish be released at life stages and in areas where residence in freshwater is reduced to the extent possible (Crain and Brenkman 2010). In response to this NPS concern regarding predation, WDFW and LEKT adjusted the final proposed salmon and steelhead supportive breeding program actions submitted to NMFS for ESA review so that outplanting of hatchery-origin juvenile salmon and steelhead into the headwater and upper river areas important for bull trout production in the watershed is no longer proposed. All juvenile hatchery salmon and steelhead will be released as actively migrating smolts (Chinook salmon, coho salmon, steelhead) or fry (fall chum and pink salmon) directly from the hatcheries in the lower river at RM 3.5 and 1.25. These release locations and life history at release strategies will ensure that the hatchery fish emigrate from the river and seaward rapidly, and within a matter of hours or a few days. For these reasons, the opportunity for any interactions with bull trout of a size vulnerable to predation by the hatchery smolts is small.

*LEKT Hatchery –* Juvenile fish are volitionally released at the time/age coinciding with the natural timing of outmigration for each species. Juveniles move quickly downstream and enter the marine environment as smolts. Returning adults may be transported upstream to appropriate spawning and rearing areas in mainstem areas above the affected areas and in tributary streams. No additional acclimation facilities are used in the program.

Steelhead smolts are released volitionally from the hatchery beginning in March or April as age-2 smolts. The extent of residualism is uncertain, but Peters (1996) did not observe residualized hatchery steelhead smolts in the lower river. The age 2+ smolt release strategy is expected to maintain a low rate of residualism (Berejikian, 2005).

Coho salmon are released volitionally from the hatchery beginning in March or April as yearling smolts. Smolts move quickly downstream to the mouth of the Elwha River, and enter the Strait of Juan de Fuca, or reside in estuarine beach lakes (RM 0.1) for a brief period prior to entering the Strait. Surveys on the Elwha River during the release period indicate that following entry into the Elwha River, smolts do not move upstream (Peters 1996).

*WDFW Rearing Channel –* Chinook are acclimated to Elwha River water. The juvenile Chinook are released directly from the channel through the adult holding area and into the Elwha River. The production and release of smolts through fish culture and volitional release practices fosters rapid seaward migration with minimal delay in the rivers, limiting interactions with wild fish. Yearlings will be released in April as smolts to speed their out-migration and reduce the potential predation and competition on wild salmonids. The location of the rearing channel in the lower river acts to reduce interactions with rearing natural-origin listed fish, including newly emerged fry present in the upper portion of the drainage. In addition to the WDFW Rearing Channel, Chinook are reared at Morse Creek acclimation ponds, which has already been addressed through section 7 consultation.

*Genetic Risk Reduction*

Chambers Creek steelhead stock will be targeted for removal in 2012 to 2013 and again in 2013 to 2014. Whenever captured through other means, they will also be removed. It is not known to what degree Chambers Creek stock will be eliminated. It is possible that some fish will return in other years, or may return and go back to sea for some period. While few Chambers Creek stock are anticipated to survive for a substantial length of time, some may and may eventually spawn or attempt to spawn and would have effects to bull trout similar to effects of native steelhead discussed below.

Species Response

Although bull trout evolved with and continue to coexist with anadromous salmonids (Ratliff and Howell 1992), hatchery releases and resultant recovery of certain anadromous salmonids may impose predation, competition, and other pressures on bull trout that are above previous levels. The expected rapid outmigration of smolts and fry released from the hatchery minimizes the potential for competitive interactions with bull trout. However, the recovery effort may also create some level of interspecific competition between salmon, steelhead, and bull trout for food and space; competition for spawning sites; and the potential for juvenile bull trout predation by salmon and steelhead.

The degree to which hatchery fish and their progeny may interact with bull trout depends upon their characteristics which include: 1) size; 2) behavior; 3) habitat use; 4) relative abundances; and 4) movement patterns. Interaction potential between salmon and steelhead and bull trout can also depend on habitat structure and system productivity. System productivity determines the degree to which fish populations may be food limited, and thus negatively impacted by limited resources. The type and level of interaction between these fish involve complex mechanisms.

Niche separation can limit the potential for competition of bull trout with salmon and steelhead. The extent to which smolts produced in the future may reside longer in freshwater, rather than emigrating immediately, is not known, but would increase the potential for interactions. These effects are expected to be minimal initially since hatchery fish will be released directly from the lower river and will tend to return there during the initial periods of fish recovery. Adult competition is not anticipated to be a significant risk until abundance approaches the capacity of spawning habitats (i.e., during the local adaptation phase of recovery or beyond), and even then is anticipated to be limited.

Benefits

There will be numerous beneficial effects that emanate from the release of anadromous salmon and steelhead and the re-establishment and recovery of natural spawning anadromous salmon and steelhead. Anadromous salmon and steelhead recovery will increase the abundance and diversity of the bull trout prey base. In addition, the enrichment of the freshwater ecosystem from input of marine derived nutrients, i.e., salmon carcasses, will have far reaching benefits throughout the food web (Bilby *et al.* 1998; Cederholm *et al.* 1999).

Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine-derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003). The returns of adult salmon and steelhead will provide carcasses contributing marine-derived nutrients to organisms in the river and tributaries.

An apex predator, such as bull trout, is anticipated to benefit from the increase in productivity and related increase in prey base. Bull trout would be expected to actively prey upon the reintroduced juvenile salmonids. Bull trout primarily function as predators, starting at a fairly small size, so re-establishing anadromous fishes would probably be a net benefit to most life stages of bull trout. We believe the contribution of salmon carcasses to the nutrient enrichment and the increased prey base resulting from the restoration of the salmon and steelhead runs will more than offset any adverse impact associated with competition for foraging habitat caused by the reintroduction of anadromous fish.

*Interspecific Competition for Food and Space*:

Overall, the reintroduction of salmon and steelhead will increase fish production in the river basin thereby increasing the available prey base for adult and subadult bull trout. The recovery effort will also indirectly increase the bull trout prey base by restoring marine-derived nutrients into the ecosystem. However, the recovery effort may also create some level of interspecific competition between salmon, steelhead, and bull trout for food and space. Competition for food and space between recovered anadromous salmonids and bull trout may occur in spawning and/or rearing areas, the migration corridor, and in the marine habitat. Competition may result from direct interactions, in which salmon and steelhead interfere with access to limited resources by bull trout, or indirect interactions, in which utilization of a limited resource reduces the amount available for bull trout.

With regard to potential competition for foraging, overwintering and rearing habitat, juvenile fluvial bull trout prefer colder water and are more-closely associated with the deeper portions of rivers. A substantial degree of overlap in habitat use of rivers by juvenile bull trout and anadromous salmonids is not anticipated. In the stream environment, juvenile bull trout do not predominately occur in the same microhabitat niche as any *Oncorhynchus* species. Rather, bull trout are more benthic, nocturnal, and cryptic (Goetz *in litt*. 2006) than salmon and steelhead. Bull trout are more closely associated with the channel bottom of streams than other salmonids (Goetz 1989; Pratt 1992; Rieman and McIntyre 1993; Connors 2003). Substantial competitive interactions between anadromous salmonids and bull trout in stream environments are likewise not anticipated.

The frequency and severity of competition, if it occurred, would probably increase over the recovery period, being greatest after full recovery. Adverse competitive interactions between the species could result if salmon and steelhead populations increased such that they were forced to use habitats marginal to those species, but preferred by bull trout. This risk is considered greatest in the mainstem river. However, because of niche partitioning and historic co-existence of these species in the river basin, we do not expect this potential competitive interaction for food and space to affect a large percentage of bull trout in the Elwha Basin and thus we do not anticipate an appreciable reduction in the local populations of bull trout.

We do not anticipate juvenile bull trout and salmon to compete for rearing habitat. Early rearing habitat for bull trout is believed to be primarily located in tributaries. We do not anticipate a substantial degree of overlap in habitat use or food resource use by juvenile bull trout and salmon and steelhead that would lead to significant competition.

*Predation*: Risks to bull trout attributable to direct predation (direct consumption) or indirect predation (increases in predation by other predator species due to enhanced attraction) could result from hatchery releases. The magnitude and vulnerability to predation from hatchery releases result from a combination of prey and predator abundance, size of bull trout in relation to the size of the hatchery fish, and feeding habitat of hatchery-origin fish. Indirect predation may be a result of attracting predators, particularly during spawning concentrations, and then the next species to utilize the area is disadvantaged. Species spawning at the same time may have the advantage of diluting predator effects.

This risk of juvenile bull trout predation would probably increase over the period of implementation and be greatest after full recovery of salmon and steelhead. However, the magnitude of the effect is unknown. First, most returning salmon are not actively feeding. Returning steelhead may feed, but would be found in larger streams and rivers due to their preferred spawning habitats.

We anticipate bull trout fry would be more susceptible to predation than larger juveniles. Fry typically emerge in February and occur in the upper watersheds when the feeding activity of the other species would be low due to inaccessibility and cold water temperatures. In addition, bull trout fry tend to be cryptic and associated with the substrate which helps them avoid predation. Bull trout fry typically remain in close proximity to and within the interstitial spaces of gravel and cobble substrates to a much greater extent than other salmonids (Pratt 1992; Rieman and McIntyre 1993) where the potential for predation by salmon and trout would be limited. Hatchery-produced yearling steelhead may prey on juvenile salmonids in the freshwater and marine environments (Hargreaves and LeBrasseur 1985; Hawkins and Tipping 1999; Pearsons and Fritts 1999). However, stomach contents of salmonids including hatchery steelhead and coho sampled near the mouth of the Elwha River in 1996, 2006, and 2007 showed no sign of piscivorous behavior (Peters 1996; Duda et al., 2011).

It is unlikely that predation rates on staging bull trout could increase substantially by installing the weir, because predators large enough to prey on adult bull trout are likely limited to mammalian and avian predators in the Elwha River. Some level of increased predation may occur over the extended life of this consultation. We already anticipated a level of injury and/or death at the weir which included these effects of increased predation on adult bull trout at the weir.

While some loss due to predation of fry and juveniles is inevitable, we expect the subpopulation as a whole to benefit (e.g., higher growth rate, greater fecundity, etc.) in response to the greater abundance and diversity of their prey base which would result from the recovery of the anadromous fish.

*Competition for Spawning Habitat and Displacement*

Although salmon and steelhead spawning may improve spawning gravel conditions for bull trout the following fall through their excavation of redds which loosen and clean spawning gravels, we do not anticipate substantial overlap of bull trout spawning areas with spawning for most of these species. Chinook, chum, and pink salmon will most likely spawn in the mainstem, generally lower in the watershed than most bull trout. Chinook in particular are adapted to spawning in larger substrate in fast moving water. Steelhead will also select faster and deeper areas with larger substrate than bull trout. Steelhead and Chinook salmon do not spawn during the same time as bull trout and tend to spawn in larger substrates; therefore, they do not pose as much risk of competition for available spawning grounds (Goetz *in litt.* 2006).

Coho salmon may pose a risk of competition for bull trout spawning habitats. Coho salmon are likely to compete with bull trout for available spawning habitat because their spawning period and preference for spawning habitat overlap (Goetz *in litt*. 2006, Pratt 2003, Burley *in litt.* 2006). Coho spawning could result in superimposition of spawning over existing bull trout redds and the loss of deposited eggs (Pratt 2003). Coho salmon may spawn immediately after bull trout. Bull trout and coho salmon select sites for redds in response to subtle differences in thermal and substrate size preferences. However, coho salmon are able to spawn in a wide variety of habitats; therefore, we anticipate overlap in bull trout spawning grounds to be relatively small because coho may distribute themselves more widely. Bull trout would likely spawn in the higher reaches of streams and are known to use stream gradients greater than 4 percent whereas coho salmon prefer gradients less than 4 percent (Sandercock *in* Groot and Margolis 1991). Therefore, the risk of redd superimposition is greatest in the lower reaches of streams. Because coho salmon excavate deeper redds than bull trout, redd superimposition could result in the loss of some bull trout eggs.

As competition for spawning habitat intensifies over time with coho salmon as their numbers increase, we may see bull trout increase their use of spawning habitat upstream in the Elwha and in the upper reaches of tributaries to reduce this competition. Bull trout are better able to ascend high-gradient cascades than salmon or steelhead, allowing them to reach headwater reaches that exceed the limits of salmon and steelhead (Tacoma 2001).

The restoration of anadromous salmon stocks can be expected to result in competition for spawning habitat and may result in the superimposition of salmon redds on bull trout redds, with resulting loss of some of the deposited bull trout eggs. Coho are likely to compete somewhat with bull trout for the available spawning habitat because their spawning period and preference for spawning habitat overlap.

*Introduction of Contaminants*

Salmon have been noted to transfer contaminants into ecosystems via their carcasses (Ewald et al. 1998; O'Toole et al. 2006). Persistent organic chemicals such as dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenyls (PCBs) are transferred through the food chain and are retained within the tissues of salmon. Analyses show that as the fish burn fat on their spawning migration, they do not metabolize these pollutants (Ewald et al. 1998). These contaminants, acquired during the salmons' ocean migration, concentrate in their tissues and roe. They are ultimately passed (i.e., biotransferred) on to the freshwater ecosystem in which the salmon return and are introduced into the food chain.

In addition, because of their trophic position in the food chain, bull trout may bioaccumulate these introduced contaminants more quickly and in greater amounts relative to other salmonids. In mature female bull trout, a proportion of these contaminants could be passed to developing eggs, which could affect their survival rates (Ewald et al. 1998). Over the life of the proposed action, the addition of carcasses may increase contaminant loads within "resident" fish. Although the ultimate implications for bull trout are uncertain due to indeterminate loading for individuals in future years, some life stages of bull trout appear to have greater sensitivity than other salmonids to some contaminants (Guiney et al. 1996; Cook et al., *in litt*. 1999). Contaminants from this source could result in an incremental reduction of fitness for some bull trout and survival rates of their eggs.

Ewald et al. (1998) found in their study in the Copper River, Alaska, that sockeye salmon (O. nerka) accumulated persistent pollutants during their ocean life stages that were not eliminated during migration but were transported to spawning lakes and bioaccumulated there. They compared the contaminant loads within the muscle tissue of the top aquatic predator, Arctic grayling (*Thymallus arcticus*) in two different populations. Grayling exposed to anadromous salmon were determined to have concentrations more than twice that of grayling not exposed to salmon. The concentrations found in grayling exposed to salmon resembled the concentration found in salmon. Their conclusion was that biotransport had a far greater influence than atmospheric deposition. Because we do not know the extent of contaminants that Elwha river anadromous salmon and steelhead are exposed to, the degree to which bull trout would bioaccumulate these chemicals, or the degree to which those concentrations would affect the physiology or normal and essential behaviors of bull trout, it is difficult to discuss any negative effects that would occur to bull trout from such biotransport.

<u>Risk of Injury or Mortality</u>

Significant competition between bull trout and other salmonids for food or general space is not expected. However, there may be some limited amount of competition for spawning sites in future years, which is anticipated to result in low levels of redd superimposition.

We anticipate that no more than two redds a year may be affected by redd superimposition or other interspecies interactions. While this rate may not be achieved for some time, it may be reached after maximum recovery of anadromous salmon and steelhead is attained. The likelihood of this occurring in any given year is low, but the extended timeframe of the effects from this action make it reasonably certain to occur.

**Actions resulting in beneficial effects**

As discussed above, the release of anadromous salmonids will have some minor adverse effects on bull trout. However, there will be numerous beneficial effects that emanate from the release of these fish and the re-establishment and recovery of natural spawning anadromous salmon and steelhead. Recovered fish runs will not only supply additional forage base directly to bull trout, but will increase the supply of marine-derived nutrients which will in turn increase primary productivity and populations of fish used for forage by bull trout. This would strengthen the genetic resiliency of the core area and reduce the risk of extirpation of these local populations within the Elwha River system from stochastic events.

**Effects to Critical Habitat**

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

Bull trout do not tolerate prolonged exposures to temperatures above 16 °C (Poole et al. 2001, p. 5). However, bull trout are known to migrate through areas with higher stream temperatures by utilizing thermal refugia, such as a confluence with a cold water tributary, deep pools, or locations with surface and groundwater exchanges. Cold water refugia are critical for bull trout, especially during the summer when adults are migrating to upstream spawning grounds.

This proposed action may affect these sources of water for bull trout critical habitat due to groundwater withdrawals for the WDFW Rearing Channel and Elwha Water Facility. Removal of water from the existing well at the LEKT hatchery may also have some effects; however, most of the river that may be affected is excluded from critical habitat designation. The groundwater is removed low in the watershed where its contribution to instream flows for bull trout in the lower river is relatively minor. Effluent discharges from the rearing channel may augment water removed from the wells, but water temperatures discharged may be slightly warmer than groundwater due to its residence time in the rearing channel. We are also uncertain about the degree to which groundwater removals will reduce the amount of flow to the river through hyporheic or other mechanisms. Therefore, the proposed action may affect groundwater sources in the Elwha River, effects to this PCE are considered significant. We anticipate the effects will be long term for the life of the project. The effects to this PCE are not anticipated to preclude its ability to function, though to a lesser extent.

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

Operation of the Elwha River weir results in a temporary barrier to bull trout migration. Bull trout are temporarily precluded from both upstream and downstream passage when the weir is operational until the fish are physically removed from the collection traps and released back into the river. The weir has been operational for several months each year from 2010 through 2012. During this 3-year period, the weir was operational for a total of 165 days, ranging from a low of 30 days in 2010 to a high of 74 days in 2012. A total of 41 bull trout were collected and released at the weir over this time period.

Because the weir is a full channel-spanning structure and fish can only move past it if they are captured and physically moved over it, the weir creates a physical barrier to bull trout between spawning, rearing, overwintering, and freshwater and marine foraging habitats due to the presence of bull trout in both the upstream and downstream collection traps. The migratory function of this PCE is temporarily impaired as bull trout are permitted to continue their movement within a short period of time (no more than 24 hours) when the weir is in place. Currently there is no funding to install and operate the weir in the future; however, if funding is obtained, we expect that the weir would be installed to allow for additional data collection. Therefore, we anticipate that the weir will significantly reduce the function of this PCE by temporarily impairing upstream and downstream migration of bull trout. The effects to this PCE from the operation of the proposed weir are considered adverse.

*PCE 3: An abundant food base, including terrestrial organisms of riparian origin, aquatic macro-invertebrates, and forage fish.*

The proposed action would not directly reduce the food base for bull trout in either the freshwater or marine environment. Increasing salmonid populations may place some additional pressures on populations of some food sources such as macroinvertebrates and small fish species; but it would also measurably increase the availability of young salmonids, which are prey for bull trout, as well as increase the primary productivity and macroinvertebrates as a result of increased marine-derived nutrients. Therefore, the proposed action is expected to beneficially affect the food base, and the effect to this PCE is considered a significant benefit.

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

The proposed action would not affect the complexity of habitats within the river or nearshore marine environments.

*PCE 5: Water temperatures ranging from 2 to 15 degrees Celsius (°C) (36 to 59 degrees Fahrenheit (°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.*

As mentioned for PCE #1, this proposed action may affect groundwater sources of water for bull trout habitat. Use of groundwater at the WDFW rearing channel supplements the surface water used. Effluent from the rearing channel is discharged into the Elwha River where it slightly augments instream flows during the summer low flows, but may be of slightly higher water temperature than groundwater due to solar exposure. We are also uncertain about the degree to which groundwater removals will reduce the amount of flow to the river through hyporheic or other mechanisms. Additionally, with the removal of surface water, water temperature within the river channel will also likely increase in temperature due to the reduced flows. Because effects of the proposed action would be expected to affect the water temperature, the effect to this PCE is considered significant. We do not anticipate that the function of this PCE would be precluded.

*PCE 6: In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.*

No spawning or rearing habitat for bull trout is anticipated to be affected due to the proposed action. Effects are anticipated only within areas used for foraging, migration, and/or overwintering.

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

The proposed action includes removal of surface water at the treatment facility and the discharge of hatchery effluent into side channels that flow to the Elwha River. The surface water diversions to the rearing facility may result in changes in water quantity, especially during periods of low flow in the river. Water is eventually discharged back into the river from the rearing facility; therefore, any effects to the river are likely limited in area and duration. However, we anticipate that due to these diversions, the effects to water quantity may be measureable between the diversion site and the point where it reenters the river. Therefore, the effects to this PCE are expected to be significant. We do not anticipate that the function of this PCE would be precluded due to this action.

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

For reasons discussed in this Opinion, we do not anticipate any measurable changes regarding water quality in the lower Elwha River. A slight decrease in water quality may result from treated releases from the WDFW Rearing Channel into the Elwha River. However, surface water diversions to the rearing facility may result in changes in water quantity, especially during periods of low flow in the river. Water is eventually discharged back into the river from the rearing facility, therefore, any effects to the river are likely limited in area and duration. However, we anticipate that due to these diversions, the effects to water quantity may be measureable between the site of diversion to the point where it reenters the river. Therefore, the effects to this PCE are expected to be significant. We do not anticipate that the function of this PCE is precluded due to this action.

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

During the short-term, we do not anticipate any competitive advantage being given to brook trout over bull trout by removal of the dams. Over the long-term, we anticipate removal of the dams would be insignificant, neutral, or beneficial to the persistence of bull trout in the presence of brook trout due to lowering of water temperatures in the lower river to natural levels during late summer and early fall, production of large amounts of large wood, and increases in habitat complexity and connectivity in the new sections of river. However, we do anticipate that brook trout will continue to exert negative pressures on bull trout in the Elwha Watershed.

For reasons discussed later in this opinion, we do not anticipate measurable changes to nonnative species to result from this action. All of the proposed salmonid stocks proposed for augmentation are native and none would be considered “nonnative.” Brook trout are not anticipated to benefit from the proposed actions for the reasons further discussed later in this Opinion (see <u>Direct and Indirect Effects of Inter-species Interactions</u> later in this document). Therefore, the proposed action would not be expected to measurably affect nonnative predatory, interbreeding, or competing species, and the effect to this PCE is considered insignificant.

## Summary of the Effects of the Action

<u>Summary of Effects to Bull Trout</u>

*Effects to Individuals*
Bull trout are likely to be captured using a variety of methods, but most bull trout captures are anticipated to occur at the weir. A small number of bull trout may be injured or killed during or following brood-stock collection, monitoring, or genetic risk-reduction activities, or from injuries at other instream structures.

A small number of bull trout may have their normal behaviors disrupted by the presence of stream-spanning structures (such as the weir) or the combined effects of effluent and holding ponds at hatchery outfalls. Because such disruptions are very short in duration these effects will not be so severe as to kill bull trout or have long-term effects on those individuals.

Bull trout are reasonably likely to experience indirect effects from salmonid spawning due in part to the long period of time that the proposed actions will occur and the even longer period of time over which the effects may manifest themselves. The probability of any particular bull trout redd being exposed to redd displacement or other effects of inter-species competition is low. However, over the period analyzed in this consultation it is reasonably certain that such displacement and/or other effects will occur because numbers of bull trout may increase, number of other salmonids spawning may increase, and bull trout may shift their use to different spawning habitats. Development of anadromy and improvement of forage base may result in larger bull trout, which would in turn prefer spawning in somewhat larger substrates, potentially leading to an increased probability of overlap in spawning sites with other anadromous species.

Bull trout are reasonably likely to experience indirect effects from delayed or displaced spawning due to the presence of stream spanning structures (such as the weir). Delays in reaching preferred spawning areas or spawning below the weir may reduce the likelihood of successful reproduction or may reduce the number or viability of offspring.

The probability of individual bull trout being directly injured or killed or being injured through impairment of essential behaviors (from inter-species relationships or delayed or displaced spawning) is relatively low. There is some potential that some activities may annoy bull trout to the extent that it disrupts normal behaviors during or immediately following operations, but would be unlikely to have long-term effects.

*Quantification of Affected Bull Trout –* We anticipate that normal behaviors of 112 bull trout may be disrupted on an annual basis. This includes 12 at the holding facilities, 30 as a result of diversion and exacerbated low flows, and 100 at the weir. We do not anticipate each of these to occur in all years. Additionally, some of these fish suffer disruption of normal behaviors will be the same fish in a given year. For instance, our estimate of 30 fish is based upon a single summer's operation of the weir. Therefore, we estimate that up to a total of 112 bull trout could be affected by sub-lethal disruption of normal behaviors on an annual basis.

We anticipate that 119 bull trout may be captured annually (100 weir, 10 seine and net, 6 at holding ponds, 2 from hook-and-line broodstock collection, and 1 from risk reduction harvest). The 100 fish captured at the weir may be handled and marked according to USFWS instructions. It is unlikely that any handling for processing will occur from other capture methods as personnel will not be prepared and thus bull trout will generally be released into the best available habitat as quickly as possible with minimal holding times.

We also anticipate that 2 adults and/or subadults may be directly injured or killed during confinement or attempting to avoid the structure, or as a result of predation at the weir. Because we do not anticipate this number to be injured or killed each year, we consider these numbers in the context of the individual estimates of injury and mortality discussed above associated with the capture and handling of up to 119 bull trout, and subsequently anticipate that in total up to 2 bull trout may be injured or killed annually as a result of these activities.

We note here that many of the 112 bull trout anticipated to be exposed to nonlethal disruption of normal behaviors will be included in the 119 captured annually.  However, we anticipate that 6 of the bull trout exposed to nonlethal disruption of normal behaviors at holding ponds will be additive to the number captured.  Together with the 2 bull trout potentially injured at the weir, a total of 127 adult or subadult bull trout would be subject to capture, injury, death, or disruption of normal behaviors.

We also anticipate that delayed or displaced spawning and capture stress could result in injury or mortality of eggs and fry associated with up to 2 adult female bull trout.  We also anticipate that inter-species interactions may result in injury or mortality of eggs and fry associated with up to 2 adult female bull trout.  Because we do not anticipate this level in all years, we anticipate that no more than eggs and fry associated with up to 2 adult female bull trout would be lost from a combination of these effects in any given year.

In summary, we anticipate short-term effects from capture and handling that will likely not affect long-term fitness of the bull trout.  We also anticipate some disruption of normal behaviors that would also not affect long-term fitness of the bull trout.  We anticipate that through all mechanisms combined up to 2 redds (including their eggs and/or fry) would be affected and that up to 2 individual adults or subadults may be injured or killed.

Table 3. Summary of estimates for annual adverse effects anticipated to occur to bull trout as a result of Elwha Fish Restoration Program.

| Action / Stressor | Non-lethal Disruption [1] | Indirect Effects / Impairment [2] | Non-lethal Capture [1] | Injury / Death [1, 4] | Handling from Processing [1] |
|---|---|---|---|---|---|
| | | | | | |
| **Effluent** | | | | | |
| LEKT | 2 | | 1 | 1 | |
| WDFW | 10 | | 5 | 1 | |
| | | | | | |
| **Salmonid Collection** | | | | | |
| Hook-and-line | | | 2 | 1 | |
| Weir | | | 100 | 1 | 100 |
| Seine / net | | | 10 | 1 | |
| Volitional [3] | | | 6 | 2 | |
| | | | | | |
| Risk Reduction Harvest [8] | | | 1 | 1 | |
| | | | | | |
| **Inter-Species Interactions** | | | | | |
| Salmonid Interactions[6] | | 2 | | | |
| | | | | | |
| **Other** | | | | | |
| Stream Spanning Structures | 100 | 2 | | 2 | |
| Diversion | 30 | | | | |
| | | | | | |
| **Total** [4, 5, 7] | 112 | 2 | 119 | 2 | 100 |
| | | | | | |

1 Estimates provided are individual fish (most likely adult or subadult)
2 Estimates provided are number of adult spawning females for which effects would occur to their eggs and/or fry. This may include 1,000 to 10,000 eggs or fry per spawning female.
3 Estimates for bull trout captured at volitional hatchery holding ponds are the same fish as those estimated for effects from effluent at the respective facilities and are only reflected once in the totals.
4 Because individual mortality is not likely to occur each year for each activity, the total number of bull trout anticipated to be killed each year is less than the sum of all estimates.
5 Because the bull trout subject to effects at the weir and effects from diversion are likely to be the same fish, the total number of bull trout anticipated to be disrupted each year is less than the sum of all estimates.
6 Salmonid interactions are less likely during the first few years considered by this consultation and will increase later in the consultation period.
7 Because impaired reproduction or redd destruction is not likely to occur each year for each activity, the total number of cases of impairment anticipated each year is less than the sum of all estimates.
8 These effects are only likely to occur during the first 2 years covered by this consultation.

*Effects to Elwha River Local Populations*

The effects to individuals are not expected to have measureable effects on Elwha River Local Populations because a very small number of individuals are expected be affected. The anticipated beneficial effects of the proposed action on the Elwha River Local Population are difficult to quantify because the USFWS does not have sufficient data to estimate the total populations or to discuss their reproduction and survival rates.  Much of the watershed (areas in which we anticipate bull trout occur) has not been surveyed during past efforts.  We do not anticipate any long-term changes in habitat or function as a result of this proposed action that would affect the numbers, reproduction, survival, or distribution of individual bull trout within the local population.  Similarly, we do not anticipate that the potential loss of up to 2 individual adult or subadult bull trout and the potential loss of up to 2 redds on an annual basis would affect the numbers, reproduction, survival, or distribution of individual bull trout within the local population.  We note the contribution the proposed action will have at the population level.  We anticipate the recovery of natural spawning salmonid populations following dam removal to have long-term beneficial effects to the recovery of bull trout populations in the Elwha River core area related to increased prey production and availability.

*Effects to Elwha River Core Area*
Because we do not anticipate any decrease in function as a result of the proposed action to any local populations or Foraging, Migrating, Overwintering habitat, we anticipate that all functioning components of the Core Area would remain intact.  We also note the contribution this action will make to supporting bull trout.  As a result, we anticipate that this action is compatible with recovery of bull trout in the Core Area and will assist in achieving recovery more quickly than otherwise might have occurred.

<u>Summary of Effects to Bull Trout Critical Habitat</u>

Removal of water from wells may influence the groundwater delivery to the lower river, but the degree to which this will affect critical habitat is uncertain, but the potential exists for exacerbating summer low flows and instream temeprature.  Diversion of surface water during summer low flows will decrease instream flows and have direct effects to critical habitat.  In addition, diversion of surface water may increase instream temperatures due to the reduction in flow.  Some short-term barriers or delay to migration and passage will occur at the weir.  These effects are both short-term and long-term effects.  Significant effects are anticipated for PCEs 1, 2, 5, 7, and 8.  However, none of these activities are anticipated to preclude the ability of the PCEs to continue to function.

## CUMULATIVE EFFECTS

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 Act.

The number of cumulative effects anticipated are few for the following reasons: 1) There is a large amount of Federal land, particularly Olympic National Park, in the watershed which reduces the potential for cumulative effects because actions conducted by Olympic National Park would be future Federal actions subject to consultation; 2) Continued management of lands by Olympic National Forest would be consistent with the Northwest Forest Plan which has already undergone consultation, and future Federal actions would be subject to additional consultation;

3) Continued forestry operations conducted under respective HCPs (i.e., Washington State Department of Natural Resources' State Trust Lands HCP (WDNR 1997) and the Forest Practices HCP (WDNR 2006) have already been consulted upon and are part of the baseline; and 4) Washington State Department of Transportation projects (funded by the Federal Highways Administration or receiving other Federal funds) would also be future Federal actions subject to consultation.

**Climate Change**

One of the most significant ongoing effects to baseline conditions for bull trout and their associated aquatic habitat throughout the state of Washington is climate change. Climate change, and the related warming of global climate, has been well documented in the scientific literature (Bates et al. 2008; ISAB 2007). Evidence includes increases in average air and ocean temperatures, widespread melting of snow and glaciers, and rising sea level. Given the increasing certainty that climate change is occurring and is accelerating (Bates et al. 2008; Battin et al. 2007), we can no longer assume that climatic conditions in the future will resemble those in the past.

Climate change has the potential to profoundly alter the aquatic habitat through both direct and indirect effects (Bisson et al. 2003). Direct effects are evident in alterations of water yield, timing and volume of peak flows, and stream temperature. Some climate models predict 10 to 25 percent reductions in late spring, summer, and early fall runoff amounts in coming decades. Indirect effects, such as increased vulnerability to catastrophic wildfires, occur as climate change alters the structure and distribution of forest and aquatic systems. Observations of the direct and indirect effects of global climate change include changes in species ranges and a wide array of environmental trends (Hari et al. 2006; ISAB 2007; Rieman et al. 2007). In the northern hemisphere, ice-cover durations over lakes and rivers have decreased by almost 20 days since the mid-1800s (WWF 2003). For cold-water-associated salmonids in mountainous regions, where their upper distribution is often limited by impassable barriers, an upward thermal shift in suitable habitat can result in a reduction in size of suitable habitat patches and loss of connectivity among patches, which in turn can lead to a population decline (Hari et al. 2006; Rieman et al. 2007).

In the Pacific Northwest, most models project warmer air temperatures and increases in winter precipitation and decreases in summer precipitation. Warmer temperatures will lead to more precipitation falling as rain rather than snow. As the snow pack diminishes, the timing of stream flow will change, and peak flows are likely to increase. Higher ambient air temperatures will likely cause water temperatures to rise (ISAB 2007). Data from long-term, stream-monitoring stations in western Washington indicate a marked increasing trend in temperatures in most major rivers over the past 25 years (WDOE 2007b).

There is still a great deal of uncertainty associated with predictions of timing, location, and magnitude of climate change. It is also likely that the intensity of effects will vary by region (ISAB 2007). Research indicates that temperatures in many areas will continue to increase due to the effects of global climate change. According to model predictions, average temperatures in Washington State are likely to increase between 1.7 °C and 2.9 °C (3.1 OF and 5.3 OF) by 2040 (Casola et al. 2005).

Bull trout require very cold water for spawning and incubation. Suitable spawning habitat is often found in accessible higher-elevation tributaries and headwaters of rivers. However, effects on hydrology associated with climate change will cause shifts in timing, magnitude, and distribution of peak flows that are also likely to be most pronounced in these high-elevation stream basins (Battin et al. 2007). The increased magnitude of winter peak flows in high-elevation areas is likely to affect spawning and incubation habitat for bull trout and Pacific salmon.

Climate change is and will be an important factor affecting bull trout distribution and population dynamics. As distribution contracts, patch size decreases, and connectivity is truncated; populations that are currently connected may become thermally isolated, which could accelerate the rate of local extinction beyond that resulting from changes in stream temperature alone (Rieman et al. 2007). In areas with already degraded water temperatures or where bull trout are at the southern edge of their range, they may already be at risk of effects from current as well as future climate change.

With respect to the Elwha River Basin, temperature has been a concern due to the actions of the reservoirs in raising instream temperatures. Now, exposure of previously submerged reaches will also be reduced to some level of warming until streambank vegetation becomes established and provides shade. The removal of the Elwha dams may provide additional refugium to bull trout to persist in the presence of climate change due to the presence of glaciers within the protection provided in the upper watersheds of the Olympic National Park. Climate change may also exacerbate revegetation efforts more than it will influence existing forests, especially where revegetation may be occurring on hostile sediments. Peak flows and summer low flows may be amplified in the Elwha by a transition from a snow or rain-on-snow zone to a rain dominated system. Potential sea-level rise may have particularly severe impacts in the Elwha estuary since it is so badly degraded and will not be as resilient as places where estuary and delta habitats are still intact. It may take many decades to re-establish delta and estuary habitat, during which time major changes may occur to climate and flow regimes, as well as sea levels.

**Recreation**

There is limited road access to the watershed. It is difficult to predict how recreation will change over the next few years. Recreation will most likely be non-motorized, and is unlikely to have an effect on water quality, instream habitat, or fish populations. There is currently a moratorium on fishing in the watershed and it is unclear at what point in the future fishing will be allowed. Additionally, the NPS would regulate the level of harvest opportunity that would occur.

**Anadromous Salmonid Harvest**

There is currently a 5-year moratorium on anadromous fish harvest in the Elwha Watershed. Additionally, it is unclear when these populations will be able to withstand exploitive harvest given the long time period over which restoration and recovery will be occurring. However, in order to approve such a harvest, NMFS would be required to make a determination which would be a future Federal action requiring consultation under the ESA. For these reasons, anadromous salmonid harvest is not considered a cumulative effect.

## INTEGRATION AND SYNTHESIS OF EFFECTS

Bull Trout

Throughout its range, the bull trout is threatened by the combined effects of habitat degradation, fragmentation, and alteration. Five segments of the coterminous United States population of the bull trout are essential to the survival and recovery of this species and are identified as Interim Recovery Units. The project is located in the Elwha core area of the Olympic Peninsula Management Unit, which supports at least two local populations of bull trout. As described in the summary of effects to bull trout, the proposed action is not expected to measurably affect the Elwha local population. Both the core area and local population are at increased risk of extirpation from natural, randomly occurring events because of the low number of population and adults, as well as the present uncertainties associated with watershed restoration and recovery, but the small effect of the action on the population is not anticipated to measurably increase this risk.

This paragraph is a summary of the factors that must be synthesized with the anticipated effects on bull trout. Bull trout spawn, rear, forage, and complete other aspects of their life history in the Elwha basin. Bull trout in the Elwha Basin represent an important component of the DPS's geographic range. We currently anticipate few cumulative effects in the action area because much of the upstream watershed is Federal land. Recreation is currently an ongoing use of the watershed but is not anticipated to change measurably in the future. Some additional recreation may occur as a result of the watershed restoration, but that type of recreation is anticipated to have minimal effects to bull trout or their habitat. Baseline conditions are degraded, primarily as a result of the previous presence of the dams compounded by the current and ongoing drastic effects of dam removal and watershed recovery. This baseline will remain dynamic and somewhat unpredictable for the next few years. The majority of the severe effects from turbidity, sediment movement, and other effects associated with dam removals will be concentrated in the lower watershed, and so bull trout located higher in the watershed may remain relatively unaffected.

We anticipate short-term negative effects associated with the dam removal, followed by long-term benefits of improved connectivity. We also anticipate long-term beneficial effects to bull trout in this core area associated with the recovery of natural salmon and steelhead populations. Given the current poor condition of most adult bull trout in the watershed (as indicated by low weight to length ratios) the reintroduction of marine-derived nutrients and a forage source of young salmon and steelhead will be very important to the recovery of bull trout in the Elwha River Basin. The conservation role of the Elwha River Basin is to maintain the genetic components of the species and maintain the geographic range of the species.

The proposed project is anticipated to adversely affect very few bull trout and to result in relatively minor short-term and long-term effects that are well mitigated for by proposed enhancing elements associated with returning natural runs of anadromous fish which will benefit bull trout. Some minor effects will continue over time (e.g., capture and handling of bull trout); while others will change. Effects associated with incidental capture of bull trout during removal of Chambers Creek stock will occur primarily in the first 2 years; while effects from species interactions may increase through the term of analyzed in this opinion. Although this action could result in the death of a few individuals, the magnitude of these effects are not likely measurable at the population level. Drawing from the above discussion of relatively minor effects, we conclude that the effects of the determinations by NMFS and associated actions relative to recovery of natural runs of fish in the Elwha River Basin, considered with cumulative effects, and in the context of the degraded and changing baseline conditions, will not appreciably reduce bull trout distribution, numbers, or reproduction within the Elwha Core Area, or affect the survival and recovery potential of bull trout within the Interim Recovery Unit, or the coterminous listed range.  In the long-term, we anticipate the bull trout population in this core area to increase due to increased prey availability associated with the recovery of native salmonid populations.

Bull Trout Critical Habitat
Critical habitat has been designated in the upper watershed where effects to critical habitat will be few and/or minor. Very little designated critical habitat exists in the lower watershed (e.g., below Elwha Dam) due to the exclusions of tribal and forest-practices lands and adjacent waters. Some areas of the lower river were not excluded (i.e., waters adjacent to WDFW-owned lands). However, designated critical habitat in the lower river is in a period of rapid change with the ongoing removal of the dams and the movement of significant amounts of sediment. These events will bring short-term impacts; but will hopefully also bring long-term benefit.

The proposed action will have direct effects to bull trout critical habitat. Effects from operating the weir will be temporary and limited in both physical extent and duration. Effects associated with water withdrawal will be permanent or long term, lasting for the functional life of the proposed hatchery and rearing facilities operations. The proposed action incorporates design elements and conservation measures which will minimize the effects to critical habitat and its functions.

The effects of the proposed action (permanent and temporary) will not preclude bull trout from foraging, migrating, or overwintering within the action area. No bull trout spawning or rearing habitat occurs within areas that will be affected by the proposed action; therefore none of these habitat functions will be affected.

Within the action area, bull trout critical habitat will retain its current ability to establish and maintain functioning PCEs. The anticipated effects of the action, combined with the effects of interrelated and interdependent actions, and the cumulative effects associated with future State, tribal, local, and private actions will not prevent the PCEs of critical habitat from being maintained, and will not degrade the current ability to establish functioning PCEs at the scale of the action area. Critical habitat within the action area will continue to serve the intended conservation role for the species at the scale of the core area, Coastal-Puget Sound interim recovery unit, and coterminous range.

## CONCLUSION

After reviewing the current status of bull trout, the environmental baseline for the action area, the effects of the proposed actions, and the cumulative effects, it is the USFWS's Biological Opinion that the determination by NMFS and associated actions, as proposed, are not likely to jeopardize the continued existence of the bull trout.

After reviewing the current status of bull trout critical habitat, the environmental baseline for the action area, the effects of the proposed actions, and the cumulative effects, it is USFWS's Opinion that the action, as proposed, will not destroy or adversely modify bull trout critical habitat.

## INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act 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 USFWS 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 USFWS as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR §17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the NMFS, NPS, BIA, and USFWS so that they become binding conditions of any grant, permit, or authorization issued to the WDFW or LEKT, as appropriate, for the exemption in section 7(o)(2) to apply. The NMFS, NPS, BIA, and USFWS have a continuing duty to regulate the activity covered by this incidental take statement. If NMFS, NPS, BIA, and USFWS 1) fail to assume and implement the terms and conditions or 2) fail to require WDFW and LEKT to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the grant, permit, or authorization document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the NMFS, NPS, BIA, and USFWS must report the progress of the action and its impact on the species to the USFWS as specified in the incidental take statement [50 CFR §402.14(i)(3)].

## AMOUNT OR EXTENT OF TAKE

The USFWS anticipates up to 127 bull trout adults or subadults, and offspring of up to 2 adult female bull trout could be taken as a result of this proposed action. The incidental take is expected to be in the form of capture and handling, injury and/or mortality, harassment, and harm as detailed below and summarized in Table 3.

Some forms of incidental take will be difficult to detect or quantify for the following reasons: the species is wide-ranging in habitats that are difficult to access; eggs, fry, and juveniles are small and follow cryptic behaviors; and some effects will result in delayed injury or mortality.

The following incidental take is anticipated due to the proposed action:

1. Incidental take of bull trout in the form of *harassment* (significant disruption or interference with normal behaviors) resulting from operation of the mainstem weir or other mainstem traps, effluent attraction of the holding ponds, and exacerbated low flows. We estimate that up to 112 adult or subadult bull trout could be harassed as a result of these activities annually for the period of this consultation.

2. Incidental take of bull trout in the form of *capture* (sub-lethal effects) resulting from handling related to fish capture and processing. We estimate that up to 119 adult or subadult bull trout could be captured as a result of operations of the weir, at facility outlets, seining and/or netting, genetic risk reduction harvests, and other forms of monitoring and broodstock collection annually for the period of this consultation. Some of these bull trout are addressed above under harassment.

3. Incidental take of bull trout in the form of *injury or death* resulting from handling related to fish capture and processing for monitoring, broodstock collection, rescue at holding ponds, or injuries sustained at the weir or other stream-spanning structures. We estimate that 2 adult or subadult bull trout could be injured or killed as a result of these activities annually for the period of this consultation.

4. Incidental take of bull trout in the form of *harm* (significant impairment with essential behaviors) resulting from delays or blockage of migration at the weir or interspecies interactions (e.g., redd displacement). We estimate that potential offspring of 2 adult female bull trout could be harmed as a result of these activities annually for the period of this consultation. However, as explained in the effects analysis, it is unlikely that this level would occur in most years. Over the extended time period of this consultation, such take is reasonably certain to occur.

## EFFECT OF THE TAKE

In the accompanying Opinion, the USFWS 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.

## REASONABLE AND PRUDENT MEASURES

The USFWS believes the following reasonable and prudent measure(s) are necessary and appropriate to minimize impacts of incidental take of (species):

1. Minimize potential for injury during fish capture and handling and collect information when handling is necessary.

## TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Federal agencies, WDFW, and LEKT 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. Capture and handling of bull trout.

    a. Follow approved capture, handling, holding, and release procedures.

    b. Document all bull trout encountered during broodstock collection, monitoring (excluding the weir for which requirements are described below), or genetic risk-reduction efforts by submitting a fish-handling and injury-occurrence report to the USFWS. The report should including include: 1) the name and address of the supervisory fish biologist; 2) methods used to minimize capture of or disturbances to bull trout; 3) stream conditions at time of operations; 4) the means of fish removal; 5) the number of bull trout removed by age class; 6) condition of all bull trout released; and 7) any incidence of observed injury or mortality to bull trout.

       Specifically, for all bull trout captured at the weir, the fisheries biologist in charge of handling will record the date and time, capture location, methods used, length and weight of the specimen, condition (if abnormal), search for and record identification numbers from any tags that may be present, and provide the collector's name. They will also inform us of any tissue samples (such as scales) that are collected. USFWS may request that additional samples be collected – see **Conservation Recommendations**.

       Reports of incidental injury or killing of bull trout would include any pertinent information such as the cause of death or injury. Such reports would generally include the quantification of take, including numbers of fish incidentally killed or injured, and the locations where this take occurred. The report should also include any insight derived from this work that may contribute to minimizing sources of injury or mortality in the future.

    c. All incidental mortalities of bull trout must be preserved in a fashion to best provide maximum scientific information. Any specimen killed shall be kept whole and put on ice or frozen as soon as possible. Such specimens shall be wrapped in aluminum foil rather than plastic to facilitate contaminant analysis. Collector shall label the specimen with appropriate information and notify Jeff Chan or Jay Davis, U.S. Fish and Wildlife Service; Washington Fish and Wildlife Office, Suite 102,510 Desmond Drive; Lacey, Washington 98503 at (360) 753-9440, so that immediate arrangements can be made for shipping or retrieving the specimens.

2. All bull trout captured will be passed over the weir in the direction of travel. It is not anticipated at this time that bull trout captured at the weir would be relocated higher within the watershed, although that option could be reconsidered in the event that a number of bull trout were being captured at the weir. Any relocation higher into the watershed (e.g., above Carlson Canyon) should be limited to bull trout genetically determined to be a part of the upper Elwha population, and would need to be approved by USFWS. The USFWS shall work with the other Federal agencies to determine methods to ensure this term and condition is properly implemented.

3. The WDFW and LEKT will submit copies of any otherwise required water-quality monitoring reports to USFWS so that USFWS may ascertain whether any concentrations of chemicals or other compounds may be resulting in unanticipated adverse effects to bull trout.

## REPORTING AND MONITORING REQUIREMENT

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

For this reason, we require reporting of the information described above in terms and conditions 1b and 1c. This ensures that we will receive information by method of capture and age class, such as length, condition, and any incidence of observed injury or mortality.

We also require that any take of bull trout observed be reported to the USFWS on an annual basis.

The USFWS believes that no more than 127 adult bull trout and progeny from 2 spawning bull trout females of bull trout will be incidentally taken annually as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action.
If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the USFWS the need for possible modification of the reasonable and prudent measures.

The USFWS is to be notified within three working days upon locating a dead, injured or sick endangered or threatened species specimen. Initial notification must be made to the nearest U.S. Fish and Wildlife Service Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should 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. Contact the U.S. Fish and Wildlife Service Law Enforcement Office at (425) 883-8122, or the USFWS's Washington Fish and Wildlife Office at (360) 753-9440.

## CONSERVATION RECOMMENDATIONS

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

<u>Collection of Tissue Samples</u>: The NMFS, NPS, BIA, and USFWS should request that personnel at the mainstem resistance-board weir operated by WDFW should collect deoxyribonucleic acid (DNA) samples as described in this Biological Opinion for any bull trout captured during fish-salvage operations. Although not listed as a required monitoring report above, the Federal agencies should submit to the USFWS within 60 days of completing such fish capture a report regarding any DNA samples collected, as well as providing the DNA samples as described in this Opinion. Because valuable information can be obtained from genetic analysis of bull trout, the USFWS requests a small tissue sample (e.g., fin clip of 2 to 5 mm in diameter, depending on fish length) from all bull trout would be preserved in a vial of 95 percent ethanol and sent to the Washington Fish and Wildlife Office for storage or processing.

If bull trout are greater than 125 mm in length, we ask that the fisheries biologist take a scale sample; if bull trout are less than 125 mm in length, no scale sample is necessary. If bull trout are greater than 40 mm in length, we ask that the fisheries biologist take a DNA sample. If the fish is greater than 85 mm in length, we ask that they clip a portion of the anal fin to obtain a 5-mm-diameter tissue sample. I f the fish is less than 85 mm in length (but greater than 40 mm), we ask that they clip a portion of the caudal fin lobe (lower lobe) to obtain a 2 mm-diameter tissue sample.

Following collection, they must place such tissue in a sample bottle containing 95 percent non-denatured ethanol solution. They must not dilute the ethanol and must not use methanol or reagent alcohol solutions (i.e., rubbing alcohol or denatured alcohol) because these chemicals disrupt DNA extraction. They must not overload the vials with tissue because DNA will degrade; vials should contain no more than 1 part tissue to 9 parts ethanol.

The biologist must label each bottle with geographic location, species, date, and sampler's name. It is important that all this information be included for the sample to be useful. If labels are to be placed inside vials, they must not use (wood) paper-based waterproof paper (e.g., Rite-in-the-

Rain®) because chemicals in those papers interfere with DNA extraction; plastic paper (e.g., Dura Copy®) is acceptable. If labels are attached to the outside of vials, they must cover the label with clear tape to ensure the writing does not get dissolved by preservative.

Such samples must be shipped to Jeff Chan; U.S. Fish and Wildlife Service; Washington Fish and Wildlife Office; 510 Desmond Drive Southeast; Suite 102; Lacey, Washington 98503.

Hydrology: The agencies should continue to explore the relationships of groundwater removal and the effects this may have on stream temperatures during low flows. They should also explore the dynamics of surface water diversion at low flows and report the results of their findings to the USFWS.

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

## REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action 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

## APPENIX A - STATUS OF THE SPECIES (Bull Trout)

### Listing Status

The coterminous United States population of the bull trout (*Salvelinus confluentus*) was listed as threatened on November 1, 1999 (64 FR 58910). The threatened bull trout generally occurs in the Klamath River Basin of south-central Oregon; the Jarbidge River in Nevada; the Willamette River Basin in Oregon; Pacific Coast drainages of Washington, including Puget Sound; major rivers in Idaho, Oregon, Washington, and Montana, within the Columbia River Basin; and the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Bond 1992, p. 2; Brewin and Brewin 1997, p. 215; Cavender 1978, pp. 165-166; Leary and Allendorf 1997, pp. 716-719).

Throughout its range, the bull trout are threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, poor water quality, entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels, and introduced non-native species (64 FR 58910). Although all salmonids are likely to be affected by climate change, bull trout are especially vulnerable given that spawning and rearing are constrained by their location in upper watersheds and the requirement for cold water temperatures (Battin et al. 2007, pp. 6672-6673; Rieman et al. 2007, p. 1552). Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats.

The bull trout was initially listed as three separate Distinct Population Segments (DPSs) (63 FR 31647; 64 FR 17110). The preamble to the final listing rule for the United States coterminous population of the bull trout discusses the consolidation of these DPSs with the Columbia and Klamath population segments into one listed taxon and the application of the jeopardy standard under section 7 of the Act relative to this species (64 FR 58910):

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

### Current Status and Conservation Needs

In recognition of available scientific information relating to their uniqueness and significance, five segments of the coterminous United States population of the bull trout are considered essential to the survival and recovery of this species and are identified as interim recovery units: 1) Jarbidge River, 2) Klamath River, 3) Columbia River, 4) Coastal-Puget Sound, and 5) St. Mary-Belly River (USFWS 2002a, pp. iv, 2, 7, 98; 2004a, Vol. 1 & 2, p. 1; 2004b, p. 1). Each of these interim recovery units is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

A summary of the current status and conservation needs of the bull trout within these interim recovery units is provided below and a comprehensive discussion is found in the Service's draft recovery plans for the bull trout (USFWS 2002a, pp. vi-viii; 2004a, Vol. 2 p. iii-x; 2004b, pp. iii-xii).

The conservation needs of bull trout are often generally expressed as the four "Cs": cold, clean, complex, and connected habitat. Cold stream temperatures, clean water quality that is relatively free of sediment and contaminants, complex channel characteristics (including abundant large wood and undercut banks), and large patches of such habitat that are well connected by unobstructed migratory pathways are all needed to promote conservation of bull trout at multiple scales ranging from the coterminous to local populations (a local population is a group of bull trout that spawn within a particular stream or portion of a stream system). The recovery planning process for bull trout (USFWS 2002a, pp. 49-50; 2004a, Vol 1 & 2 pp. 12-18; 2004b, pp. 60-86) has also identified the following conservation needs: 1) maintenance and restoration of multiple, interconnected populations in diverse habitats across the range of each interim recovery unit, 2) preservation of the diversity of life-history strategies, 3) maintenance of genetic and phenotypic diversity across the range of each interim recovery unit, and 4) establishment of a positive population trend. Recently, it has also been recognized that bull trout populations need to be protected from catastrophic fires across the range of each interim recovery unit (Rieman et al. 2003).

Central to the survival and recovery of bull trout is the maintenance of viable core areas (USFWS 2002a, pp. 53-54; 2004a, Vol. 1 pp. 210-218, Vol 2. pp. 61-62; 2004b, pp. 15-30, 64-67). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat. Each of the interim recovery units listed above consists of one or more core areas. There are 121 core areas recognized across the coterminous range of the bull trout (USFWS 2002a, pp. 6, 48, 98; 2004a, Vol. 1 p. vi, Vol. 2 pp. 14, 134; 2004b, pp. iv, 2; 2005, p. ii).

<u>Jarbidge River Interim Recovery Unit</u>

This interim recovery unit currently contains a single core area with six local populations. Less than 500 resident and migratory adult bull trout, representing about 50 to 125 spawning adults, are estimated to occur in the core area. The current condition of the bull trout in this interim recovery unit is attributed to the effects of livestock grazing, roads, incidental mortalities of released bull trout from recreational angling, historic angler harvest, timber harvest, and the introduction of non-native fishes (USFWS 2004b). The draft bull trout recovery plan (USFWS 2004b) identifies the following conservation needs for this interim recovery unit: 1) maintain the current distribution of the bull trout within the core area, 2) maintain stable or increasing trends in abundance of both resident and migratory bull trout in the core area, 3) restore and maintain suitable habitat conditions for all life history stages and forms, and 4) conserve genetic diversity and increase natural opportunities for genetic exchange between resident and migratory forms of the bull trout. An estimated 270 to 1,000 spawning bull trout per year are needed to provide for the persistence and viability of the core area and to support both resident and migratory adult bull trout (USFWS 2004b).

Klamath River Interim Recovery Unit

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

Columbia River Interim Recovery Unit

The Columbia River interim recovery unit includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin, and presently occur in 45 percent of the estimated historical range (Quigley and Arbelbide 1997, p. 1177). This interim recovery unit currently contains 97 core areas and 527 local populations. About 65 percent of these core areas and local populations occur in central Idaho and northwestern Montana. The Columbia River interim recovery unit has declined in overall range and numbers of fish (63 FR 31647). Although some strongholds still exist with migratory fish present, bull trout generally occur as isolated local populations in headwater lakes or tributaries where the migratory life history form has been lost. Though still widespread, there have been numerous local extirpations reported throughout the Columbia River basin. In Idaho, for example, bull trout have been extirpated from 119 reaches in 28 streams (IDFGin litt., in litt. 1995). The draft Columbia River bull trout recovery plan (USFWS 2002c) identifies the following conservation needs for this interim recovery unit: 1) maintain or expand the current distribution of the bull trout within core areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all bull trout life history stages and strategies, and 4) conserve genetic diversity and provide opportunities for genetic exchange.

This interim recovery unit currently contains 97 core areas and 527 local populations. About 65 percent of these core areas and local populations occur in Idaho and northwestern Montana. The condition of the bull trout within these core areas varies from poor to good. All core areas have been subject to the combined effects of habitat degradation and fragmentation caused by the following activities: dewatering; road construction and maintenance; mining; grazing; the blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment into diversion channels; and introduced non-native species. The Service completed a core area conservation assessment for the 5-year status review and determined that, of the 97 core areas in this interim recovery unit, 38 are at high risk of extirpation, 35 are at risk, 20 are at potential risk, 2 are at low risk, and 2 are at unknown risk (USFWS 2005, pp. 2, Map A, pp. 73-83).

Coastal-Puget Sound Interim Recovery Unit

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

St. Mary-Belly River Interim Recovery Unit

This interim recovery unit currently contains six core areas and nine local populations (USFWS 2002b). Currently, bull trout are widely distributed in the St. Mary-Belly River drainage and occur in nearly all of the waters that it inhabited historically. Bull trout are found only in a 1.2-mile reach of the North Fork Belly River within the United States. Redd count surveys of the North Fork Belly River documented an increase from 27 redds in 1995 to 119 redds in 1999. This increase was attributed primarily to protection from angler harvest (USFWS 2002b). The current condition of the bull trout in this interim recovery unit is primarily attributed to the effects of dams, water diversions, roads, mining, and the introduction of non-native fishes (USFWS 2002b). The draft St. Mary-Belly River bull trout recovery plan (USFWS 2002b) identifies the following conservation needs for this interim recovery unit: 1) maintain the current

[3] Bull trout migrate from saltwater to freshwater to reproduce are commonly referred to as anadromous. However, bull trout and some other species that enter the marine environment are more properly termed amphidromous. Unlike strictly anadromous species, such as Pacific salmon, amphidromous species often return seasonally to fresh water as subadults, sometimes for several years, before returning to spawn (Brenkman and Corbett 2005, p. 1075; Wilson 1997, p. 5). Due to its more common usage, we will refer to bull trout has exhibiting anadromous rather than amphidromous life history patterns in this document.

distribution of the bull trout and restore distribution in previously occupied areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all life history stages and forms, 4) conserve genetic diversity and provide the opportunity for genetic exchange, and 5) establish good working relations with Canadian interests because local bull trout populations in this interim recovery unit are comprised mostly of migratory fish, whose habitat is mostly in Canada.

**Life History**

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, pp. 1-18) . Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Fraley and Shepard 1989, p. 1; Goetz 1989, pp. 15-16). 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, pp. 135-137; Goetz 1989, pp. 22-25), or saltwater (anadromous form) to rear as subadults and to live as adults (Cavender 1978, pp. 139, 165-68; McPhail and Baxter 1996, p. 14; WDFW et al. 1997, pp. 17-18, 22-26). 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, pp. 135-137; Leathe and Graham 1982, p. 95; Pratt 1992, p. 6; Rieman and McIntyre 1996, p. 133).

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

Growth varies depending upon life-history strategy. Resident adults range from 6 to 12 inches total length, and migratory adults commonly reach 24 inches or more (Goetz 1989, pp. 29-32; Pratt 1984, p. 13) The largest verified bull trout is a 32-pound specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982).

**Habitat Characteristics**

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993, p. 7). 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, pp. 137, 141; Goetz 1989, pp. 19-26; Bond in Hoelscher and Bjornn 1989, p. 57; Howell and Buchanan 1992, p. 1; Pratt 1992, p. 6; Rich 1996, pp. 35-38; Rieman and McIntyre 1993, pp. 4-7; Rieman and McIntyre 1995, pp. 293-294; Sedell and Everest 1991, p. 1; Watson and Hillman 1997, pp. 246-250). Watson and Hillman (1997, pp. 247-249) 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, p. 7), bull trout should not be expected to simultaneously occupy all available habitats (Rieman et al. 1997, p. 1560).

Migratory corridors link seasonal habitats for all bull trout life histories. The ability to migrate is important to the persistence of bull trout (Gilpin, in litt. 1997, pp. 4-5; Rieman and McIntyre 1993, p. 7; Rieman et al. 1997, p. 1114). 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. 7; Spruell et al. 1999, pp. 118-120). Migration also allows bull trout to access more abundant or larger prey, which facilitates growth and reproduction. Additional benefits of migration and its relationship to foraging are discussed below under “Diet.”

Cold water temperatures play an important role in determining bull trout habitat quality, as these fish are primarily found in colder streams (below 15 °C or 59 °F), and spawning habitats are generally characterized by temperatures that drop below 9 °C (48 °F) in the fall (Fraley and Shepard 1989, p. 133; Pratt 1992, p. 6; Rieman and McIntyre 1993, p. 7).

Thermal requirements for bull trout appear to differ at different life stages. Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Baxter et al. 1997, pp. 426-427; Pratt 1992, p. 6; Rieman and McIntyre 1993, p. 7; Rieman et al. 1997, p. 1117). Optimum incubation temperatures for bull trout eggs range from 2 °C to 6 °C (35 °F to 39 °F) whereas optimum water temperatures for rearing range from about 6 °C to 10 °C (46 °F to 50 °F) (Buchanan and Gregory 1997, pp. 121-122; Goetz 1989, pp. 22-24; McPhail and Murray 1979, pp. 41, 50, 53, 55). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 °C to 9 °C (46 °F to 48 °F), within a temperature gradient of 8 °C to 15 °C (4 °F to 60 °F). In a landscape study relating bull trout distribution to maximum water temperatures, Dunham et al. (2003) found that the probability of juvenile bull trout occurrence does not become high (i.e., greater than 0.75) until maximum temperatures decline to 11 °C to 12 °C (52 °F to 54 °F).

Although bull trout are found primarily in cold streams, occasionally these fish are found in larger, warmer river systems throughout the Columbia River basin (Buchanan and Gregory 1997, pp. 121-122; Fraley and Shepard 1989, pp. 135-137; Rieman and McIntyre 1993, p. 2; Rieman and McIntyre 1995, p. 288; Rieman et al. 1997, p. 1114). Availability and proximity of cold water patches and food productivity can influence bull trout ability to survive in warmer rivers (Myrick et al. 2002). For example, in a study in the Little Lost River of Idaho where bull trout were found at temperatures ranging from 8 °C to 20 °C (46 °F to 68 °F), most sites that had high densities of bull trout were in areas where primary productivity in streams had increased following a fire (Gamett, pers. comm. 2002).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989, pp. 135-137; Goetz 1989, pp. 22-25; Hoelscher and Bjornn 1989, p. 54; Pratt 1992, p. 6; Rich 1996, pp. 35-38; Sedell and Everest 1991, p. 1; Sexauer and James 1997, pp. 367-369; Thomas 1992, pp. 4-5; Watson and Hillman 1997, pp. 247-249). Maintaining bull trout habitat requires stability of stream channels and maintenance of natural flow patterns (Rieman and McIntyre 1993, p. 7). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997, pp. 367-369). 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, pp. 135-137; Pratt 1992, p. 6; Pratt and Huston 1993, pp. 70-72). Pratt (1992, p. 6) indicated that increases in fine sediment reduce egg survival and emergence.

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. 135). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989, p. 15; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p. 8). After hatching, fry remain in the substrate, and time from egg deposition to emergence may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Ratliff and Howell 1992 in Howell and Buchanan 1992, pp. 10, 15; Pratt 1992, pp. 5-6).

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

A literature review conducted by the Washington Department of Ecology (WDOE 2002) indicates that adverse effects of lower oxygen concentrations on embryo survival are magnified as temperatures increase above optimal (for incubation). In a laboratory study conducted in Canada, researchers found that low oxygen levels retarded embryonic development in bull trout (Giles and Van der Zweep 1996, pp. 54-55). Normal oxygen levels seen in rivers used by bull trout during spawning ranged from 8 to 12 mg/L (in the gravel), with corresponding instream levels of 10 to 11.5 mg/L (Stewart et al. 2007). In addition, IGDO concentrations, water velocities in the water column, and especially the intergravel flow rate, are interrelated variables that affect the survival of incubating embryos (ODEQ 1995). Due to a long incubation period of 220+ days, bull trout are particularly sensitive to adequate IGDO levels. An IGDO level below 8 mg/L is likely to result in mortality of eggs, embryos, and fry.

Migratory forms of bull trout may develop when habitat conditions allow movement between spawning and rearing streams and larger rivers, lakes or nearshore marine habitat where foraging opportunities may be enhanced (Brenkman and Corbett 2005, pp. 1073, 1079-1080; Frissell 1993, p. 350; Goetz et al. 2004, pp. 45, 55, 60, 68, 77, 113-114, 123, 125-126). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams, lakes, and marine waters; greater fecundity resulting in increased reproductive potential; and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Frissell 1999, pp. 15-16; MBTSG 1998, pp. iv, 48-50; Rieman and McIntyre 1993, pp. 18-19; USFWS 2004a, Vol. 2, p. 63). 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 fish with higher fecundity is lost (Rieman and McIntyre 1993, pp. 1-18).

**Diet**

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. A single optimal foraging strategy is not necessarily a consistent feature in the life of a fish, because this strategy can change as the fish progresses from one life stage to another (i.e., juvenile to subadult). Fish growth depends on the quantity and quality of food that is eaten (Gerking 1994), and as fish grow, their foraging strategy changes as their food changes, in quantity, size, or other characteristics. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987, p. 58; Donald and Alger 1993, pp. 239-243; Goetz 1989, pp. 33-34). Subadult and adult migratory bull trout feed on various fish species (Brown 1994, p. 21; Donald and Alger 1993, p. 242; Fraley and Shepard 1989, p. 135; Leathe and Graham 1982, p. 95). Bull trout of all sizes other than fry have been found to eat fish up to half their length (Beauchamp and VanTassell 2001). In nearshore marine areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) (Goetz et al. 2004, p. 114; WDFW et al. 1997, p. 23).

Bull trout migration and life history strategies are closely related to their feeding and foraging strategies. Migration allows bull trout to access optimal foraging areas and exploit a wider variety of prey resources. Optimal foraging theory can be used to describe strategies fish use to choose between alternative sources of food by weighing the benefits and costs of capturing one source of food over another. For example, prey often occur in concentrated patches of abundance ("patch model") (Gerking 1994). As the predator feeds in one patch, the prey population is reduced, and it becomes more profitable for the predator to seek a new patch rather than continue feeding on the original one. This can be explained in terms of balancing energy acquired versus energy expended. For example, in the Skagit River system, anadromous bull trout make migrations as long as 121 miles between marine foraging areas in Puget Sound and headwater spawning grounds, foraging on salmon eggs and juvenile salmon along their migration route (WDFW et al. 1997). Anadromous bull trout also use marine waters as migration corridors to reach seasonal habitats in non-natal watersheds to forage and possibly overwinter (Brenkman and Corbett 2005, p. 1079; Goetz et al. 2004, pp. 36, 60).

Changes in Status of the Coastal-Puget Sound Interim Recovery Unit

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

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

Changes in Status of the Columbia River Interim Recovery Unit

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

Changes in Status of the Klamath River Interim Recovery Unit

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

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

Changes in Status of the Saint Mary-Belly River Interim Recovery Unit

The overall status of bull trout in the Saint Mary-Belly River interim recovery unit has not changed appreciably since its listing on November 1, 1999. Extensive research efforts have been conducted since listing, to better quantify populations of bull trout and their movement patterns. Limited efforts in the way of active recovery actions have occurred. Habitat occurs mostly on Federal and Tribal lands (Glacier National Park and the Blackfeet Nation). Known problems due to instream flow depletion, entrainment, and fish passage barriers resulting from operations of the U.S. Bureau of Reclamation's Milk River Irrigation Project (which transfers Saint Mary-Belly River water to the Missouri River Basin) and similar projects downstream in Canada constitute the primary threats to bull trout and to date they have not been adequately addressed under section 7 of the Act. Plans to upgrade the aging irrigation delivery system are being pursued, which has potential to mitigate some of these concerns but also the potential to intensify dewatering. A major fire in August 2006 severely burned the forested habitat in Red Eagle and Divide Creeks, potentially affecting three of nine local populations and degrading the baseline.

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# APPENDIX B – STATUS OF THE BULL TROUT CRITICAL HABITAT

# APPENDIX B - Status of Bull Trout Critical Habitat (Rangewide)

**Legal Status**

Current Designation

The U.S. Fish and Wildlife Service (Service) published a final critical habitat designation for the coterminous United States population of the bull trout on October 18, 2010 (70 FR 63898); the rule becomes effective on November 17, 2010. A justification document was also developed to support the rule and is available on our website (http://www.fws.gov/pacific/bulltrout). The scope of the designation involved the species' coterminous range, including six draft recovery units [Mid-Columbia, Saint Mary, Columbia Headwaters, Coastal, Klamath, and Upper Snake (75 FR 63927)]. The Service's 1999 coterminous listing rule identified five interim recovery units (50 CFR Part 17, pg. 58910), which includes the Jarbidge River, Klamath River, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments (also considered as interim recovery units). Our five year review recommended re-evaluation of these units based on new ()information (USFWS 2008, p. 9). However, until the bull trout draft recovery plan is finalized, the current five interim recovery units will be used for purposes of section 7 jeopardy analyses and recovery planning. The adverse modification analysis in this biological opinion does not rely on recovery units, relying instead on the newly listed critical habitat units and subunits.

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 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 |

The 2010 revision increases the amount of designated bull trout critical habitat by approximately 76 percent for miles of stream/shoreline and by approximately 71 percent for acres of lakes and reservoirs compared to the 2005 designation.

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

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

Table 2.—Stream/shoreline distance excluded from bull trout critical habitat based on tribal ownership or other plan.

| **Ownership and/or Plan** | **Kilometers** | **Miles** |
|---|---|---|
| Lewis River Hydro Conservation Easements | 7.0 | 4.3 |
| DOD – Dabob Bay Naval | 23.9 | 14.8 |
| HCP – Cedar River (City of Seattle) | 25.8 | 16.0 |
| HCP – Washington Forest Practices Lands | 1,608.30 | 999.4 |
| HCP – Green Diamond (Simpson) | 104.2 | 64.7 |
| HCP – Plum Creek Central Cascades (WA) | 15.8 | 9.8 |
| HCP – Plum Creek Native Fish (MT) | 181.6 | 112.8 |
| HCP–Stimson | 7.7 | 4.8 |
| HCP – WDNR Lands | 230.9 | 149.5 |
| Tribal – Blackfeet | 82.1 | 51.0 |
| Tribal – Hoh | 4.0 | 2.5 |
| Tribal – Jamestown S’Klallam | 2.0 | 1.2 |
| Tribal – Lower Elwha | 4.6 | 2.8 |
| Tribal – Lummi | 56.7 | 35.3 |

| Ownership and/or Plan | Kilometers | Miles |
|---|---|---|
| Tribal – Muckleshoot | 9.3 | 5.8 |
| Tribal – Nooksack | 8.3 | 5.1 |
| Tribal – Puyallup | 33.0 | 20.5 |
| Tribal – Quileute | 4.0 | 2.5 |
| Tribal – Quinault | 153.7 | 95.5 |
| Tribal – Skokomish | 26.2 | 16.3 |
| Tribal – Stillaguamish | 1.8 | 1.1 |
| Tribal – Swinomish | 45.2 | 28.1 |
| Tribal – Tulalip | 27.8 | 17.3 |
| Tribal – Umatilla | 62.6 | 38.9 |
| Tribal – Warm Springs | 260.5 | 161.9 |
| Tribal – Yakama | 107.9 | 67.1 |
| Total | 3,094.9 | 1,923.1 |

Table 3. Lake/Reservoir area excluded from bull trout critical habitat based on tribal ownership or other plan.

| Ownership and/or Plan | Hectares | Acres |
|---|---|---|
| HCP – Cedar River (City of Seattle) | 796.5 | 1,968.2 |
| HCP – Washington Forest Practices Lands | 5,689.1 | 14,058.1 |
| HCP – Plum Creek Native Fish | 32.2 | 79.7 |
| Tribal – Blackfeet | 886.1 | 2,189.5 |
| Tribal – Warm Springs | 445.3 | 1,100.4 |
| Total | 7,849.3 | 19,395.8 |

**Conservation Role and Description of Critical Habitat**

The conservation role of bull trout critical habitat is to support viable core area populations (75 FR 63898:63943 [October 18, 2010]). The core areas reflect the metapopulation structure of bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. CHUs generally encompass one or more core areas and may include FMO areas, outside of core areas, that are important to the survival and recovery of bull trout.

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

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

The Olympic Peninsula and Puget Sound CHUs are essential to the conservation of anadromous[4] bull trout, which are unique to the Coastal-Puget Sound population segment. These CHUs contain marine nearshore and freshwater habitats, outside of core areas, that are used by bull trout from one or more core areas. These habitats, outside of core areas, contain PCEs that are critical to adult and subadult foraging, overwintering, and migration.

*Primary Constituent Elements for Bull Trout*

Within the designated critical habitat areas, the PCEs for bull trout are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. Based on our current knowledge of the life history, biology, and ecology of this species and the characteristics of the habitat necessary to sustain its essential life-history functions, we have determined that the following PCEs 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 °C to 15 °C (36 °F to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific

[4] Bull trout migrate from saltwater to freshwater to reproduce are commonly referred to as anadromous. However, bull trout and some other species that enter the marine environment are more properly termed amphidromous. Unlike strictly anadromous species, such as Pacific salmon, amphidromous species often return seasonally to fresh water as subadults, sometimes for several years, before returning to spawn (Brenkman and Corbett 2005, p. 1075; Wilson 1997, p. 5). Due to its more common usage, we will refer to bull trout has exhibiting anadromous rather than amphidromous life history patterns in this document.

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

6. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

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

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

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

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

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

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

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

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

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

**Current Critical Habitat Condition Rangewide**

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

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PCEs, those which appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows: 1) fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Dunham and Rieman 1999, p. 652; Rieman and McIntyre 1993, p. 7); 2) degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989, p. 141; MBTSG 1998, pp. ii - v, 20-45); 3) the introduction and spread of nonnative fish species, particularly brook trout and lake trout, as a result of fish stocking and degraded habitat conditions, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary et al. 1993, p. 857; Rieman et al. 2006, pp. 73-76); 4) in the Coastal-Puget Sound region where amphidromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine nearshore foraging and migration habitat due to urban and residential development; and 5) degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

**Effects of Climate Change on Bull Trout Critical Habitat**

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

**Consulted on Effects for Critical Habitat**

The Service has formally consulted on the effects to bull trout critical habitat throughout its range. Section 7 consultations include actions that continue to degrade the environmental baseline in many cases. However, long-term restoration efforts have also been implemented that provide some improvement in the existing functions within some of the critical habitat units.

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