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United States Department of the Interior

FISH AND WILDLIFE SERVICE

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

MAY 15 2006

Memorandum

To: Manager, Division of Environmental Assessment and Restoration
Western Washington Fish and Wildlife Office
Lacey, Washington

From: Manager, Division of Consultation and Technical Assistance
Western Washington Fish and Wildlife Office
Lacey, Washington

Subject: Biological Opinion, Letter of Concurrence, and Conference for the Programmatic Biological Assessment for Habitat Restoration Activities of the Western Washington Fish and Wildlife Office (FWS Reference: 1-3-05-FWF-0167)

This document transmits the Biological Opinion, Letters of Concurrence, and Conference Reports of the U.S. Fish and Wildlife Service (Service) based on our review of the Programmatic Biological Assessment (PBA) for Habitat Restoration Activities of the Western Washington Fish and Wildlife Office. The activities will occur in any western Washington county within the range of the Coastal-Puget Sound bull trout interim recovery unit.

The PBA analyzed the effects on the following federally listed resources: the brown pelican (*Pelecanus occidentalis*), columbian white-tailed deer (*Odocoileus virginanus leucurus*), marsh sandwort (*Arenaria paludicola*), Bradshaw's desert-parsley (*Lomatium bradshawii*), bald eagle (*Haliaeetus leucocephalus*), bull trout (*Salvelinus confluentus*), Canada lynx (*Lynx canadensis*), gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos horribilis*), marbled murrelet (*Brachyramphus marmoratus*), northern spotted owl (*Strix occidentalis caurina*), Oregon silverspot butterfly (*Speyeria zerene hippolyta*), western snowy plover (*Charadrius alexandrinus nivosus*), golden paintbrush (*Castilleja levisecta*), water howellia (*Howellia aquatilis*), Nelson's checker-mallow (*Sidalcea nelsoniana*), Kincaid's lupine (*Lupinus sulphureus* ssp. *Kincaidii*), marbled murrelet designated critical habitat, northern spotted owl designated critical habitat, western snowy plover designated critical habitat, and bull trout designated critical habitat, in accordance with section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq*.). The PBA also analyzed the effects on the following Federal candidate species: the Oregon spotted frog (*Rana pretiosa*), mardon skipper (*Polites mardon*), northern wormwood (*Artemisia campestris* var. *wormskioldii*), streaked horned lark (*Eremophila alpestris strigata*), yellow-billed cuckoo (*Coccyzus americanus*), mazama pocket gopher (*Thomomys mazama*), whulge checkerspot (*Euphydras editha taylori*), and the West Coast distinct population segment of the fisher (*Martes pennanti*).

The request for formal consultation on bull trout was received on January 25, 2005. In addition, you requested 1) concurrence with the determinations of "may affect, not likely to adversely affect" for the other listed species and critical habitat, 2) conference for the determination of "no jeopardy" for the proposed and candidate species, and 3) conference for the determination of "not likely to adversely modify" for proposed bull trout critical habitat in western Washington.

Subsequent to receiving the request for consultation, critical habitat for bull trout was designated and critical habitat for the western snowy plover was re-designated. The PBA was amended to include a full analysis for bull trout designated critical habitat. Restoration activities that may affect snowy plover critical habitat are not included in the PBA and will be consulted upon individually. The attached BO addresses adverse effects to bull trout and bull trout designated critical habitat.

The PBA determined there would be no effect to the leatherback sea turtle (*Dermochelys coriacea*), green sea turtle (*Chelonia mydas*), loggerhead sea turtle (*Caretta caretta*), or olive ridley sea turtle (*Lepidochelys olivacea*). Therefore, no concurrence is necessary.

The Biological Opinion, concurrences, and conferences are based on information provided in the January 2005 PBA, meetings between Consultation and Technical Assistance and Environmental Assessment and Restoration staff, and the revised PBA. A complete administrative record of this consultation is on file at this office.

If you have any questions about the enclosed Biological Opinion, letters of concurrence, conference reports, or your responsibilities under the Endangered Species Act, please contact Deanna Lynch (360) 753-9545 or John Grettenberger (360) 753-6044, of my staff.

Attachment

Biological Opinion
Letter of Concurrence
Conference for the Programmatic Biological Assessment
for Habitat Restoration Activities
of the Western Washington Fish and Wildlife Office

FWS Reference # 1-3-05-FWF-0167

U.S. Fish and Wildlife Service
510 Desmond Drive SE Suite 102
Lacey, Washington 98503

May 15, 2006

for Ken S. Berg, Manager

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CONSULTATION HISTORY

The draft Programmatic Biological Assessment (PBA) was submitted to the U.S. Fish and Wildlife Service (Service) Division of Consultation and Technical Assistance (CTA) on January 25, 2005. Comments were provided to the Division of Environmental Assessment and Restoration (EAR) on February 14, 2005. The CTA and EAR Divisions worked together to resolve technical issues and refine the PBA throughout the consultation period. Final revisions to the PBA were completed while this Biological Opinion (BO) was being prepared, such that the PBA can reflect any new analyses or terms and conditions included in the BO. This will enable the Division of Environmental Assessment and Restoration biologists to refer to a single document when evaluating the effects of their projects on listed species.

The request for formal consultation on bull trout was received on January 25, 2005. In addition, you requested 1) concurrence with the determinations of "may affect, not likely to adversely affect" for the other listed species and critical habitat, 2) conference for the determination of "no jeopardy" for the proposed and candidate species, and 3) conference for the determination of "not likely to adversely modify" for proposed bull trout critical habitat in Western Washington.

Subsequent to receiving the request for consultation, critical habitat for bull trout was designated and critical habitat for the western snowy plover was re-designated. The PBA was amended to include a full analysis for bull trout designated critical habitat. Restoration activities that may affect snowy plover critical habitat are not included in the PBA and will be consulted upon individually. The following BO addresses adverse effects to bull trout and bull trout designated critical habitat.

CONCURRENCE

Endangered Species

Brown Pelican

Explosives will not be used within 1.0 mile of Sand and Goose Islands in Grays Harbor or Dead Man Island in Willapa Bay between June 1 and October 31. Prior to implementation of activities which directly alter islands within Grays Harbor or Willapa Bay, site-specific conservation measures will be developed during individual project design and will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to brown pelicans are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" brown pelicans. Project-specific concurrence will be deferred until the site-specific conservation measures are reviewed.

Columbian White-tailed Deer

Activities on Puget Island, the Hunting Islands, Price Island, and 2.0 miles inland from the Columbia River between 2.0 miles east of Cathlamet and 2.0 miles west of Skamokawa Creek in

Wahkiakum County, will not occur from June 1 to June 30 in order to avoid or minimize impacts during the fawning period. Only three-strand barbed wire will be used for fencing projects in order to avoid or minimize impacts to deer movement. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" the Columbian white-tailed deer.

Marsh Sandwort

Prior to implementation of activities in freshwater swamps and marshes in Pierce County, site-specific conservation measures will be developed during individual project design and will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to marsh sandwort are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" the marsh sandwort. Project specific concurrence will be deferred until the site-specific conservation measures are reviewed.

Bradshaw's Desert-parsley

Site-specific conservation measures will be developed during individual project design for activities in wet meadows and pastures in Clark County. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to Bradshaw's desert-parsley are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" Bradshaw's desert-parsley. Project specific concurrence will be deferred until the site-specific conservation measures are reviewed.

Threatened Species

Bald Eagle

No trees will be altered or removed which are known to provide nesting or night roost for bald eagles. Activities generating noise above ambient levels will be avoided when within 0.25 mile (1.0 mile for blasting and pile driving) out of line-of-sight or 0.5 mile within line-of-sight of known or suspected nesting territories, occupied roost sites, or key winter foraging areas. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" the bald eagle.

Canada Lynx

Site-specific conservation measures will be developed during individual project design for activities in lodgepole pine, cedar/hemlock and sub-alpine forest habitats at or above 3,000 feet in elevation in Cowlitz, King, Lewis, Pierce, Skagit, Skamania, Snohomish, and Whatcom Counties. Projects will be designed to avoid and minimize impacts to Canada lynx and snowshoe hare and their habitat. Conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to Canada lynx are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" Canada lynx. The project- specific concurrence will be deferred until the site-specific conservation measures are reviewed.

Gray Wolf

Activities generating noise above ambient levels will be minimized near known gray wolf dens, rendezvous sites, ungulate winter habitat, and ungulate calving, fawning, and kidding grounds. Activities will not increase trail or road densities within gray wolf habitat. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" gray wolves.

Grizzly Bear

Activities generating noise above ambient levels will be minimized near known grizzly bear den sites, early season foraging areas, and late season foraging areas. Activities will not degrade or destroy key foraging habitat within core habitat. Activities will not increase trail or road densities within core habitat. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" grizzly bears.

Marbled Murrelet

Prior to removing trees with suitable nest habitat, consult with the CTA biologist. Activities that generate noise above ambient levels within 0.25 mile (1.0 mile for blasting and pile driving) of suitable nesting habitat will not occur between April 1 and August 5. Activities that generate noise above ambient levels within 0.25 mile (1.0 mile for blasting and pile driving) of suitable nesting habitat between August 6 and September 15 will occur between 2 hours after sunrise and 2 hours before sunset. Aircraft will not be used within 0.25 mile of suitable nesting habitat between April 1 and August 5. Between August 6 and September 15, aircraft will maintain a distance of at least 250 feet from nesting habitat and will only fly near nesting habitat between 2 hours after sunrise and 2 hours before sunset. The PBA does allow for the use of CH-47 Chinook or larger helicopters. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" marbled murrelets.

Marbled Murrelet Critical Habitat

Activities within marbled murrelet designated critical habitat will not remove or kill trees with suitable platforms, remove suitable platforms, reduce the suitability of the stand as nesting habitat, inhibit the development of stands of at least one-half the site potential tree height, or reduce any buffering qualities of a stand for adjacent suitable habitat. Activities which modify stands adjacent to critical habitat will not impede development of constituent elements or reduce any buffering qualities of the stand for adjacent suitable habitat. Therefore, we concur that the program of work "may affect, but is not likely to adversely affect" marbled murrelet designated critical habitat.

Northern Spotted Owl

Activities will retain existing snags and downed logs and will not otherwise impact the suitability of spotted owl habitat. Activities in dispersal habitat will not remove 50 percent or more of standing trees measuring 11 inches diameter at breast height or remove 40 percent of the canopy, thus the habitat will continue to function for dispersal. Activities that generate noise above ambient levels within 0.25 mile (1.0 mile for explosives and pile driving) of un-surveyed or occupied nesting habitat will not occur from March 1 to July 31, unless current surveys indicate the site is not occupied by spotted owls. Therefore, we concur that the program of work "may affect, but is not likely to adversely affect" northern spotted owls.

Northern Spotted Owl Critical Habitat

Activities will not occur within northern spotted owl designated critical habitat. Adjacent activities will not adversely impact constituent elements, impede development of constituent elements, reduce any buffering qualities of the stand for adjacent suitable habitat, or result in the stand no longer being considered dispersal habitat. Therefore, we concur that the program of work "may affect, but is not likely to adversely affect" northern spotted owl designated critical habitat.

Oregon Silverspot Butterfly

Site-specific conservation measures will be developed during individual project design for activities on the Long Beach peninsula in Pacific County. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to Oregon silverspot butterfly are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" Oregon silverspot butterfly. The project specific concurrence will be deferred until the site-specific conservation measures are reviewed.

Western Snowy Plover

Activities will not occur within 0.25 mile (1.0 mile for blasting and pile driving) of known western snowy plover nesting areas from March 15 to September 30. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" western snowy plovers.

Golden Paintbrush

Site-specific conservation measures will be developed during individual project design for activities in prairies and coastal grasslands where golden paintbrush is known to occur. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to golden paintbrush are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" the golden paintbrush. The project specific concurrence will be deferred until the site-specific conservation measures are reviewed.

Water Howellia

Site-specific conservation measures will be developed during individual project design for activities in ephemeral or vernal pool wetlands ringed by primarily deciduous vegetation in Mason, Pierce, Thurston, and Clark Counties. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to water howellia are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" water howellia. The project specific concurrence will be deferred until the site-specific conservation measures are reviewed.

Nelson's Checker-mallow

Site-specific conservation measures will be developed during individual project design for activities in wetlands, stream corridors, or prairies in the Willapa Hills/Coast Range in Lewis and Cowlitz Counties. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to Nelson's checker-mallow are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" Nelson's checker-mallow. The project specific concurrence will be deferred until the site-specific conservation measures are reviewed.

Kincaid's Lupine

Site-specific conservation measures will be developed during individual project design for activities in grassland habitat near Boistfort, in Lewis County. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to Kincaid's lupine are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work "may effect, but is not likely to adversely affect" Kincaid's lupine. The project specific concurrence will be deferred until the site-specific conservation measures are reviewed.

CONFERENCE

Candidate Species

Oregon Spotted Frog

Wetlands, sluggish streams, ponds, or lakes with emergent vegetation will be inspected by trained biologists for Oregon spotted frogs prior to initiating activities. If the Oregon spotted frog or its habitat are determined to be present, site-specific conservation measures will be developed during individual project design. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to the Oregon spotted frog are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work is not likely to jeopardize the continued existence of the Oregon spotted frog.

Mardon Skipper

Site-specific conservation measures will be developed during individual project design for activities in Thurston, Pierce, Skamania, and Klickitat Counties. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to the Mardon skipper are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work is not likely to jeopardize the continued existence of the Mardon skipper.

Northern Wormwood

Site-specific conservation measures will be developed during individual project design for activities in sandy areas along the Columbia River. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to northern wormwood are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work is not likely to jeopardize the continued existence of northern wormwood.

Streaked Horned Lark

Site-specific conservation measures will be developed during individual project design for activities in the Puget Lowlands. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to the streaked horned lark are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work is not likely to jeopardize the continued existence of the streaked horned lark.

Yellow-billed Cuckoo

Site-specific conservation measures will be developed during individual project design for activities in the Puget Lowlands and lower Columbia River in riparian habitat. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to the yellow-billed cuckoo are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work is not likely to jeopardize the continued existence of the yellow-billed cuckoo.

Western Pocket Gopher

Site-specific conservation measures will be developed during individual project design for activities in prairies, open fields, and sup-alpine meadows on the Olympic Peninsula and south of Tacoma. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to the Western pocket gopher are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work is not likely to jeopardize the continued existence of the Western pocket gopher.

Whulge Checkerspot

Site-specific conservation measures will be developed during individual project design for activities in the Puget Trough, Straits of Juan de Fuca, and the San Juan Islands in maritime prairie, Straits shoreline, post-glacial gravelly outwash, and mounded prairie habitats. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to the Whulge checkerspot are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work is not likely to jeopardize the continued existence of the Whulge checkerspot.

Pacific Fisher

Site-specific conservation measures will be developed during individual project design for activities in forests of the Olympic Mountains and the northern Cascade Range. These specific conservation measures will be reviewed and approved by a qualified staff member in the CTA Division as sufficient to assure the effects to the Pacific fisher are insignificant or discountable. These conservation measures will be incorporated into the project description. Therefore, we concur that the program of work is not likely to jeopardize the continued existence of the Pacific fisher.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The PBA is intended to cover the following Service-funded programs that support habitat restoration on non-Federal lands in Washington State: Chehalis Fisheries Restoration Program, Jobs in the Woods Watershed Restoration Program, Partners for Fish and Wildlife Program, Puget Sound Coastal Program, National Fish Passage Program, National Fish Habitat Initiative/Western Native Trout Initiative, Natural Resource Damage Assessment and Restoration Program, and the Private Stewardship Grant Program. This BO only covers the portions of these programs that are managed by the Western Washington Fish and Wildlife Office and does not cover "pass-through" funding where the Service does not have an active role in project oversight and environmental compliance. All programs include a mandatory agreement with cooperators and landowners to insure that projects are maintained for a minimum of 10 years.

Length of Consultation

The PBA and associated BO will cover projects implemented between 2006 and 2013, as long as projected impacts to listed, candidate, or proposed species do not occur beyond December 2013. Projects that could have negative impacts beyond December 2013 are not included in this consultation.

Activities Not Covered Under this Programmatic Consultation

The following actions have not been included in the PBA. These types of activities require individual project review with a more detailed and thorough analysis than that provided in a Programmatic Biological Assessment Consistency Form (PBACF) format.

1. Streambank stabilization. These actions do not restore watershed processes and functions over the long term, and often limit the channel migration zone and the ability of the channel to form and maintain habitat.

2. Creation of new stream channels or restoring natural stream morphology.

3. Use of pesticides to control or remove vertebrate and invertebrate species and microorganisms (viruses, bacteria, fungi).

4. Use of herbicides to control or remove vegetation.

5. Forest thinning projects that use heavy equipment to access the site and to thin the trees, and that remove the thinned trees/vegetation from the project area.

6. Restoration activities within the boundaries of Federal land, such as a National Forest or National Park.

7. Culvert replacement or removal projects that are found to fall into the high risk category using the *Dichotomous Key to Evaluate the Potential for Stream Incision at Sites Being Considered for Culvert Replacement or Removal Projects* (PBA Appendix P).

8. Culvert replacement or removal projects or other restoration activities that may require dewatering of the stream reach in known or potential bull trout local population areas.

Restoration Activities Covered Under this Programmatic Consultation

The following assumptions have been made regarding restoration activities to be implemented consistent with the PBA:

- The identified restoration activity has been determined by the Service to be an appropriate management action at a particular location, given watershed and site conditions.
- The restoration activity will be implemented using current methods and techniques commonly used in habitat restoration work.
- The restoration activity is being implemented for the explicit purpose of restoration of either watershed processes or functions, including the provision of fish and wildlife habitat.
- Each restoration activity implemented is unique given land ownership, site specific conditions, and partner involvement; accordingly, each activity may vary slightly from the following information.
- The presence of endangered, threatened and/or proposed species, as identified on the species list generated for the project area, is assumed in the absence of site-specific surveys and information.
- The best management practices (BMP) and conservation measures of the PBA will minimize impacts to species while undertaking restoration activities.

If at any time there are uncertainties with interpreting the conditions of the PBA or with a project's compliance with the PBA, the project biologist will coordinate with CTA staff to address these concerns and determine a course of action. Any minor exceptions to the PBA agreed to by CTA staff on a project-specific basis will be noted in the PBACF. In situations where constraints or conditions in this consultation process become so restrictive as to prevent the implementation of restoration activities, the project biologist will first attempt to work informally with CTA staff to modify the project to eliminate or reduce adverse impacts. If this is not possible, the project will either be withdrawn or a separate non-programmatic consultation will be initiated. The following 15 activity types are covered by this programmatic. The best management practices listed for each activity type are described on pages 18-23.

1. <u>Install instream structures</u>

The purpose of this restoration activity is to provide instream spawning, rearing, and resting habitat for salmonids; provide high flow refugia; increase interstitial spaces for benthic organisms and juvenile salmonids; increase instream structural complexity and diversity; promote natural vegetation composition and diversity; reduce embeddedness in spawning gravels; reduce siltation in pools; reduce the width/depth ratio of the stream; mimic natural input of large woody debris in aquatic systems that have been altered by channelization and land use practices; restore historic hydrologic regimes; decrease flow velocities; and deflect flows into adjoining flood plain areas. This restoration activity is designed specifically to restore channel and habitat-forming processes in existing channels. It will not be connected to, or be part of, a bank stabilization activity or the creation of a new channel.

Instream structures will be installed that are capable of enhancing habitat-forming processes and migratory corridors within previously degraded stream reaches. These structures include the installation of engineered logjams and other cover structures designed with large woody debris and/or boulder materials. Structures will be installed only in streambed gradients of 6 percent or less. Structure placement will be limited to areas where structures are, or would be, naturally present; therefore, manmade structures as cross vanes of j-hook vanes are not covered under this programmatic consultation. This may include structure types that are designed to lower a stream's width to depth ratio while providing habitat and migratory corridors capable of connecting existing habitats and promoting a naturally functioning channel. Large woody debris structures will be designed to minimize the need for anchoring. However, dependent on site location and design criteria, some structures may be anchored. If anchored, a variety of methods may be used. These include buttressing the wood between riparian trees, cabling the structure to existing structures, and/or anchoring with boulders, concrete blocks, or new log wedges.

The large wood used for these structures will be donated, purchased, or salvaged. Whole trees, logs, and rootwads will be obtained from, but not limited to 1) local lumber mills, 2) approved silvicultural operations on Federal, State, Tribal, and private lands, and 3) roadway projects and urban development sites. Riparian timber stands will not be harvested to supply large wood to complete a restoration activity.

A limited number of appropriately sized (i.e. length and diameter) conifer trees in upland habitats (e.g., 10 conifer trees/stream or road mile) may be harvested and incorporated as key structural components in restoration activities. Harvesting of upland conifer trees will only occur in habitats where there are no impacts to federally listed species or their habitats. Large wood will be obtained during appropriate seasonal periods to minimize or eliminate soil disturbance and compaction.

Work may require the use of heavy equipment, power tools, and/or hand crew.

Other project activities may be related to enhancing the development of riparian corridors capable of sustaining water quality and recruitment of woody debris to the system. RA 8 (Plant native vegetation) and RA 9 (Promote native vegetation growth) described below will be used to describe these project activities in the riparian corridor.

BMPs 1-19, 25, 26, 31, and 32 will be applied to this restoration activity.

2. Improve secondary channel habitats

The purpose of this restoration activity is to increase the area available for rearing habitat, improve access to rearing habitat, increase hydrologic capacity of side channels, increase channel diversity and complexity, provide resting areas for fish and wildlife species at various levels of inundation, reduce flow velocities, and provide protective cover for fish and other aquatic species. This activity is specifically designed to restore channel and habitat-forming processes in existing channels and will not be connected to, or part of, a bank stabilization activity or creation of a new channel.

Channel and bank sediments will be removed in order to open access to existing secondary channel habitats or increase channel area. Instream structures capable of enhancing habitat forming processes and maintaining flow regimes through secondary channels will be installed (see Restoration Activity 1 for a description of instream structure installation and large woody debris sources). Work may entail use of heavy equipment, power tools, and/or hand crew.

BMPs 1-19, 25, 26, 31, and 32 will be applied to this restoration activity.

3. Reduce upland sediment production/delivery

The purpose of this restoration activity is to reduce sediment loading of down slope stream, riparian, and wetland habitats and to restore vegetation on high gradient slopes.

This activity is typically undertaken in areas associated with forest roads, cut banks, and steep slopes. These activities are conducted above the ordinary high water mark outside of the riparian area. Structures and/or treatments that may be used include hand terracing, log terracing, live crib wall construction, brush layering, contour wattling, fascine construction and/or grading slopes back to eliminate or reduce erosion. Natural materials such as vegetation, boulders, and woody debris will be installed to reduce erosion and prevent or reduce mass wasting. Additional materials such as riprap and fiber matting may be used in conjunction with natural materials to improve stability. Treatment areas will be planted with native trees and shrubs or seeded with native species. Work may entail use of heavy equipment, power tools, and/or hand crew.

BMPs 1-19 will be applied to this restoration activity.

4. Restore wetland hydrology

The purpose of this restoration activity is to re-establish hydrologic regimes and wetland processes which have been disrupted by human activities. These include, water depth, seasonal fluctuations, flooding periodicity, connectivity, fish and wildlife habitat, flood water attenuation, nutrient and sediment storage, native plant community support, and pollutant removal.

Restoration of wetland hydrology may include the excavation and removal of fill materials, development of berms or impoundments, with or without the installation of water control structures, reintroduction of beavers in areas where they have been removed, plugging and/or removing drain tiles in agricultural fields, excavating depressional areas and ponds, removal of tide gates, dike breaching, and de-leveling areas that have been leveled. Wetland creation typically involves excavation and/or berm construction to create a geomorphic depression in conjunction with a water source. Hydric soils may be salvaged to provide an appropriate substrate and/or seed source for hydrophytic plant community development. Hydric soils will only be obtained from wetland salvage sites. Work may entail use of heavy equipment, power tools, and/or hand crew.

BMPs 1-19 and 32 will be applied to this restoration activity.

5. Install/develop wildlife structures

The purpose of this restoration activity is to enhance terrestrial habitats until native plant communities or other natural habitat features become established, and to augment, not replace, natural habitat features and processes.

This activity involves the installation or development of a variety of structures that mimic natural features and provide support for wildlife foraging, breeding, and resting or refuge. These can include bat roosting/breeding structures, avian nest boxes, snags, brush/cover piles, coarse woody debris, and raptor perches. Work may occur in riparian and upland habitats.

If work occurs in riparian areas, activities will not occur immediately adjacent to the stream channel or streambank, leaving a vegetated buffer along the stream channel to eliminate any impacts to the channel. Activities will be designed to minimize ground and vegetation disturbance. In riparian areas, only deciduous trees would be used for snag or habitat creation. For coarse woody debris, existing downed deciduous or coniferous wood may be manipulated if there is an excess of supply, such as a debris flow, or wood would be imported from a non-riparian source. See RA 1 (Install instream structures) for restrictions on source areas for wood. Work may entail use of power tools and/or hand crew.

BMPs 1-20 will be applied to this restoration activity.

6. Reduce livestock impacts

The purpose of this restoration activity is to eliminate or reduce livestock degradation of streams, streambanks, unstable upland slopes, and riparian/wetland vegetation; reduce soil compaction and erosion; reduce fecal input to streams and wetlands; and improve riparian habitat function. Livestock exclusion fences and cross pasture fences will be installed. Installation may involve the removal of native or non-native vegetation along the proposed fence line. Livestock stream crossings may be installed to allow access to pastures. Crossings may consist of a bridge, culvert, or hardened stream section. Hardened stream crossings may involve the placement of angular rock along the stream bottom. Work may entail use of heavy equipment, power tools, and/or hand crew.

BMPs 1-19, and 21 will be applied to this restoration activity.

7. Improve road/trail conditions

The purpose of this restoration activity is to eliminate secondary impacts from roads and trails and include 1) erosion and mass-wasting hazards and the resultant sedimentation of aquatic habitats, particularly in sensitive areas such as riparian habitats or geologically unstable zones, and 2) human caused impacts, such as timber theft, wildlife disturbance and poaching, and illegal dumping. This restoration activity can include road and trail maintenance, decommissioning, storm-proofing, obliteration, or relocation and could occur in upland and riparian habitats. Work may entail use of heavy equipment, power tools and/or hand tools.

This restoration activity can include road and trail maintenance, decommissioning, stormproofing, obliteration, or relocation, and could occur in upland and riparian habitats. Work may entail use of heavy equipment, power tools, and/or hand crew.

Road and trail maintenance: Road or trail maintenance is performed to reduce erosion and sedimentation and other problems associated with active road or trails, and to maintain the road or trail in a condition that supports use with reduced impacts on the surrounding environment. Activities may include cleaning culverts to prevent plugging, grading the road to address damage from concentrated water and sediment runoff, outsloping the road surface in order to re-route road-related runoff to stable areas, cleaning inboard ditches to reduce erosion and sedimentation, clearing downed trees, replacing old or undersized culverts, correcting stream diversion potentials, and installing proper-sized culverts.

Road and trail decommissioning/stormproofing: Road and trail decommissioning or stormproofing are performed to minimize short-term sediment production and restore the road or trail for potential future reconstruction and use. The original construction investment is retained, and road-caused erosion is addressed in the interim. Road maintenance and repair costs could likely be reduced while the road is not in use. Activities may include creating barriers to access such as gates, fences, boulders, logs, tank traps, vegetative buffers and signs; removing culvert or bridge stream crossings and cross drain culverts; restoring sites where stream diversion is a potential occurrence; removing or stabilizing sidecast or unstable fill by pulling back sidecast or fill and placing it in a more stable location; re-routing road drainage to a more stable area; filling inboard ditches; outsloping the road surface; and installing cross drains or waterbars. This activity could include vegetation removal along the road cutbanks, sidecast areas, or stream or cross drain removal locations. Vegetation will be retained as much as possible with the joint goal of removing as much unstable sidecast and road fill as possible. Any vegetation removed will be retained on site as coarse woody debris.

Road and trail obliteration: Road or trail obliteration is performed to remove the road or trail with no plans for reconstruction. Road obliteration restores original landforms to the greatest extent possible. Activities may include removal and re-contouring of culvert or bridge stream crossings and cross drain culverts; removal of sidecast and road fill or sidecast pull back to match the surrounding landscape as much as possible and create a stable slope formation; re-contouring of cutbanks and road side slopes using road fill or sidecast material to match the surrounding landscape as much as possible; ripping remaining road and fill sites; placing large woody debris for erosion protection, nutrient sources and wildlife habitat; and planting disturbed areas with native species. Specific activities will be dependent upon the project site. This activity could include vegetation removal along the road cutbanks, sidecast areas, or stream or cross drain removal locations. Vegetation will be retained as much as possible with the joint goal of removing as much unstable sidecast and road fill as possible. Any vegetation removed will be retained on site as coarse woody debris.

Road relocation: Road relocation entails relocating a road to a less hydrologically and geologically sensitive area. The road to be relocated would either be decommissioned, stormproofed, or obliterated, according to the guidelines provided above.

BMPs 1-19, 22-24, 31, 32, 36, and 37 will be applied to this restoration activity.

8. <u>Plant native vegetation</u>

The purpose of this restoration activity is to provide feeding, breeding, and sheltering habitat for native wildlife; control or eliminate non-native, invasive plant species that compete with or displace native plant communities, in order to maximize habitat processes and functions associated with native vegetation diversity, form, outputs, structure, and composition; establish new or augment existing populations of listed plants as part of implementing tasks identified in a recovery plan; and recover watershed processes and functions associated with native plant communities, such as thermal and microclimate regulation, hydrologic and nutrient cycling, channel formation and sediment storage, soil development and stability, flood energy dissipation, and filtering.

Planting sites will be prepared by cutting, digging, grubbing roots, scalping sod, decompacting soil, and removing existing vegetation, as needed. Soil at the site will be mowed, disced, or leveled. Woody debris, wood chips, compost, mulch, or soil will be placed at select locations to alter microsites. Plant specimens or seeds will be planted in prepared planting sites. Plants/seeds will be fertilized, mulched, stems wrapped to protect from rodent girdling, buds capped to protect from herbivory, and transplanted from nearby, established plant sources. Competing herbaceous or small woody vegetation will be cut or removed during routine maintenance work. Work may entail use of heavy equipment, power tools, and/or hand crew.

Planting sites will be monitored for survival and success by trained and qualified personnel post-project for the period of the cooperative agreement (3-5 years). Service biologists will work with project cooperators to attempt to achieve survival of 80 percent of the target number of plantings for the site, within 3 years after planting. If the 80 percent survival is not met within 3 years, Service biologists will continue to work with project cooperators to improve plant survival to the greatest extent feasible until the expiration date of the cooperative agreement.

BMPs 1-19 will be applied to this restoration activity.

9. Promote native vegetation growth

The purpose is this restoration activity is to alter plant communities to recover or maintain select native plant communities; control or eliminate non-native, invasive plant species that compete with or displace native plant communities, in order to maximize habitat processes and functions associated with native vegetation diversity, form, outputs, structure, and composition; increase the abundance, growth, size, diversity, and distribution of native trees and shrubs, particularly in riparian areas, to enhance future recruitment of large woody debris to the stream channel to improve instream habitats and channel forming processes; establish new or augment existing populations of listed plants as part of implementing tasks identified in a recovery plan; increase the size and amount of coarse woody debris in riparian areas; increase the growth, size, and age-class distribution of forest stands to improve stand health, promote biodiversity, and enhance wildlife habitat; and recover watershed processes and functions associated with native plant communities, such as thermal and microclimate regulation, hydrologic and nutrient cycling, channel formation and sediment storage, soil development and stability, flood energy dissipation, and filtering.

This activity can occur in upland and riparian areas. Mechanical, physical, or burn techniques may be applied. Undesirable vegetation may be cut, thinned, brushed, hayed, dug, mulched, or shaded/covered. Individual plants or clumps of undesirable vegetation will be pulled.

Prescribed burning will be set and controlled. Grazing will be timed and limited. Soil composition will be altered by the addition of amendments or removal of organics.

Forest thinning will occur in overstocked areas or conifer release areas, as prescribed in a management plan for the site. Trees will be thinned manually, by cutting or girdling using chainsaws. Felled whole trees will be left onsite for nutrient cycling, cover, and to reduce elk/deer browse on seedlings. Limbs will be manually pruned to attain attributes of growth, structure, or form. RA 8 (Plant native vegetation) will be followed if planting of native species will occur on the project site. Work may entail use of power tools and/or hand crew.

BMPs 1-19, 25-27, and 35 will be applied to this restoration activity.

10. Remove/setback hydraulic constrictions

The purpose of this restoration activity is to eliminate or reduce adverse effects of artificial structures which impede or prevent full hydraulic capacity of a watercourse and to provide for increased hydraulic capacity, dissipation of hydraulic energy, release of stored bedload, re-establishment of pre-disturbance hydrology, and improved riparian and channel complexity.

Reducing or eliminating hydraulic constrictions involves activities such as levee setbacks, dike or impoundment removal, and removal or replacement of tidegates. Heavy equipment is typically used to break up, excavate, and remove material that forms the artificial structure. Following removal, the area may be recontoured to pre-disturbance conditions. Work may entail use of heavy equipment, power tools, and/or hand crew. Explosives may be used in some situations where equipment access, haul routes, or spoil disposal areas are limited; explosives will not be used in water.

BMPs 1-19 and 32 will be applied to this restoration activity.

11. Remove/replace structural barriers

The purpose of this restoration activity is to improve fish passage, prevent streambank and roadbed erosion, facilitate natural sediment and wood movement, eliminate or reduce excess sediment loading, and eliminate or reduce dynamic changes in stream flow patterns through culverts that cause streambank erosion, undermining of roadbeds, and the washout of culverts.

Culverts will be removed, where possible, and the natural channel cross section will be re-established. Stream crossings determined to be inappropriate for culvert installations will be redesigned for steel, wood, or concrete reinforced bridge installations. Bridge footings will not be placed within the boundaries of the bankfull channel width. Riprap may be used around bridge footings for protection during flooding events. Grade control structures made of either rock or wood may be placed within the channel to ensure fish passage until the channel stabilizes.

Culverts that present a barrier to upstream or downstream fish movement due to excessive velocity, slope, lack of substrate, or outfall drop (as determined by the Washington Department of Fish and Wildlife's (WDFW) Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual, August 2000; or similar assessment manual) will be replaced with appropriately sized culverts. Replacement culverts will be set below the natural streambed elevation (i.e., partially buried). Misaligned culverts will be excavated and realigned. Where replacement or lowering is not feasible, and the culvert dimensions otherwise meet WDFW design criteria, culverts may be modified by installing baffles to redirect or reduce flow velocities, step-and-pool weirs at culvert outlets, or erosion protection structures at culvert outlets or inlets. Guidelines provided (WDFWs Design of Road Culverts for Fish Passage, 2003) will be used. Specifically, the No-slope and Stream Simulation design options may be used; the Hydraulic design option will not be used. Grade control will be placed when necessary to ensure fish passage through the project structure. Grade control may consist of rock or wood, and be placed upstream, downstream, or within the project structure. Culvert replacement projects may result in the placement of additional riprap. This additional riprap may occur primarily along the side and above the culvert opening. It will not affect hydrology or the streambank condition upstream or downstream of the culvert.

This restoration activity allows for minimal road widening to occur in order to address safety concerns, or for accommodating longer culvert length. This activity does not allow for road widening to the extent that a retrofit of stormwater management facilities is needed, nor does it allow for additional new lanes of traffic.

Prior to project implementation, the risk of channel incision/headcutting following culvert removal or replacement will be evaluated using the *Dichotomous Key to Evaluate the Potential for Stream Incision at Sites Being Considered for Culvert Replacement or Removal Projects* (PBA Appendix P). If the project is determined to be a high risk project, it will not be covered by this programmatic consultation.

In the event that the project 1) does not meet the duration, velocity, flow, depth, and elevation drop standards to allow passage of the target fish species and life history stage, or 2) results in unacceptable incision and headcuts, the permittee is required to implement corrective actions necessary to allow passage of the target fish species and correct or stop the incision process.

Work may entail use of heavy equipment, power tools, and/or hand crew. When heavy equipment is required, the applicant will use equipment having the least impact necessary to accomplish the authorized work (e.g., low ground pressure, minimally sized, rubber tires). Explosives may be used in some instances to remove diversion structures where equipment access is limited; however, explosives will not be used in water.

A Pollution and Erosion Control Plan will be developed for each authorized project to prevent point-source pollution related to construction operations. Temporary erosion controls (e.g., straw bales, silt fences) will be appropriately installed downslope of project activities within the riparian area. Effective erosion control measures will be in place at all times during the project, and will remain and be maintained until such time that permanent erosion control measures are effective.

All disturbed areas will be re-planted with native vegetation within 3 days of the end of construction, unless covered or otherwise stabilized with appropriate erosion and sediment control measures. Planting shall be completed no later than April 15 of the year following construction. If invert protecting riprap has been placed, native materials will be placed over the top of the riprap and re-vegetated.

Monitoring will be conducted to ensure that culverts are functioning appropriately and fish passage is occurring. This activity will fall under RA 12 (Collect information/monitor) described below. Additional monitoring of RA 11 activities is addressed at the end of this section. BMPs 1-19, 22, 23, 28, 32, and 33 will be applied to this restoration activity.

12. <u>Collect information/monitor</u>

The purpose of this restoration activity is to collect information about existing on-ground conditions relative to habitat type, condition, and impairment; species presence, abundance, and habitat use; and conservation, protection, and restoration opportunities or effects.

Physical measurements will be recorded through visual estimates or with survey instruments. Rebar or other markers along transects or reference points will be installed manually. Piezometers and staff gauges to assess hydrology will be installed manually. Physical features associated with structures on watercourses (such as culverts, bridges, gauges, and dams) will be located and measured. Fish presence, redds, or carcasses will be visually located and recorded. Plant presence, frequency, and condition will be visually located, identified, and recorded. Roads will be inventoried for general condition, needed work, and sediment sources. Work may entail use of trucks, boats, survey equipment, hand tools, and hand crews.

BMPs 1-19 will be applied to this restoration activity.

13. <u>Install/modify fish passage structures</u>

The purpose of this restoration activity is to provide fish passage beyond artificial barriers (such as dams and spillways) when removal of those artificial barriers is not feasible. The intent of this activity is to address small stream blockages that occur at small diversion dams, stock watering reservoirs, and otherwise legally maintained structures on smaller stream systems. This restoration activity is not intended to include large scale, mainstem, hydroelectric or flood control dams or other large scale projects, or to provide passage beyond natural barriers.

Fish ladders or similar devices will be constructed with baffles or a series of stepped pools in order to slow water velocities and provide adequate water depths which enable fish passage. Depending on site conditions, work may deepen plunge pools, install debris deflectors, maintain attracting entrance flows, and divert fish into appropriate passage structures. Work may entail use of heavy equipment, power tools, and/or hand crews.

Monitoring will be conducted to ensure that fish passage is occurring. This activity will fall under RA 12 (Collect information/monitor) described above. Additional monitoring of RA 13 activities is addressed at the end of this section.

BMPs 1-19, 28, 32, and 34 will be applied to this restoration activity.

14. Install signs

The purpose of this restoration activity is to display project-related information; encourage fish, wildlife, and habitat protection; and to notify, educate, or warn the public.

Signs of varying sizes will be nailed either to trees, posts, or fences, or erected on concrete-reinforced posts or metal supports. Hole digging and brushing of vegetation may be required. Work may entail the use of power tools and/or hand crews.

BMPs 1-19 will be applied to this restoration activity.

15. Deploy salmon carcasses

The purpose of this restoration activity is to increase biomass to food webs and nutrient cycling processes; supply immediate nutrient enrichment to stream and riparian habitats; enhance feeding opportunities for wildlife, juvenile salmon, and aquatic invertebrates; and enhance riparian vegetation nutrient uptake by adding organic matter.

Salmon carcasses or carcass analogs will be obtained from nonstream sources, generally hatcheries, to distribute instream systems that have below-historic numbers of salmon carcasses. Distribution of carcasses will follow protocols established by WDFW (the WDFW protocol and guidelines document describes the application of fertilizer; however, this activity is not covered by the PBA). Distribution of carcasses will occur within the current anadromous zone of a watershed or within areas historically accessible to anadromous fish. Carcasses may be frozen for storage, with some thawed prior to deployment, so that a mixture of frozen and thawed carcasses are deployed. Carcasses will be trucked to distribution points and smaller batches will be carried out for deployment. Carcasses will be deployed randomly throughout riparian and stream areas by placing individual or several carcasses on the ground, in the water, or wedging into accumulated wood. Work may entail the use of trucks and hand crews.

BMPs 1-19, 29, 30, and 38-42 will be applied to this restoration activity.

Best Management Practices

1. All regulatory permits and official project authorizations (e.g., National Environmental Policy, National Historic Preservation Act, Level I Contaminants Survey, WDFWs Hydraulic Project Approvals, and permits from the Army Corps of Engineers) must be secured before project implementation. All terms and conditions in these regulatory permits and other official project authorizations must be followed to eliminate or reduce adverse impacts to any endangered, threatened, or sensitive species or their critical habitats.

2. Modifications to an approved workplan must be reviewed and approved by the project biologist and the cooperators and/or landowner(s) before the work can be carried out or

continued. This includes changes requiring modifications of permits or alterations to the scope, design, or intent of the project.

3. Use existing roadways or travel paths for access to project sites. No new roads or other temporary access roads will be built for access to project sites. If a new road needs to be built for access to a project site, that activity would not be covered under this PBA, and a separate section 7 consultation would need to be completed. See RA 7 (Improve Road/Trail Conditions) and BMPs 36 and 37 for guidance on relocated or replacement roads.

4. Avoid the use of heavy equipment and techniques that will result in excessive soil disturbances or compaction of soils, especially on steep or unstable slopes.

5. Use of heavy equipment in or adjacent to streambeds and streambanks, and ingress/egress points must be minimized to reduce sedimentation rates, channel instability, and aquatic habitat impacts. Vehicles and machinery must cross streams at right angles to the main channel whenever possible. Heavy equipment will be cleaned (e.g., power washed, steamed) prior to use below the ordinary high water mark. Machinery will be inspected for leaks of hydraulic fluid or fuel after cleaning and prior to entering sensitive areas.

6. Excavation or transport equipment/machinery will be limited in capacity, but sufficiently sized to complete required restoration activities.

7. Streams, riparian zones, and wetlands must not be used as equipment staging or refueling areas. Equipment must be stored, serviced, and fueled in a contained area that is at least 150 feet away from aquatic habitats or other sensitive areas. Prior to project construction, critical riparian vegetation areas, wetlands, and other sensitive sites will be flagged to prevent ground disturbance.

8. In the riparian area, entry and disturbance by equipment will be minimized. If the activity will remove vegetation from an area greater than 50 linear feet within an area that may impact channel shade or temperature, the project biologist will contact CTA staff to jointly determine how the project will avoid likely significant impacts to channel shade or temperature in areas critical to bull trout migration, spawning, or rearing and provide documentation of the agreement in the PBACF. Cable systems will be used, where appropriate, to eliminate or reduce the need for ground-based equipment.

9. Native vegetation will be planted on disturbed sites (including project site, disposal and staging areas, and access roads) within 3 days of the end of construction, given appropriate planting seasons, or will be covered or otherwise stabilized with appropriate erosion and sediment control measures. Planting shall be completed no later than April 15 of the year following construction. Vegetative planting techniques must not cause major disturbances to soils and slopes.

10. Boulder, rock, and large woody debris materials used for restoration projects must not be removed from any streams.

11. All construction activities shall comply with water quality standards (RCW 940.48 and WAC 173-201A) set forth by the Washington Department of Ecology. If the Service or our project partners anticipate that water quality standards will be exceeded, then we, or our project partners, shall seek a Temporary Water Quality Modification Permit from the Washington Department of Ecology. A Pollution and Erosion Control Plan will be developed for each authorized project to prevent point-source pollution related to construction operations. Sedimentation and erosion controls (e.g., straw bales, silt fences) will be implemented on all project sites where restoration activities are implemented, materials or equipment is staged or stockpiled, or fill is placed, to minimize the release of fines into the aquatic environment. Effective erosion control measures will be in place at all times during the project, and will remain and be monitored and maintained until such time that permanent erosion control measures are effective.

12. Excavated materials removed during the completion of a restoration activity must be salvaged and/or disposed of properly and/or stabilized to eliminate future environmental problems.

13. All garbage from work crews must be removed from the project site daily and disposed of properly. All waste from project activities must be removed from the project site before project completion and disposed of properly.

14. Structures containing concrete must be cured or dried before they are placed in streams, riparian zones, or wetlands. Creosote-treated wood, or other forms of treated wood will not be used. Wet concrete or runoff from cleaning tools that have wet concrete slurry or lye dust must never enter aquatic habitats. Runoff control measures must be employed, such as hay bales and silt fences, until the risk of aquatic contamination has ended.

15. Inspection will be performed within 1 year following project completion to ensure that restoration activities implemented at individual project sites do not create unintended consequences to fish, wildlife, plant species, and their critical habitats. Corrective actions, as appropriate, must be taken for potential or actual problems.

16. Soil and/or slope disturbances along stream channels should be eliminated or reduced wherever possible. Undisturbed vegetated buffer zones will be retained along stream channels to the greatest extent possible to reduce sedimentation rates, channel instability, and impacts to aquatic habitat.

17. Till unvegetated compacted road surfaces to promote vegetation establishment and growth. Drainage improvements should be constructed and stabilized before the rainy season. Do not sidecast excavated road materials; and avoid accumulating or spreading these materials in upland draws, depressions, intermittent streams, and springs. Efforts will be made to restore the original hydrology of the site.

18. Fill material used on project sites must not be from streambed and wetland sources and must be free of a large amount of fines.

19. Entry into the stream channel will be minimized to the greatest extent possible during project design, collection of information, implementation, or pre- or post-project monitoring. Project implementers, contractors, stream surveyors and others will stay out of the stream channel as much as possible. If a stream crossing for vehicle or livestock access is included in the project design, EAR project biologists or other local agency biologists will conduct a survey and create a map of potential spawning habitat at the stream crossing. If and when entry into the channel is necessary, spawning areas will not be disturbed.

20. Prior to implementing an activity developed specifically for species of concern, CTA or Species Lead staff will be consulted, and documentation of consultation will be noted on the Appendix G PBACF.

21. Livestock crossings will be located to minimize compaction and/or damage to sensitive soils, slopes, vegetation, or fish spawning habitat due to congregating livestock. Livestock fords across streams will be appropriately rocked to stabilize soils/slopes and prevent erosion. Fords should be placed on bedrock or stable substrates whenever possible. Prior to developing crossings, a survey for redds will be completed to avoid impacts to known spawning reaches.

22. Do not backfill culverts or bridge abutments with vegetation, debris, or mud. Abutments should be properly protected (e.g., rock armored) to prevent future scouring actions and erosion hazards.

23. Develop, submit to the Service, and implement maintenance schedules for culvert installations to ensure they remain in proper functioning condition. Information on maintenance checks, maintenance conducted, and culvert performance will be included in the required project reporting.

24. Remove all fill-associated wood during sidecast removal.

25. Tree thinning will be designed so there will be no reduction of shade along any nearby watercourse.

26. Thinning or single tree removal will be restricted to areas above the slope break on steep slopes and highly erodible soils to prevent accelerated soil erosion and increased sedimentation rates.

27. Prescribed burning will be planned and managed to maximize the benefits and reduce the detrimental effects of burns. Fire suppression equipment will be located at the project site during prescribed burnings. If the need to use chemical suppression arises, an emergency consultation will be conducted.

28. Projects will be designed to meet WDFWs *Design of Road Culverts for Fish Passage* (WDFW 2003) for salmon and trout at a minimum, and will be maintained for optimal operation. Fishways will be designed to minimize the potential for structural failure or the potential for the creation of unstable substrate.

29. WDFWs *Protocols and Guidelines for Distributing Salmonid Carcasses to Enhance Stream Productivity (2004)* in Washington State will be followed. The WDFW protocol and guidelines document describes the application of fertilizer; however, this activity is not covered by the PBA.

30. Salmon carcass deployment will not be conducted in areas where documented grizzly bear sightings have occurred within the last 4 weeks.

31. If the length of the project site is greater than or equal to 0.5 mile, the project biologist will contact CTA staff to jointly determine if the project complies and is consistent with the intent of the programmatic consultation, and provide documentation of the agreement in the PBACF.

32. Dependent upon the project site and implementation conditions, this activity may require fish capture and removal from the project area and channel dewatering. If fish capture, removal, and channel dewatering is required, dewatering and fish capture protocols (Appendix A) will be followed. If electrofishing is used as a tool to remove fish, PBA Appendix N. Backpack Electrofishing Guidelines will be followed. However, if this activity will occur in a known or potential bull trout local population area, it is outside the scope of this consultation.

33. For projects that occur in streams with gradients of greater than 4 percent and will replace a culvert that blocks fish passage with a structure that provides fish passage, project biologists will provide a justification regarding the choice of structure and a description of the structure selected in the PBACF.

34. If there is any question as to the applicability of RA 13s (Install signs) purpose and description to a project site, the project biologist will consult with CTA staff to determine if the project complies and is consistent with the intent of this programmatic consultation, and document the agreement in the PBACF.

35. Thinning/felling trees or single tree removal will be done manually. Felled trees will be left onsite. No temporary roads, skid trails, or other points of access will be built as a part of this activity. If this BMP cannot be met, the project requires separate section 7 consultation.

36. Replacement roads under the road relocation description will only be built in locations where there are no negative impacts to federally listed species or their habitats.

37. Replacement roads under the road relocation description will not add additional road miles to the watershed. If additional road miles are needed, the project requires a separate section 7 consultation. Replacement roads will be constructed to maintain natural drainage pathways as much as feasible.

38. If the source population for carcasses is not sampled according to established procedure as documented in the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State, Formally adopted on March 17, 1998*, the carcasses can only be distributed within the drainage of origin.

39. To transfer carcasses out of the drainage of origin, the following must occur and be documented: 1) every population must be sampled according to established procedure (minimum of 60 fish) as documented in the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State, Formally adopted on March 17, 1998,* and 2) populations must be sampled for viruses *Yersinia ruckeri* (Enteric redmouth), *Aeromonas salmonicida* (Furunculosis), *Renibacterium salmoninarum* (Bacterial kidney disease), and *myxobolus cerebralis* (Whirling disease).

40. There will not be any transfer of carcasses into drainages where viruses, *Myxobolus cerebralis,* or drug resistant bacteria are not known to occur (no introduction of viruses). Fish health experts at the WDFW and the Service will be consulted to determine disease status of drainages.

41. If live salmon identified for carcass deployment are treated with drugs while in the hatchery, all drugs must be used per labeled directions or other permits as issued by the Food and Drug Administration, including directions regarding the withdrawal times for the drugs. Mortalities which occur prior to the end of the withdrawal time will not be used for carcass deployment.

42. There will not be any transfer of salmon carcasses that are resistant to antibiotics used to treat diseases.

Conservation Measures

The following conservation measures will be implemented for all projects in order to reduce impacts to bull trout. Conservation measures BT1 and BT3 supersede conservation measure F1 with regard to in-water work periods. Conservation measure BT2 supersedes conservation measure F1 with regards to fish passage projects.

F1. When the restoration activity requires a Hydraulic Project Approval permit, this permit will be secured and conditions will be followed. Any ambiguities related to permit conditions will be cleared up prior to construction.

BT1. In bull trout local population areas (spawning and early rearing areas), in-water work will only occur during the watershed-specific timing windows identified in WDFW's Gold and Fish Pamphlet (WDFW 1999) or more up-to-date, Service-approved information. For information on local population areas, refer to the "Key Habitat for Bull Trout Recovery" maps in the Draft Recovery Plan for the Coastal-Puget Sound bull trout Interim Recovery Unit (IRU)(USFWS 2004a,b). This conservation measure supersedes conservation measure F1 when conducting in-water restoration activities in bull trout local population areas.

BT2. Fish passage structures will not be installed and barriers will not be removed in locations where there are concerns for impacts to bull trout populations from exotic or non-native species. This conservation measure supersedes conservation measure F1 when conducting fish passage activities.

BT3. In-water work will only occur during the timing windows identified in Appendix B, when the in-water restoration activity occurs in the following water bodies: the Duwamish Waterway, Lake Union and the Ship Canal, Lake Washington, Sammamish Basin, Columbia River Mainstem, or in marine nearshore and estuarine areas. This conservation measure supersedes conservation measure F1 when conducting in-water restoration activities in the above mentioned areas.

Review Process

A PBACF will be completed by the implementing biologist for each project. A project may consist of multiple restoration activities. The PBACF will be completed in coordination with CTA and Division of Listing and Recovery staff when necessary, as indicated in Table 1.3 and accompanying narrative in the "Guidelines for Use" section of the PBA. All proposed restoration activities will be consistent with the PBA and BO. Restoration activities that "may affect" a listed, proposed, or candidate species will be reviewed and approved by a CTA staff member prior to implementation. Predicted incidental take associated with activities that "may affect, and are likely to adversely affect" bull trout will be recorded on the PBACF. The monitoring required for each activity will clarify the actual extent of incidental take. Predicted and actual incidental take will be tracked to ensure compliance with the PBA and BO.

Monitoring

The PBA acknowledges the importance and need for monitoring restoration activities in order to evaluate effects to riparian and aquatic environments, and to ensure the activities are achieving the desired result. Therefore, monitoring of planting, sediment, channel incision, and fish passage will be implemented. The monitoring scheme relevant to RA 8 (Plant Native Vegetation) is included in the restoration activity description above. The following descriptions are provided for monitoring of sediment, channel incision, and fish passage.

Sediment

RA 1 (Install Instream Structures), RA 2 (Improve Secondary Channel Habitats), RA 4 (Restore Wetland Hydrology), RA 6 (Reduce Livestock Impacts), RA 7 (Improve Road/Trail Conditions), RA 10 (Remove/Setback Hydraulic Constrictions), RA 11 (Remove/Replace Structural Barriers), and RA 13 (Install/Modify Fish Passage Structures) have the potential to impact water quality due to increased turbidity. Monitoring will be conducted across the range of the Coastal-Puget Sound bull trout IRU to evaluate the impacts from turbidity and sedimentation. The goals of the turbidity monitoring are to 1) test the assumptions regarding the duration and extent of the downstream turbidity plume, and 2) improve understanding of the short-term impacts from project construction. The concentration, duration, and extent of the turbidity plume associated with restoration activities will be monitored. Pre-project baseline monitoring, monitoring during project construction, and where possible, monitoring during the first post-construction high flow event will occur.

A minimum of three projects over the 8-year time-frame of this programmatic consultation will be monitored. Project selection will occur on a yearly basis and will be dependent upon restoration activity types selected for funding and the feasibility of conducting the monitoring. Based upon the likely extent and duration of projects, RA 1 (Install Instream Structures), RA 2 (Improve Secondary Channel Habitats), RA 7 (Improve Road/Trail Conditions), RA 10 (Remove/Setback Hydraulic Constrictions), RA 11 (Remove/Replace Structural Barriers), and RA 13 (Install/Modify Fish Passage Structures) will be the activity types assessed for monitoring.

The Service's division of Environmental Assessment and the Division of Consultation and Technical Assistance will work together to develop the monitoring strategy. A monitoring strategy has been developed (see PBA Appendix S) that outlines the protocols to be used, including the intensity of the monitoring effort, the methods to be used, and the required duration. Monitoring and reporting results will be maintained by the Service. Implementation will begin in 2007.

Fish Passage and Channel Incision

Monitoring of RA 11 (Remove/Replace Structural Barriers) and RA 13 (Install/Modify Fish Passage Structures) will be conducted to ensure that fish passage is occurring. Monitoring will include the observation of anadromy of target species above the culvert or gathering of data showing that flows meet WDFW criteria for adults and juveniles of the target species. The Service will conduct an immediate post-project evaluation of the culvert and provide documentation that the culvert is functioning appropriately. In addition, after project construction, Service project biologists or local biologists will check the culvert during salmon migration time periods to verify that the structure is providing passage for the target fish species or will collect data to ensure flows meet WDFW criteria for adults and juveniles of the target species during the 5-year time period of the cooperative agreement for the project. Passage information will be provided in a final project report to the Service.

In the event that the project 1) does not meet the duration, velocity, flow, depth, and elevation drop standards to allow passage of the target fish species and life history stage, or 2) results in unacceptable incision and headcuts, the permittee shall implement corrective actions necessary to allow fish passage of the target species at the project site, and correct or stop the incision process.

Any channel incision occurring due to the project will be investigated. Investigation will document the depth and longitudinal extent of the incision, and document upstream and downstream impacts to aquatic and riparian habitat and to fish passage. Information from these investigations will be used to re-evaluate and amend the *Dichotomous Key to Evaluate the Potential for Stream Incision at Sites Being Considered for Culvert Replacement or Removal Projects* (PBA Appendix P) to improve its predictive accuracy.

Table 1. Coastal-Puget Sound Bull Trout distinct population segment foraging, migration, and overwintering (FMO) areas, core areas, and local populations within the area covered by the PBA and the maximum number of restoration projects likely to adversely affect bull trout.

Management or Recovery Unit	FMO Area	Core Area	Local Population Area(s)	Maximum number of restoration projects that are likely to adversely affect bull trout
Olympic Peninsula	Hood Canal and independent tributaries up to the National Forest boundary			
	Strait of Juan de Fuca and independent tributaries up to the National Park boundary			
	Pacific Ocean and independent coastal tributaries (areas of National Park are not included)			
	Lower Chehalis River/Grays Harbor and independent tributaries			
		Skokomish River, including North and South Forks from the mouth up to the National Forest or National Park boundaries	None with the area covered by the PBA	4 No more than 2 in any 1 year
		Dungeness River up to the National Forest boundary	Middle Dungeness River and tributaries up to river mile 24 and including Silver, Gold, and Canyon Creeks (adverse effects are not anticipated to occur in these local population areas)	6 No more than 3 in any 1 year

Management or Recovery Unit	FMO Area	Core Area	Local Population Area(s)	Maximum number of restoration projects that are likely to adversely affect bull trout
Olympic Peninsula cont.		Elwha River up to the National Forest or National Park boundary	Little River (potential local population) (adverse effects are not anticipated to occur in this potential local population area)	2 No more than 1 in any 1 year
		Hoh River up to the National Forest or National Park boundaries	South Fork Hoh River and tributaries (adverse effects are not anticipated to occur in this local population area)	2 No more than 1 in any 1 year
		Queets River up to the National Park boundary	None within the area covered by the PBA	2 No more than 1 in any 1 year
		Quinault River up to the National Forest or National Park boundary	None within the area covered by the PBA	10 No more than 5 in any 1 year
Puget Sound	Samish River			
	Lake Washington including the following: Lower Cedar River: Sammamish River; Lakes Washington, Sammamish and Union; and Ship Canal			
	Lower Green River			
	Lower Nisqually River			
	Marine Areas of Puget Sound			
		Chilliwack River up to the National Forest boundary	None within the area covered by the PBA	2 No more than 1 in any 1 year

Table 1. Coastal-Puget Sound Bull Trout distinct population segment foraging, migration, and overwintering (FMO) areas, core areas, and local populations within the area covered by the PBA and the maximum number of restoration projects likely to adversely affect bull trout.

Management or Recovery Unit	FMO Area	Core Area	Local Population Area(s)	Maximum number of restoration projects that are likely to adversely affect bull trout
Olympic Peninsula	Hood Canal and independent tributaries up to the National Forest boundary			
	Strait of Juan de Fuca and independent tributaries up to the National Park boundary			
	Pacific Ocean and independent coastal tributaries (areas of National Park are not included)			
	Lower Chehalis River/Grays Harbor and independent tributaries			
		Skokomish River, including North and South Forks from the mouth up to the National Forest or National Park boundaries	None with the area covered by the PBA	4 No more than 2 in any 1 year
		Dungeness River up to the National Forest boundary	Middle Dungeness River and tributaries up to river mile 24 and including Silver, Gold, and Canyon Creeks (adverse effects are not anticipated to occur in these local population areas)	6 No more than 3 in any 1 year

Management or Recovery Unit	FMO Area	Core Area	Local Population Area(s)	Maximum number of restoration projects that are likely to adversely affect bull trout
Olympic Peninsula cont.		Elwha River up to the National Forest or National Park boundary	Little River (potential local population) (adverse effects are not anticipated to occur in this potential local population area)	2 No more than 1 in any 1 year
		Hoh River up to the National Forest or National Park boundaries	South Fork Hoh River and tributaries (adverse effects are not anticipated to occur in this local population area)	2 No more than 1 in any 1 year
		Queets River up to the National Park boundary	None within the area covered by the PBA	2 No more than 1 in any 1 year
		Quinault River up to the National Forest or National Park boundary	None within the area covered by the PBA	10 No more than 5 in any 1 year
Puget Sound	Samish River			
	Lake Washington including the following: Lower Cedar River: Sammamish River; Lakes Washington, Sammamish and Union; and Ship Canal			
	Lower Green River			
	Lower Nisqually River			
	Marine Areas of Puget Sound			
		Chilliwack River up to the National Forest boundary	None within the area covered by the PBA	2 No more than 1 in any 1 year

Management or Recovery Unit	FMO Area	Core Area	Local Population Area(s)	Maximum number of restoration projects that are likely to adversely affect bull trout
		Nooksack River up to the National Forest boundary	Glacier Creek (adverse effects are not anticipated to occur in this local population area) Lower Canyon Creek (adverse effects are not anticipated to occur in this local population area) Lower North Fork Nooksack Lower Middle Fork Nooksack River Lower South Fork Nooksack River Middle North Fork Nooksack River (adverse effects are not anticipated to occur in this local population area) Upper Middle Fork Nooksack River (adverse effects are not anticipated to occur in this local population area)	20 No more than 5 in any 1 year No more than 2 within a local population in any 1 year*
		Lower Skagit River up to the National Forest or National Park boundary	Illabot Creek (adverse effects are not anticipated to occur in this local population area)	10 No more than 5 in any 1 year
		Stillaguamish River up to the National Forest boundary	South Fork Canyon Creek (adverse effects are not anticipated to occur in this local population area) North Fork Stillaguamish River	20 No more than 5 in any 1 year

Management or Recovery Unit	FMO Area	Core Area	Local Population Area(s)	Maximum number of restoration projects that are likely to adversely affect bull trout
			Upper Deer Creek (adverse effects are not anticipated to occur in this local population area)	No more than 2 within a local population in any 1 year*
		Snohomish/Skykomish Rivers up to the National Forest boundary	South Fork Skykomish River	10 No more than 5 in any 1 year No more than 2 within a local population in any 1 year*
		Puyallup River up to the National Forest or National Park boundary	Carbon River Clearwater River (potential) Greenwater River Upper Puyallup and Mowich Rivers Upper White River West Fork White River	20 No more than 5 in any 1 year No more than 2 within a local population in any 1 year*

* May be exceeded if approved by CTA and Listing and Recovery staff identified as bull trout species leads.

STATUS OF THE SPECIES (Rangewide)

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; in the Jarbidge River in Nevada; in the Willamette River Basin in Oregon; in Pacific Coast drainages of Washington, including Puget Sound; throughout major rivers in Idaho, Oregon, Washington, and Montana within the Columbia River Basin; and in the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Cavender 1978; Bond 1992; Brewin and Brewin 1997; Leary and Allendorf 1997).

Throughout its range, the bull trout is threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering; road construction and maintenance; mining; grazing; the blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels; and introduced non-native species (64 FR 58910). 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 Units (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, plus two other population segments, into one listed taxon and the application of the jeopardy standard under section 7 of the ESA relative to this species (64 FR 58930):

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

Current Status and Conservation Needs

As noted above, 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 (USFWS 2004c); (2) Klamath River (USFWS 2002); (3) Columbia River (USFWS 2002); (4) Coastal-Puget Sound (USFWS 2004 a,b); and (5) St. Mary-Belly River (USFWS 2002). 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. A comprehensive discussion of these topics is found in the FWSs draft recovery plan for the bull trout (USFWS 2002; 2004a,b,c).

The conservation needs of the 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. The recovery planning process for bull trout (USFWS 2002; 2004a,b,c) 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.

Central to the survival and recovery of the bull trout is the maintenance of viable core areas (USFWS 2002, 2004a,b,c). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat, and in some cases in their use of spawning 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 2002; 2004a,b,c).

Jarbidge River

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 spawners, are estimated to occur within the core area. The current condition of the bull trout in this interim recovery unit is attributed to the effects of livestock grazing, roads, angler harvest, timber harvest, and the introduction of non-native fishes (USFWS 2004c). The draft bull trout recovery plan (USFWS 2004c) identifies the following conservation needs for this unit: maintain the current distribution of the bull trout within the core area; maintain stable or increasing trends in abundance of both resident and migratory bull trout in the core area; restore and maintain suitable habitat conditions for all life history stages and forms; and conserve genetic diversity and increase natural opportunities for genetic exchange between resident and migratory forms of the bull trout. An estimated 270 to 1,000 spawning fish per year are needed to provide for the persistence and viability of the core area and to support both resident and migratory adult bull trout (USFWS 2004c).

Klamath River

This interim recovery unit currently contains 3 core areas and 12 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 2002). Bull trout populations in this unit face a high risk of extirpation (USFWS 2002). The draft bull trout recovery plan (USFWS 2002) identifies the following conservation needs for this unit: maintain the current distribution of the bull trout and restore distribution in previously occupied areas; maintain stable or increasing trends in bull trout abundance; restore and maintain suitable habitat conditions for all life history stages and strategies; 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 3,250 adults currently to 8,250 adults are needed to provide for the persistence and viability of the 3 core areas (USFWS 2002).

Columbia River

This interim recovery unit currently contains about 90 core areas and 500 local populations. About 62 percent of these core areas and local populations occur in central Idaho and northwestern Montana. The condition of the bull trout within these core areas varies from poor to good but generally all have been subject to the combined effects of habitat degradation, fragmentation, fisheries management, and alterations associated with one or more of the following activities: dewatering; road construction and maintenance; mining, and grazing; the blockage of migratory corridors by dams or other diversion structures; poor water quality; poaching and incidental mortality from other targeted fisheries; entrainment into diversion channels; and introduced non-native species. The draft bull trout recovery plan (USFWS 2002) identifies the following conservation needs for this unit: maintain or expand the current distribution of the bull trout within core areas; maintain stable or increasing trends in bull trout abundance; maintain/restore suitable habitat conditions for all bull trout life history stages and strategies; and conserve genetic diversity and provide opportunities for genetic exchange.

Coastal-Puget Sound

Bull trout in the Coastal-Puget Sound interim recovery unit exhibit anadromous, adfluvial, fluvial, and resident life history patterns. The anadromous life history form is unique to this unit. This interim recovery unit currently contains 14 core areas and 67 local populations (USFWS 2004a,b). Bull trout are distributed throughout most of the large rivers and associated tributary systems within this unit. With only a few exceptions, bull trout continue to be present in nearly all major watersheds where they likely occurred historically within this unit. Generally, bull trout distribution has contracted and abundance has declined especially in the southeastern part of the 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 and incidental mortality from other targeted fisheries, and the introduction of non-native species. The draft bull trout recovery plan (USFWS 2004a,b) identifies the following conservation needs for this unit: maintain or expand the current distribution of bull trout within existing core areas; increase bull trout abundance to about 16,500 adults across all core areas; and maintain or increase connectivity between local populations within each core area.

St. Mary-Belly River

This interim recovery unit currently contains 6 core areas and 9 local populations (USFWS 2002). Currently, the bull trout is widely distributed in the St. Mary River drainage and occurs 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 2002). 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 2002). The draft bull trout recovery plan (USFWS 2002) identifies the following conservation needs for this unit: maintain the current distribution of the bull trout and restore distribution in previously occupied areas; maintain stable or increasing trends in bull trout abundance; restore and maintain suitable habitat conditions for all life history stages and forms; conserve genetic diversity and provide the opportunity for genetic exchange; and establish good working relations with Canadian interests because local bull trout populations in this unit are comprised mostly of migratory fish, whose habitat is mostly in Canada.

The Olympic Peninsula and Puget Sound recovery teams identified 14 core areas in the Coastal-Puget Sound interim recovery unit: (1) Chilliwack, (2) Lower Nooksack, (3) Lower Skagit, (4) Upper Skagit, (5) Stillaguamish, (6) Snohomish-Skykomish, (7) Chester Morse Lake, and (8) Puyallup; (9) Skokomish, (10) Dungeness, (11) Elwha, (12) Hoh, (13) Queets, and (14) Quinault.. Within these core areas, there are a total of 67 local populations.

Each recovery team also identified areas containing important foraging, migration, and overwintering habitat (FMO) that is necessary for bull trout recovery. Some areas were previously identified by the Service as subpopulations at the time of listing; however, based on new information, we now believe that spawning does not occur within these areas and their importance to bull trout is primarily for foraging and overwintering. Additional areas not previously identified as subpopulations have been identified through surveys and other research as providing important foraging, migration and overwintering habitat.

The Puget Sound Recovery Team identified five FMO areas: (1) Samish, (2) Lake Washington, (3) Lower Green, (4) Lower Nisqually, and (5) marine areas of Puget Sound. The Olympic Peninsula Recovery Team identified four FMO areas: (1) Hood Canal and its eastside tributaries, (2) Straits of Juan de Fuca and its independent tributaries, (3) Pacific Coast and its independent tributaries, and (4) Grays Harbor/Lower Chehalis and their independent tributaries.

ENVIRONMENTAL BASELINE (Bull Trout)

Regulations implementing the Act (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. The action area considered in this BO includes the entire range of the Coastal-Puget Sound population segment.

Core Areas

Rieman and McIntyre (1993) and Rieman and Allendorf (2001) evaluated the bull trout population numbers and habitat thresholds necessary for long-term viability of the species. They identified four key elements, and the characteristics of each of those elements, for consideration when evaluating the viability of bull trout populations. These four elements include (1) the number of local populations; (2) adult abundance (defined as the number of spawning fish present in a core area in a given year); (3) productivity, or the reproductive rate of the population (as measured by population trend and variability); and (4) connectivity (as represented by the presence of the migratory life history form and functional habitat). For each element, the recovery teams classified bull trout core areas into relative risk categories (described below) based on the best available data and the professional judgement of the recovery team (USFWS 2004a, 2004b).

Local Populations

Metapopulation theory is important to consider in bull trout recovery. A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994). The distribution and interconnection of multiple local populations throughout a watershed provide a mechanism for spreading risk from random, naturally occurring events and allows for potential recolonization in the event of local extirpations. In part, the number and connectivity of local populations in the watershed is an indicator of a functioning core area. Based in part on guidance from Rieman and McIntyre (1993), bull trout core areas with fewer than 5 local populations are at increased risk of local extirpation, core areas with between 5 and 10 local populations are at intermediate risk, and core areas with more than 10 interconnected local populations are at diminished risk.

Based on existing information and local expertise, the recovery teams identified fewer than 5 local populations in each of the Chilliwack, Chester Morse Lake, Stillaguamish, Snohomish-Skykomish, Skokomish, Dungeness, Hoh, Quinault, Queets and Elwha core areas. Consequently, these core areas are at increased risk of local extirpation. The Puyallup, Upper Skagit and Nooksack core areas each have between 5 and 10 local populations and are considered to be at intermediate risk given the current number of local populations that have been identified. The Lower Skagit core area currently has 19 local populations and is considered to be at diminished risk of local extirpation.

Adult Abundance

For the purposes of bull trout recovery planning, abundance levels were evaluated at the local population and core area levels. Rieman and Allendorf (2001) estimated bull trout need a minimum population size of between 500 and 1,000 adults in a core area to minimize the deleterious effects of genetic drift. Deleterious effects include reduced genetic variation, which can reduce the long-term viability of the population. Bull trout core areas containing fewer than 1,000 spawning adults per year were classified as at risk from genetic drift.

Based on available data sets, habitat considerations, the population guidance discussed above, and best professional judgement, the adult abundance likely exceeds 1,000 spawners in the Upper Skagit, Lower Skagit, and Chilliwack core areas, and these core areas are currently not considered to be at risk from genetic drift. There are likely fewer than 1,000 adult bull trout in each of the remaining core areas: Snohomish-Skykomish, Chester Morse Lake, Nooksack, Stillaguamish, Puyallup, Hoh, Dungeness, Elwha, Queets, and Quinault (USFWS 2004a, 2004b). These core areas face risk from genetic drift. However, a more accurate evaluation of risk from genetic drift in the core areas will be possible with additional abundance information. The Skokomish River abundance is estimated to be less than 500 adults and this core area is at an increased risk of genetic drift.

Productivity

A stable or increasing population is a key criterion for recovery. Since estimates of the total population size are rarely available, the productivity or population growth rate is usually estimated from temporal trends in indices of abundance at a particular life stage. For example, redd counts are often used as an index of a spawning adult population. The direction and magnitude of a trend in the index can be used as a surrogate for the growth rate of the entire population. For instance, a downward trend in an abundance indicator may signal the need for increased protection, regardless of the actual size of the population. A population that is below recovered abundance levels, but that is moving toward recovery, would be expected to exhibit an increasing trend in the indicator.

For a population to contribute to recovery, its growth rate must indicate that the population is stable or increasing for a period of time. Because the trend status is unknown due to lack of data, bull trout populations in the Chilliwack, Nooksack, Upper Skagit, Stillaguamish, Chester Morse Lake, Puyallup, Dungeness, Hoh, Queets, Quinault, and Elwha core areas are considered at an increased risk until sufficient information is collected to properly assess their productivity. In the Skokomish core area only the North Fork Skokomish River local population has received long-term monitoring. Recent counts in this population demonstrate a declining trend from a peak of 412 adults in 1993 to 100 adults in 2002 (USFWS 2004b). Based on this information and the lack of adequate trend data in the South Fork Skokomish River, the Skokomish core area is currently considered at increased risk of extirpation. Significant increases in abundance for the past 3 years in the Chester Morse Lake core area suggest that this core area is at a lower risk. However, additional years of trend data are needed to confirm this. In contrast, bull trout in the Lower Skagit and the Snohomish-Skykomish core areas are at a diminished threat due to long-term redd counts that indicate increasing population trends.

Connectivity

The presence of the migratory life history form within the Coastal-Puget Sound interim recovery unit is used as an indicator of the functional connectivity of populations. If the migratory life form is absent, or if the migratory form is present but local populations lack connectivity, the core area is considered to be at increased risk. If the migratory life form persists in at least some local populations, with partial ability to connect with other local populations, the core area is judged to be at intermediate risk. Finally, if the migratory life form is present in all or nearly all local populations, and had the ability to connect with other local populations, the core area is considered to be at diminished risk.

Migratory bull trout likely persist in most local populations in the Chilliwack, Lower Skagit, Upper Skagit, Stillaguamish, Snohomish-Skykomish, Chester Morse Lake, Dungeness, Hoh, Queets, and Quinault core areas; these areas are therefore considered at a diminished risk. Although migratory bull trout may persist in some local populations in the Nooksack, Puyallup, Skokomish, and Elwha core areas, poor fish passage, such as from diversions, faulty culverts, or dams block connectivity between local populations within these core areas and these core areas are considered to be at an intermediate risk. The low abundance of the migratory life history strategy in these core areas limits the possibility for genetic exchange and local population re-establishment.

Life History

Bull trout in the Coastal-Puget Sound interim recovery unit demonstrate anadromous, adfluvial, and fluvial (migratory) and resident (non-migratory) life history patterns. These diverse life history types are important to the stability and viability of bull trout populations by increasing the resilience of populations to environmental and demographic perturbations (Rieman and McIntyre 1993).

Within the range of bull trout in the coterminous United States, anadromy, or technically "amphidromy," is unique to the Coastal-Puget Sound interim recovery unit. Unlike strict anadromy, amphidromous individuals often return seasonally to freshwater as subadults, sometimes for several years, before returning to spawn (Wilson 1997). Subadult bull trout in the Coastal-Puget Sound population segment can move into marine waters to forage or migrate and return to freshwater to take advantage of seasonal forage provided by salmonids eggs, smolts, or juveniles.

Migratory forms appear to develop when habitat conditions allow movement between spawning and rearing streams and larger rivers and lakes and, for bull trout in the Coastal-Puget Sound interim recovery unit marine and estuarine waters where foraging opportunities are enhanced (Kraemer 1994; Frissell 1999). Benefits to migratory bull trout include greater growth in the more productive waters of larger streams, lakes, estuaries, and nearshore marine areas; greater fecundity resulting in increased reproductive potential; and enhanced dispersal of the population across space and time. In the Skagit River system, anadromous bull trout with access to a more productive marine forage base attain greater size at maturity than their fluvial counterparts (Kraemer, *in litt.* 2003).

Anadromous and fluvial life history forms typically have widely distributed foraging, migration, and overwintering habitat. Migratory bull trout use nonnatal (habitat outside of their spawning and early rearing habitat) watersheds to forage, migrate, and overwinter (S. Brenkman and S. Corbett, Olympic National Park, *in litt.* 2003a,b). Larger juvenile and subadult bull trout can migrate throughout a core area looking for feeding opportunities, or they can move through marine areas to access independent tributaries (tributaries that connect directly to marine waters) to forage or, potentially, to take refuge from high flows in their core areas (Brenkman and Corbett, *in litt.* 2003a,b).

Within the Coastal-Puget Sound interim recovery unit, current bull trout distribution has been reduced from historic distribution, most notably in the Hood Canal, and Satsop, Green, and Nisqually Rivers, and population abundance has significantly decreased throughout much of the unit (USDI 1999). Highly migratory life history forms, such as fluvial and anadromous fish, have been eliminated from many large, productive river systems in the INTERIM RECOVERY UNIT. Isolated, remnant populations, which lack connectivity to migratory populations, often have a low likelihood of persistence because of reduced access to prey and reduced opportunities for recolonization (Rieman and McIntyre 1993, Rieman and Allendorf 2001). For example, bull trout isolated in the upper North Fork Skokomish River still migrate into Lake Cushman but, due to the presence of the Cushman Dams, they cannot migrate into the Lower North Fork or into Hood Canal, where the prey base can be more productive.

For all life history types, juveniles typically rear in tributary streams for 1 to 3 years before migrating downstream into a larger river, lake, or estuary and/or nearshore marine area to mature (Rieman and McIntyre 1993). In some lake systems, juveniles may migrate directly to lakes (Riehle et al. 1997). Juvenile and adult bull trout frequently inhabit side channels, stream margins and pools with suitable cover (Sexauer and James 1993) and areas with cold hyporheic zones or groundwater upwellings (Baxter and Hauer 2000).

Bull trout become sexually mature between 4 and 9 years of age and may spawn in consecutive or alternate years (Shepard et al. 1984, Pratt 1992). Migratory bull trout may begin their spawning migrations as early as April and have been known to migrate upstream as far as 250 kilometers (km) (155 miles) to spawning grounds (Fraley and Shepard 1989). Spawning typically occurs from August through December in cold, low-gradient 1^{st}- to 5^{th}-order tributary streams, over loosely compacted gravel and cobble having groundwater inflow (Shepard et al. 1984, Brown 1992, Rieman and McIntyre 1996, Swanberg 1997, MBTSG 1998, Baxter and Hauer 2000). Spawning sites frequently occur near cover (Brown 1992). Hatching occurs in winter or early spring, and alevins may stay in the gravel for up to 3 weeks before emerging from the gravel. The total time from egg deposition to fry emergence from the gravel may exceed 220 days. Post-spawning mortality, longevity, and repeat-spawning frequency are not well known (Rieman and McIntyre 1996), but life spans may exceed 10-13 years (McPhail and Murray 1979, Pratt 1992, Rieman and McIntyre 1993).

Bull trout are apex predators and require a large prey base and home range. Adult and subadult migratory bull trout are primarily piscivorous, feeding on various trout and salmon species, whitefish (*Prosopium* spp.), yellow perch (*Perca flavescens*), and sculpin (*Cymatogaster* spp.). Subadult and adult migratory bull trout move throughout and between basins in search of prey. Anadromous bull trout in the Coastal-Puget Sound interim recovery unitalso feed on ocean fish, such as surf smelt (*Hypomesus pretiosus*) and sandlance (*Ammodytes hexapterus*). Resident and juvenile bull trout prey on terrestrial and aquatic insects, macrozooplankton, amphipods, mysids, crayfish, and small fish (Wyman 1975, Rieman and Lukens 1979 *in* Rieman and McIntyre 1993, Boag 1987, Goetz 1989, Donald and Alger 1993). A recent study in the Cedar River Watershed of western Washington found bull trout diets also consist of aquatic insects, crayfish, and salamanders (Connor et al. 1997).

Habitat Requirements

Bull trout have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993). Growth, survival, and long-term persistence are dependent on the following habitat characteristics: cold water, complex instream habitat, a stable substrate with a low percentage of fine sediments, high channel stability, and stream/population connectivity. Stream temperature and substrate type, in particular, are critical factors for the sustained long-term persistence of bull trout. Spawning is often associated with the coldest, cleanest, and most complex stream reaches within basins. However, bull trout exhibit a patchy distribution even in pristine habitats (Rieman and McIntyre 1995) and should not be expected to occupy all available habitats at the same time (Rieman et al. 1997).

While bull trout clearly prefer cold waters and nearly pristine habitat, it cannot be assumed that they do not occur in streams where habitat is degraded. Given the depressed status of some subpopulations, it is likely that individuals in degraded rivers are using less than optimal habitat because that may be all that is available. In basins with high productivity, such as the Skagit River basin, bull trout may be using marginal areas when optimal habitat becomes fully occupied (Kramer 2003). Bull trout have been documented using habitats that may be atypical or characterized as likely to be unsuitable (USFWS 2000).

<u>Temperature</u>

For long-term persistence, bull trout populations need a stream temperature regime that ensures sufficient amounts of cold water are present at the locations and during the times needed to complete their life cycle. Temperature is most frequently recognized as the factor limiting bull trout distribution (Dunham and Chandler 2001, Rieman and McIntyre 1993). Probability of occurrence for juvenile bull trout in Washington is relatively high (75 percent) when maximum daily temperatures did not exceed approximately 11 to 12° C (52 to 54 °F) (Dunham et al. 2001). Water temperature also seems to be an important factor in determining early survival, with cold water temperatures resulting in higher egg survival and faster growth rates for fry and juveniles (Pratt 1992). Optimum incubation temperatures range from 2 to 6 °C (36 to 43 °F). At 8 to 10 °C (46 to 50 °F), survival ranged from 0-20 percent (McPhail and Murray 1979). Tributary stream temperature requirements for rearing juvenile bull trout are also quite low, ranging from 6 to 10 °C (43 to 50 °F) (Buchanan and Gregory 1997, Goetz 1989, Pratt 1992, McPhail and Murray 1979).

Increases in stream temperatures can cause direct mortality, increased susceptibility to disease or other sublethal effects, displacement by avoidance (McCullough et al. 2001, Bonneau and Scarnecchia 1996), or increased competition with species more tolerant of warm stream temperatures (Rieman and McIntyre 1993, Craig and Wissmar 1993 *in* USDI (1997), MBTSG 1998). Brook trout (*S. fontinalis*) which can hybridize with bull trout, may be more competitive than bull trout and displace them, especially in degraded drainages containing fine sediment and higher water temperatures (Clancy 1993 *in* USFWS 1998; Leary et al. 1993). Recent laboratory studies suggest bull trout are at a particular competitive disadvantage in competition with brook trout at temperatures greater than 12 °C (54 °F) (McMahon et al. 2001).

Although bull trout require a narrow range of cold water temperatures to rear, migrate, and reproduce, they are known to occur in larger, warmer river systems that may cool seasonally, and which provide important migratory corridors and forage bases. For migratory corridors, bull trout typically prefer water temperatures ranging between 10 to 12 °C (50 to 54 °F) (McPhail and Murray 1979, Buchanan and Gregory 1997). When bull trout migrate through stream segments with higher water temperatures they tend to seek areas offering thermal refuge such as confluences with cold tributaries (Swanberg 1997), deep pools, or locations with surface and groundwater exchanges in alluvial hyporheic zones (Frissell 1999). Water temperatures above 15 °C are believed to limit bull trout distribution, which partially explains their generally patchy distribution within a watershed (Fraley and Shepard 1989, Rieman and McIntyre 1995).

Substrate

Bull trout show a strong affinity for stream bottoms and a preference for deep pools in cold water streams (Goetz 1989, Pratt 1992). Stream bottom and substrate composition are highly important for juvenile rearing and spawning site selection (Rieman and McIntyre 1993, Graham et al. 1981, McPhail and Murray 1979). Fine sediments can influence incubation survival and emergence success (Weaver and White 1985, Pratt 1992) but might also limit access to substrate interstices that are important cover during rearing and overwintering (Goetz 1994, Jakober 1995). Rearing densities of juvenile bull trout have been shown to be lower when there are higher percentages of fine sediment in the substrate (Shepard et al. 1984). Due to this close connection to substrate, bed load movements and channel instability can negatively influence the survival of young bull trout.

Cover and Stream Complexity

Bull trout of all age classes are closely associated with cover, especially during the day (Baxter and McPhail 1997, Fraley and Shepard 1989). Cover may be in the form of overhanging banks, deep pools, turbulence, large wood, or debris jams. Young bull trout use interstitial spaces in the substrate for cover and are closely associated with the streambed. This association appears to be more important for bull trout than for other salmonid species (Pratt 1992, Rieman and McIntyre 1993).

Bull trout distribution and abundance is positively correlated with pools and complex forms of cover, such as large or complex woody debris and undercut banks, but may also include coarse substrates (cobble and boulder) (Rieman and McIntyre 1993, Jakober 1995, MBTSG 1998). Studies of Dolly Varden showed that population density declined with the loss of woody debris after clearcutting or the removal of logging debris from streams (Bryant 1983, Dolloff 1986, Elliott 1986, Murphy et al. 1986).

Large pools consisting of a wide range of water depths, velocities, substrates, and cover are characteristic of high quality aquatic habitat and an important component of channel complexity.

Reduction of wood in stream channels, either from present or past activities, generally reduces pool frequency, quality, and channel complexity (Bisson et al. 1987, House and Boehne 1987, Spence et al. 1996). Large wood in streams enhances the quality of habitat for salmonids and contributes to channel stability (Bisson et al. 1987). It creates pools and undercut banks, deflects streamflow, retains sediment, stabilizes the stream channel, increases hydraulic complexity, and improves feeding opportunities (Murphy 1995). By forming pools and retaining sediment, large wood also helps maintain water levels in small streams during periods of low streamflow (Lisle 1986).

Channel and Hydrologic Stability

Due to the bull trout's close association with the substrate, bed load movements and channel instability can reduce the survival of young bull trout. Maintaining bull trout habitat requires stream channel and flow stability (Rieman and McIntyre 1993). Bull trout are exceptionally sensitive to activities that directly or indirectly affect stream channel integrity. Juvenile and adult bull trout frequently inhabit areas of reduced water velocity, such as side channels, stream margins, and pools that are easily eliminated or degraded by management activities (Rieman and McIntyre 1993). Channel dewatering caused by low flows and bed aggradation has blocked access for spawning fish resulting in year-class failures (Weaver 1992). Timber harvest and the associated roads may cause landslides that affect many miles of stream through aggradation of the streambed.

Patterns of streamflow and the frequency of extreme flow events that influence substrates may be important factors in population dynamics (Rieman and McIntyre 1993). With lengthy overwinter incubation and a close tie to the substrate, embryos and juveniles may be particularly vulnerable to flooding and channel scour associated with the rain-on-snow events that are common in some parts of the range (Rieman and McIntyre 1993). Surface/groundwater interaction zones, which are typically selected by bull trout for redd construction, are increasingly recognized as having high dissolved oxygen, constant cold water temperatures, and increased macro-invertebrate production.

Migration

The persistence of migratory bull trout populations requires maintaining migration corridors. Stream habitat alterations that restrict or eliminate bull trout migration corridors include degradation of water quality (especially increasing temperatures and increased amounts of fine sediments), alteration of natural streamflow patterns, impassable barriers (e.g., dams and culverts), and structural modification of stream habitat (e.g. channelization or removal of cover). In the Coastal-Puget Sound INTERIM RECOVERY UNIT, migratory corridors may link seasonal marine and freshwater habitats, as well as linking lake, river, and tributary complexes necessary for bull trout to complete their life history requirements.

The importance of maintaining the migratory life history form of bull trout, as well as migratory runs of other salmonids that may provide a forage base for bull trout, is repeatedly emphasized in the scientific literature (Rieman and McIntyre 1993, MBTSG 1998, Dunham and Rieman 1999, Nelson et al. 2002). Isolation and habitat fragmentation resulting from migratory barriers have negatively affected bull trout by (1) reducing geographical distribution (Rieman and McIntyre 1993, MBTSG 1998); (2) increasing the probability of losing individual local populations (Rieman and McIntyre 1993, MBTSG 1998, Nelson et al. 2002, Dunham and Rieman 1999); (3) increasing the probability of hybridization with introduced brook trout (Rieman and McIntyre 1993); (4) reducing the potential for movements in response to developmental, foraging, and seasonal habitat requirements (MBTSG 1998, Rieman and McIntyre 1993); and (5) reducing reproductive capability by eliminating the larger, more fecund migratory form from many subpopulations (MBTSG 1998, Rieman and McIntyre 1993). Therefore, restoring connectivity and restoring the frequency of occurrence of the migratory form will be an important factor in the recovery of bull trout.

Unfortunately, migratory bull trout have been restricted or eliminated in parts of their range due to stream habitat alterations, including seasonal or permanent obstructions, detrimental changes in water quality, increased temperatures, and the alteration of natural streamflow patterns. Dam and reservoir construction and operations have altered major portions of bull trout habitat in the Skokomish, Elwha, Skagit, Nooksack, and Puyallup core areas. Dams without fish passage create barriers to fluvial and adfluvial bull trout that isolate populations. The operations of dams and reservoirs alter the natural hydrograph, thereby affecting forage, water temperature, and water quality (USDI 1997).

Marine Habitat Use

The estuaries and shoreline areas comprise what is known as the nearshore marine habitat. This nearshore environment supports habitat critical to both bull trout and salmon. This habitat provides food production and foraging areas, refuge (from predation, seasonal high flows, winter storms, etc.), and migratory corridors.

Bull trout first migrate to tidal areas between age 1 and 3. These juvenile fish may rear in the tidally influenced delta within intertidal marsh, distributary channels, or may pass through into nearshore marine areas. Although there have been no studies describing the salinity tolerance of bull trout, both sub-adult and adult bull trout are able to survive a wide range of salinities, varying from fresh to brackish to marine waters and are able to move between these areas with little or no delay for acclimation.

Additional information provided by bull trout acoustic radio telemetry and habitat study projects indicates that bull trout in marine waters are more active at night than during the day, may prefer deeper nearshore habitat than shallow nearshore habitat, can be found at depths as great as 60 to 75 meters, and that bull trout from different freshwater populations may overlap in their use of marine and estuarine waters. Although bull trout are likely to be found in nearshore marine waters year round, the period of greatest use is March through July (Goetz and Jeanes 2004). In the Skagit Bay, although bull trout may be found year round, there appears to be a bi-modal distribution where significant numbers of bull trout are present in the periods from April through July and October through December (Beamer and Henderson 2004).

Anadromous bull trout forage and mature in the nearshore marine habitats on the Washington coast, Straits of Juan de Fuca, and in Puget Sound. In Puget Sound the distribution of bull trout in the nearshore waters has been hypothesized to be correlated to the nearshore distribution of baitfish (Kraemer 1994). It also appears that certain life history stages may utilize different marine prey species. For example, the younger bull trout (age 1-3) that move to marine waters appear to select smaller prey items, such as shrimp. By age 4, the diet of anadromous bull trout has shifted largely to fish. Bull trout from Puget Sound prey on surf smelt, Pacific herring, Pacific sand lance, pink salmon smolts, chum salmon smolts, and a number of invertebrates (Kraemer 1994).

These nearshore marine habitats have been significantly altered by human development (PSWQAT 2000). Construction of bulkheads and other structures have modified the nearshore areas and resulted in habitat loss that has directly affected forage fish for bull trout. Other impacts to the marine environment include alterations to water quality resulting from fish pathogens, nutrients and toxic contaminants, urbanization, and stormwater runoff from basins that feed Puget Sound. Global changes in sea level and climate may also have more widespread ramifications on these habitats and on the Puget Sound ecosystem as a whole (Klarin et al. 1990; Thom 1992).

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 interim recovery unit 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. Habitat improvements have occurred following restoration projects intended to benefit either bull trout or salmon, although monitoring the effectiveness of these projects seldom occurs. The status of this interim recovery unit has also been affected by a number of Federal and non-Federal actions, some of which are addressed through BOs prepared 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.

Three recent section 10(a)(1)(B) permits have been issued for Habitat Conservation Plans (HCPs) completed in the Coastal-Puget Sound INTERIM RECOVERY UNIT: 1) the City of Seattle's Cedar River Watershed HCP, 2) the Simpson Timber HCP, and 3) the Tacoma Public Utilities Green River HCP. In addition, the Washington State Department of Natural Resources (WDNR) and the West Fork Timber HCPs (Nisqually River) have been amended to include the Coastal-Puget Sound interim recovery unitof bull trout. 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 may result in short-term degradation of the baseline. All HCPs permit the incidental take of bull trout.

Relationship of Core Areas to Survival and Recovery of Bull Trout

Leary and Allendorf (1997) reported evidence of genetic divergence among bull trout subpopulations, indicating relatively little genetic exchange among them. Recolonization of habitat where isolated bull trout subpopulations have been lost is either unlikely to occur (Rieman and McIntyre 1993) or will only occur over extremely lengthy time-periods. Remnant or regional populations without the connectivity to refound or support local populations have a greater likelihood of extinction (Rieman and McIntyre 1993, Rieman et al. 1997, MBTSG 1998).

Healy and Prince (1995) reported that the conservation of phenotypic diversity is achieved through conservation of the subpopulation within its habitat because phenotypic diversity is a consequence of the genotype interacting with the habitat. They further note that adaptive variation among salmonids has been observed to occur under relatively short timeframes (e.g., changes in genetic composition of salmonids raised in hatcheries and the rapid emergence of divergent phenotypes for salmonids introduced to new environments). Healy and Prince (1995) conclude the loss of a few subpopulations within an ecosystem might have only a small effect on overall genetic diversity, but the effect on phenotypic diversity, and potentially on overall population viability, could be substantial.

This concept of preserving variation in phenotypic traits determined by both genetic and environmental (i.e., local habitat) factors has also been identified by Hard (1995) as an important component in maintaining intraspecific adaptability (i.e., phenotypic plasticity) and ecological diversity within a genotype. Hard argues that adaptive processes are not entirely encompassed by the interpretation of molecular genetic data. In other words, phenotypic and genetic variation in adaptive traits may exist without detectable variation at the molecular genetic level, particularly for neutral genetic markers. Therefore, the effective conservation of genetic diversity necessarily involves consideration of the conservation of biological units smaller than taxonomic species. Reflecting this theme, maintenance of local subpopulations has been specifically emphasized as a mechanism for conservation of bull trout (Rieman and McIntyre 1993).

Based on this information, the Service concludes that each bull trout core population is an important phenotypic, genetic, and distributional component of its respective interim recovery unit. Therefore, adverse effects compromising the functional integrity of a bull trout core population may appreciably reduce the likelihood of survival and recovery of the larger interim recovery unit or coterminous range of the species, by reducing distribution and potential ecological and genetic diversity at those larger scales.

Conservation Needs of the Coastal-Puget Sound interim recovery unit

The recovery of bull trout in the Coastal-Puget Sound interim recovery unitwill depend on the reduction of adverse effects that result from dams, timber harvest, agriculture practices, road building, urbanization, and fisheries management and on remedying remaining effects from past activities. The Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentus)* (USFWS 2004a; 2004b) and the Bull Trout Interim

Conservation Guidance (USFWS 1998a) identify conservation actions necessary to recover bull trout. General conservation needs include the following:

- Removing or modifying "man-made" impassable barriers (e.g., culverts, dams) to provide passage, to allow recolonization of previously occupied habitat and promotion of genetic exchange, and, where applicable, to eliminate entrainment.

- Screening water-control structures and diversions in order to prevent entrapment and injury.

- Implementing land use (i.e., agricultural, forestry, industrial) practices, such as minimizing the loss of riparian vegetation, that will maintain or restore stream flows and temperature regimes to support bull trout, and that minimize chemical- and nutrient-contaminated run-off.

- Improving approaches to urbanization and road building, such as requiring setbacks from streambanks and marine shorelines, and adequately treating stormwater run-off in order to minimize impacts to foraging and migratory habitats.

- Reducing associated incidental mortality of bull trout from commercial, recreational, and tribal salmon and steelhead harvest.

- Restoring impaired stream channels, floodplains, and riparian areas to their appropriate function in order to provide suitable habitat for bull trout in both currently and previously occupied streams.

The Coastal-Puget Sound interim recovery unit is unique in that it contains the only known anadromous life history form of bull trout. As described above, anadromous bull trout use the marine habitats for foraging, migration and overwintering. There has been a documented decline in forage fish, bottom fish, and wild salmon in Puget Sound (PSWQAT 2000). This decline has been attributed to human encroachment and development of the nearshore areas throughout Puget Sound, which has resulted in the loss of nearshore habitat[1]. It is likely that anadromous bull trout have been impacted by this decline in their forage base and the loss of habitat in the marine environment. Additional conservation needs pertaining to the marine environment include the following:

- Preserving and restoring healthy forage fish populations.

- Preserving and restoring nearshore habitats that support forage fish by removing, modifying, or moving artificial structures (e.g., bulkheads, riprap, dikes, tidegates); using alternative shoreline erosion and flooding protection measures that avoid or minimize

[1]Nearshore habitat, 65 ft below MLW to 200 ft upland of the OHWM, generally encompasses several of the following habitats: bluffs, beaches, marshes, riparian vegetation, sandflats, mudflats, rock and gravel habitats, unvegetated subtidal areas, kelp beds, intertidal algae, and eelgrass beds (PSWQAT 2000).

impacts to natural nearshore process; and restoring estuaries and nearshore habitats such as eelgrass beds and kelp beds.

- Reducing human encroachment and development along the marine shoreline and within nearshore areas.

Core Areas – Olympic Peninsula Management Unit

Dungeness River Core Area

The Dungeness River core area comprises the Dungeness and Grey Wolf Rivers, associated tributaries, and estuary. The Dungeness River core area is one of two core areas in the Olympic Peninsula Management Unit that are connected to the Strait of Juan de Fuca.

Bull trout occur throughout the Dungeness and Gray Wolf Rivers downstream of impassable barriers, which are present on both rivers. They also occur in the Dungeness River estuary and Gold Creek, a tributary to the Dungeness River. Twenty-five char sampled in the Dungeness River were all bull trout (Spruell and Maxwell 2002). However, 50 char sampled upstream of the barrier at river mile 24 on the Dungeness River were all Dolly Varden (S. Young, WDFW, *in litt.* 2001).

Fluvial and anadromous life history forms of bull trout occur in the Dungeness River core area. Mainstem rivers within the core area provide spawning, rearing, foraging, migration, and overwintering habitats.

The status of a bull trout population in a core area 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 2004b).

Number and Distribution of Local Populations

Two local populations have been identified: (1) middle Dungeness River up to river mile 24 and tributaries, including Silver, Gold, and Canyon Creeks; and (2) Gray Wolf River to confluence with Cameron, Grand, and Cedar Creeks. With only two local populations, bull trout in this core area are considered at increased risk of extirpation and adverse effects from random naturally occurring events (see "Life History").

Adult Abundance

Little is known about adult abundance in the Dungeness River core area, mainly due to lack of survey effort and difficult access to the upper watershed. However, the Dungeness River core area probably supports at least 500 but fewer than 1,000 adults. With fewer than 1,000 adults, this population is considered at increased risk of genetic drift.

From late August through November 1984, comprehensive redd surveys were conducted in the Gray Wolf and middle Dungeness Rivers. These surveys combined walking surveys with radio telemetry tracking. Eight redds were observed in the middle Dungeness, above the confluence with the Gray Wolf River and below the impassable barrier, and 32 redds were observed in the Gray Wolf River local population area. This probably represents approximately 90 percent of the redds in the two local populations (L. Ogg, USFS, pers. comm. 2004b). There appear to be two spawning peaks during the year, with large (27- to 30-inch) bull trout observed during the second peak.

Productivity

Bull trout in the Dungeness core area are considered at risk of extirpation until sufficient information is collected to properly assess productivity.

Connectivity

Barriers to fish movement and migration in the Dungeness River core area include improperly sized or installed culverts throughout the core area. Connectivity between the Dungeness River and its floodplain has been eliminated by diking to prevent flooding. Migration during late summer and early fall can be blocked by reduced flows from water diversions for irrigation in the lower Dungeness watershed. Migration at certain times of the year may be blocked by the WDFW fish hatchery collection rack on the lower Dungeness River. In addition, the hatchery water intake is a complete barrier to upstream fish passage in Canyon Creek. Despite these alterations, migratory bull trout persist in both local populations. Bull trout in this core area have diminished risk of extirpation from habitat isolation and fragmentation.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, Federal actions occurring in the Dungeness River core area have caused 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. Capture and handling during implementation of section 6 and section 10(a)(1)(A) permits have directly affected bull trout in the Dungeness core area.

The number of non-Federal actions occurring in the Dungeness River core area since the bull trout listing is unknown. Activities conducted on a regular basis, such as emergency flood control, development, and infrastructure maintenance, affect riparian and instream habitat and probably negatively affect bull trout.

One of the greatest causes of bull trout habitat degradation in the upper Dungeness River watershed is the presence of forest roads in an area having naturally unstable geology and steep slopes. Mass wasting and sediment delivery to streams are common problems. The lower watershed has been permanently modified by timber harvest and development into farming and housing areas. Water rights are over-appropriated in the Dungeness River. Consequently, water diversions have altered stream flows, resulting in increased water temperatures, seasonal migration barriers, and false attractions of bull trout to other streams. Storm water runoff from urban and residential development and agricultural practices also affect water quality. Incidental mortality of bull trout due to tribal and recreational fishing are likely affecting bull trout.

Reasons for Decline

Threats to bull trout in the Dungeness River core area include:

- Past and current timber harvest and harvest-related activities, such as roads, have degraded habitat conditions (e.g., fisheries, water quality, and connectivity) in the upper watershed, which has a naturally unstable geology with steep slopes that are susceptible to mass wasting.

- Past and current agricultural practices and the over-appropriation of water rights negatively affect instream flow, increase water temperatures, and increase sediment deposition in the streambed. Other impacts include blocked migration, decreased juvenile rearing areas, false attractions of bull trout to other streams, transportation of pollutants in irrigation flows, reduced amounts of large woody debris, and loss of estuarine rearing and foraging habitat.

- Water quality has been degraded by municipal, agricultural, and industrial effluent discharges and development.

- Residential and urban development along the shore, which include intertidal filling, bank armoring, and shoreline modifications, have caused the loss of extensive eelgrass meadows in the nearshore.

- Bull trout are susceptible to incidental mortality associated with tribal gill-net fisheries, which target coho and steelhead at the mouth of the Dungeness River for approximately 74 days per year. Although recreational fishing for bull trout has been closed in the Dungeness River core area since 1994, incidental catch does occur, particularly during the early portion of the winter steelhead fisheries (NMFS, *in litt.* 2004).

- Predation by eagles and ospreys has caused the mortality of several fish in the Dungeness River (L. Ogg, USFS, pers. comm. 2004a).

Elwha Core Area

The core area comprises 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. There is no upstream passage at either the Elwha Dam or Glines Canyon Dam, which fragment the core area.

Anadromous, fluvial, adfluvial, and resident life history forms probably occupy Elwha core area, although there is no available information. No spawning sites have been identified above the two dams, and there probably is little habitat suitable for bull trout spawning and incubation downstream from the dams. Elevated stream temperatures in both the lower and middle reaches of the Elwha River, due to the dams, likely limit reproducing populations of bull trout.

The status of a bull trout population in a core area 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 2004b).

Number and Distribution of Local Populations

Only one local population has been identified in the Elwha core area. However, future surveys may increase the number of local populations. Although no spawning areas have been identified, the presence of multiple age classes of bull trout in the Elwha River and accessible tributaries upstream from Glines Canyon Dam indicates spawning and juvenile rear occur in the area. Many of the available tributaries have limited accessible habitat. The Little River has been identified as a potential local population, based on the availability of suitable habitat and the likelihood of spawning occurring when the Elwha and Glines Canyon dams are removed. With only one local population, bull trout in the Elwha core are considered at increased risk of extirpation and adverse effects from random naturally occurring events (see "Life History").

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. At the time of listing, bull trout were rare (i.e., one or two fish per year) in the Elwha River below the Elwha dam. Thirty-one bull trout, with sizes ranging from 250 to 620 millimeters, were documented in this section of the river during snorkel surveys in 2003 (G. Pess, NMFS, *in litt.* 2003).

There is no information on trends in abundance of Elwha River bull trout, and the status of Elwha River bull trout is unknown. Consequently, the bull trout population in this core area is considered at risk of genetic drift.

Productivity

Bull trout in the Elwha core area are considered at risk of extirpation until sufficient information is collected to properly assess productivity.

Connectivity

The Elwha and Glines Canyon Dams in the Elwha River fragment the populations of bull trout in the Elwha core area. Restoration of connectivity in the Elwha River will be required to allow full expression of the bull trout's migratory life history form, including anadromy.

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, which 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. Capture and handling during implementation of section 6 and section 10(a)(1)(A) permits have directly affected bull trout in the Elwha core area.

The number of non-Federal actions occurring in the Elwha River core area since the bull trout listing is unknown.

State forest practice regulations were significantly revised in 2000, following the Forest and Fish agreement (FFR 1999; WFPB 2001). Revised regulations increased riparian protection, unstable slope protection, and recruitment of large wood; road standards improved significantly over the old regulations. Because there is biological uncertainty associated with some of the prescriptions, the Forest and Fish agreement relies on an adaptive management program for assurance that the new rules will meet the conservation needs of bull trout. The updated regulations will significantly reduce the level of future timber harvest impacts to bull trout streams on private lands. However, most negative effects from past forest practices will likely continue to be a threat for decades.

Reasons for Decline

Threats to bull trout in the Elwha core area include the following:

- Two dams in the Elwha River prevent connectivity, increase injury and mortality of bull trout attempting to navigate through the dams, reduce spawning gravel recruitment, prevent recruitment of fluvially transported sediment to the estuary, affect the beach and eelgrass beds in the estuary, and increase water temperatures below the dams.

- Some commercial timber harvest occurring on private lands in the Elwha core area, outside of the Olympic National Park, have 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 has severely affected nearshore and estuary habitat and processes.
- Incidental mortalities to bull trout from tribal salmon and steelhead gill-net fisheries are likely affecting bull trout in the Elwha core area.

Hoh River Core Area

The Hoh River core area comprises the Hoh and South Fork Hoh Rivers and associated tributaries. Active glaciers at the headwaters of the Hoh River watershed deliver both cold water and "glacial flour" to the mainstem.

Bull trout occur throughout the mainstem Hoh and South Fork Hoh Rivers. However, bull trout were not detected in 17 of 18 tributaries surveyed in the upper Hoh River. A series of cascades in the upper Hoh River (at RM 48.5) may be a barrier to upstream fish passage. There is a potential barrier to upstream fish passage in the South Fork Hoh River at RM 14.

Resident and migratory life history forms of bull trout, including anadromous forms, likely occur in the Hoh River core area. Genetic analysis has identified only bull trout (no Dolly Varden) in the Hoh core area (Spruell and Maxwell 2002).

The status of bull trout in a core area 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 2004b).

Number and Distribution of Local Populations

Two local populations have been identified: (1) Hoh River above the confluence with the South Fork Hoh River and (2) South Fork Hoh River. With only two local populations, the bull trout in this core area is considered at increased risk of extirpation and adverse effects from random naturally occurring events (see "Life History").

Adult Abundance

Historically the Hoh core area likely comprised the largest population of bull trout on the Washington coast (Mongillo 1993). Currently there is insufficient information for a precise estimate of adult bull trout abundance, but the Hoh core area probably supports at least 500 but fewer than 1,000 adults. With fewer than 1,000 adults, this population is considered at increased risk of genetic drift.

Productivity

Bull trout in the Hoh core area are considered at risk of extirpation until sufficient information is collected to properly assess productivity.

Connectivity

Barriers to fish movement and migration in the Hoh core area include improperly sized or installed culverts in several locations. The mainstem is disconnected from off-channel habitats and adjacent riparian forest by riprap for bank armoring along the Upper Hoh Road. Impassable barriers of cedar spalt debris have formed in coastal rivers and streams in the core area. Holding and rearing areas for adult bull trout during spawning migration and for juveniles during rearing movements among different stream reaches are reduced due to reduction of instream large woody debris. Despite these habitat alterations, migratory bull trout persist in the Hoh River core area. Recent studies have shown that bull trout in the Hoh River core area move into adjacent independent coastal tributaries (Brenkman and Corbett 2003). Bull trout in this core area have diminished risk of extirpation from habitat isolation and fragmentation.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, Federal actions occurring in the Hoh River core area have resulted in harm to, or harassment of, bull trout. These actions include statewide Federal restoration programs, which 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. Capture and handling during implementation of section 6 and section 10(a)(1)(A) permits have directly affected bull trout in the Hoh core area.

The number of non-Federal actions occurring in the Hoh River core area since the bull trout listing is unknown.

State forest practice regulations were significantly revised in 2000, following the Forest and Fish agreement (FFR 1999; WFPB 2001). Revised regulations increased riparian protection, unstable slope protection, and recruitment of large wood; road standards improved significantly over the old regulations. Because there is biological uncertainty associated with some of the prescriptions, the Forest and Fish agreement relies on an adaptive management program for assurance that the new rules will meet the conservation needs of bull trout. The updated regulations will significantly reduce the level of future timber harvest impacts to bull trout streams on private lands. However, most negative effects from past forest practices will likely continue to be a threat for decades.

Reasons for Decline

Threats to bull trout in the Hoh River core area include:

- Past and current timber harvest and harvest-related activities, such as roads, have degraded habitat conditions (e.g., fisheries, water quality, and connectivity) in the lower and middle watershed. Numerous steep slopes are susceptible to mass wasting and channelized landslides. The resulting substantial increase in the number of debris flows has reduced macroinvertebrate populations in the Hoh River. Riparian roads have increased fine sediments and peak flows.

- Other impacts from logging include reduced amounts of large woody debris, altered stream morphologies (especially reduced pool area and quality), and loss of riparian vegetation leading to increased water temperatures. Cedar spalts in several tributaries block fish passage, impede water flows, increase water temperature, leach tannins into the water, inhibit plant growth in the riparian area, and form dams that carve stream- banks and increase fine sediments.

- Riprap for bank armoring along the Upper Hoh Road has prevented channel migration and formation of new habitats, created unnatural meander patterns, and disconnected the mainstem from off-channel habitats and adjacent riparian forest.

- Tribal and recreational fisheries cause incidental mortality of bull trout and are likely affecting the local populations.

- Black spot disease may be a factor in the decline of bull trout in the Hoh River.

<u>Queets Core Area</u>

The Queets core area comprises the Queets River, all of its tributaries, and the estuary. The Queets mainstem, except for the lower 8 miles, is contained entirely within a narrow corridor of the Olympic National Park. The tributaries flow through the Quinault Indian Reservation, Olympic National Forest, and State and private landholdings.

Fluvial, resident, and anadromous life history forms of bull trout occur in the Queets core area.

The status of a bull trout population in a core area 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 2004b).

Number and Distribution of Local Populations

One local population has been identified: Queets River and associated tributaries upstream from the confluence with Tshletshy Creek. Bull trout occur in the Queets River up to river mile 46; in the Salmon, Sams, and Clearwater Rivers; and in Matheny Creek. The Queets River mainstem and tributaries are designated as mixed use (i.e., rearing, foraging, migration, overwintering). Spawning occurs in the mainstem river between river miles 45 and 48. With only one local population, bull trout in this core area are considered at increased risk of extirpation and adverse effects from random naturally occurring events (see "Life History").

Adult Abundance

The Queets core area probably supports at least 500 but fewer than 1,000 adults. With fewer than 1,000 adults, the bull trout population in this core area is considered at increased risk of genetic drift.

Productivity

The bull trout population in the Queets core area is considered to be at risk of extirpation until sufficient information is collected to properly assess productivity.

Connectivity

Bull trout occur in the Queets River from the marine waters of the anadromous zone up to the headwater spawning sites. Although there are barriers to movement (e.g., impassable culverts) in some tributaries, there are no barriers to movement in the mainstem Queets River. This migratory corridor is relatively pristine and intact.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, several Federal actions occurring in the Queets core area may have resulted in harm to, or harassment of, bull trout. These actions include forest management activities and culvert replacements outside of the local population. The culvert replacements are designed to provide long-term benefits to the watershed and bull trout. The more recent forest management activities that are consistent with the Quinault Indian Reservation 10-year Forest Management Plan incorporate riparian buffers and conservation measures designed to reduce impacts to bull trout. No section 6 or section 10(a)(1)(A) permits have been issued in the Queets core area for effects to bull trout through capture and handling.

The number of non-Federal actions occurring in the Queets core area since the bull trout listing is unknown. State forest practice regulations were significantly revised in 2000, following the Forest and Fish agreement (FFR 1999; WFPB 2001). Revised regulations increased riparian protection, unstable slope protection, and recruitment of large wood; road standards improved significantly over the old regulations. Because there is biological uncertainty associated with some of the prescriptions, the Forest and Fish agreement relies on an adaptive management program for assurance that the new rules will meet the conservation needs of bull trout. The updated regulations will reduce the level of future timber harvest impacts to bull trout streams on private lands. However, most negative effects from past forest practices will likely continue to be a threat for decades.

Reasons for Decline

Threats to bull trout in the Queets core area include:

- Past timber harvest and harvest-related activities, such as roads, degraded habitat conditions in the Clearwater, Sams, and Salmon Rivers and Matheny Creek.
- Road densities in the Clearwater River basin are high, and roads throughout the core area are in need of repair.
- Bull trout are susceptible to incidental mortality associated with gill-net fisheries, which target salmon and steelhead at the mouth of the Queets River, and incidental hooking mortality from recreational fishers.

Quinault Core Area

The Quinault core area comprises the mainstem Quinault and North Fork Quinault Rivers, associated tributaries, the estuary of the river, and Lake Quinault. Fifty-one percent of the core area lies within the Olympic National Park, 32 percent is owned by the Quinault Indian Nation, 13 percent is managed by the Olympic National Forest, and the remaining 4 percent are private landholdings, with Rayonier Timberlands Company, the largest private landowner.

Fluvial, adfluvial, anadromous and, possibly, resident life history forms of bull trout occur in the Quinault core area. The Cook Creek watershed provides foraging and overwintering habitat.

The status of a bull trout population in a core area 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 2004b).

Number and Distribution of Local Populations

Two local populations have been identified: 1) North Fork Quinault River and its associated tributaries and 2) upper mainstem Quinault River (East Fork), upstream from the confluence with the North Fork Quinault River. These two local populations occur entirely within the Olympic National Park. Although there may be more than two local populations, there is insufficient information at this time to identify additional local populations. Dolly Varden occur with bull trout in the upper mainstem Quinault River. There is no evidence of hybridization or introgression between the two species (Leary and Allendorf 1997).

Bull trout occur from the headwaters to the estuary and in numerous tributaries above the lake. Although spawning sites have not been located in the Quinault core area, the presence of multiple age classes of bull trout in both local populations indicates spawning and rearing does occur. With only two local populations, bull trout in this core area are considered at increased risk of extirpation and adverse effects from random naturally occurring events (see "Life History").

Adult Abundance

Currently there is insufficient information for a precise estimate of adult bull trout abundance, but the Quinault core area probably supports at least 500 but fewer than 1,000 adults. With fewer than 1,000 adults, this population is considered at increased risk of genetic drift.

Productivity

Bull trout in the Quinault core area are considered at risk of extirpation until sufficient information is collected to properly assess productivity.

Connectivity

Migratory bull trout occur in both local populations in the Quinault core area. Adequate connectivity between the two local populations, and throughout the core area, diminishes the risk of extirpation of bull trout in the core area from habitat isolation and fragmentation.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, several Federal actions occurring in the Quinault core area have resulted in harm to, or harassment of, bull trout. These actions primarily consist of forest management activities and road repair outside of the local populations. Capture and handling during implementation of section 6 and section 10(a)(1)(A) permits have directly affected bull trout in the Quinault core area. The only known Federal action occurring in a local population was a road reconstruction adjacent to the Upper East Fork Quinault River. In general, the road repair actions were designed to provide long-term benefits to the watershed and bull trout. The more recent forest management activities that are consistent with the Quinault Indian Reservation 10-year Forest Management Plan incorporate riparian buffers and conservation measures designed to reduce impacts to bull trout.

The number of non-Federal actions occurring in the Quinault core area since the bull trout listing is unknown. State forest practice regulations were significantly revised in 2000, following the Forest and Fish agreement (FFR 1999; WFPB 2001). Revised regulations increased riparian protection, unstable slope protection, and recruitment of large wood; road standards improved significantly over the old regulations. Because there is biological uncertainty associated with some of the prescriptions, the Forest and Fish agreement relies on an adaptive management program for assurance that the new rules will meet the conservation needs of bull trout. The updated regulations will reduce the level of future timber harvest impacts to bull trout streams on private lands. However, most negative effects from past forest practices will likely continue to be a threat for decades.

Reasons for Decline

Threats to bull trout in the Quinault core area include:

- Tributaries and rivers outside of the Olympic National Park have been affected by timber harvest.

- Current and long-term historical impacts from roads and transportation networks affect fisheries, water quality, and connectivity. The core area below Lake Quinault has been modified by extensive road construction and timber harvest activities.

- Bull trout are susceptible to incidental mortality associated with gill-net fisheries, which target salmon and steelhead at the mouth of the Quinault River, and to incidental hooking mortality from recreational anglers.

- Physical reductions of stream channel depths and cover habitat, along with flow regime changes in the mid to lower subbasins, have altered migratory corridors.

Skokomish Core Area

The Skokomish core area comprises the South Fork Skokomish River, North Fork Skokomish River (above Cushman Dam), Vance Creek, and their tributaries. Mainstem rivers in the area provide important foraging, migration, and overwintering habitat for subadult and adult bull trout. Available spawning and early rearing habitat is limited and fragmented. One lake in the core area, Lake Cushman, supports a typical adfluvial population.

Fluvial, adfluvial and, possibly, anadromous and resident life history forms of bull trout occur in the Skokomish core area.

The status of a bull trout population in a core area 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 2004b).

Number and Distribution of Local Populations

Two local populations have been identified: 1) North Fork Skokomish River (including Elk and Slate Creeks), and 2) South Fork Skokomish River (including Church Creek). Bull trout are distributed throughout the Skokomish core area, mainly downstream of barriers to migration in the South Fork Skokomish River and upstream of Cushman Dam in the North Fork Skokomish River. A third potential local population may occur in Brown Creek. With only two known local populations, bull trout in this core area are at increased risk of local extirpation and adverse effects from random naturally occurring events (see "Life History").

Adult Abundance

The Skokomish core area likely supports fewer than 200 adult bull trout. Olympic National Forest estimates 60 adults occupy the South Fork Skokomish (WSCC 2003). In the North Fork Skokomish River bull trout numbers remained relatively stable from 1990 to 1996. Counts during this period averaged 302 adults, ranging from 250 to 413. More recent counts from 1998 to 2004 indicate a decline to an average of 100 adults, ranging from 89 to 133 (S. Brenkman, Olympic National Park, *in litt.* 2003; S. Brenkman, pers. comm. 2004). With fewer than 1,000 adults, the bull trout population in this core area is considered at risk of genetic drift. With fewer than 100 adults, the South Fork Skokomish River local population is considered at risk from inbreeding depression.

The bull trout population in this core area is one of the most depressed in the Olympic Peninsula Management Unit. The decline in numbers of adult bull trout in the North Fork Skokomish River and the low number of spawning adults in the South Fork Skokomish River indicate that bull trout in this core area are at increased risk of extirpation and adverse effects from random naturally occurring events (see "Life History").

Productivity

The Olympic National Forest completed intensive redd surveys in the core area over a 3-year period. In 2000 in the South Fork Skokomish River, 20 redds were located in 5 spawning areas between river mile 19 and river mile 23.4, and 2 reds were located in the lower 0.5 mile of Church Creek. One questionable redd was observed in Brown Creek. There were 18 redds in the South Fork Skokomish River and 2 Church Creek in 2001. In 2002, there were13 redds in the South Fork Skokomish River and 1 in Church Creek.

Bull trout in the Elwha core area are considered at risk of extirpation until sufficient information is collected to properly assess productivity.

Connectivity

Migratory bull trout likely are present in the South Fork Skokomish River local population. Bull trout in the North Fork Skokomish River local population occupy Lake Cushman and the river upstream from the reservoir in Olympic National Park. Adfluvial bull trout occupy the reservoir at Lake Cushman, the North Fork Skokomish River, and Elk and Slate Creeks. Bull trout occur upstream from Lake Cushman to the confluence of Four Streams in Olympic National Park. Restoration of the migratory corridor between the two local populations and between the local populations and Hood Canal will be required to allow full expression of the bull trout's migratory life history form.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, Federal actions occurring in the Skokomish River core area have resulted in harm to, or harassment of, bull trout. These actions include statewide Federal restoration programs, which 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; the Cushman hydropower project; and section 10(a)(1)(B) permits for HCPs addressing forest management practices. Capture and handling during implementation of section 6 and section 10(a)(1)(A) permits have directly affected bull trout in the Skokomish core area.

The number of non-Federal actions occurring in the Skokomish River core area since the bull trout listing is unknown.

State forest practice regulations were significantly revised in 2000, following the Forest and Fish agreement (FFR 1999; WFPB 2001). Revised regulations increased riparian protection, unstable slope protection, and recruitment of large wood; road standards improved significantly over the old regulations. Because there is biological uncertainty associated with some of the prescriptions, the Forest and Fish agreement relies on an adaptive management program for assurance that the new rules will meet the conservation needs of bull trout. The updated regulations will significantly reduce the level of future timber harvest impacts to bull trout streams on private lands. However, most negative effects from past forest practices will likely continue to be a threat for decades.

The Service, National Marine Fisheries Service, and the Environmental Protection Agency assisted the Simpson Timber Company in completing a HCP in 2000. The principle area of the HCP overlaps bull trout distribution in the South Fork Skokomish River and the accessible reaches of its major tributaries. The HCP includes management prescriptions designed to address wetlands, unstable slopes, road construction, road maintenance and decommissioning, certain harvest limitations to moderate snowmelt runoff, and riparian buffers that vary from 5 to 65 meters. The HCP also includes provisions for research and monitoring and a scientific committee of stakeholders.

Reasons for Decline

Threats to bull trout in the Skokomish core area include the following:

- Past timber harvest and harvest-related activities, such as roads, have degraded habitat conditions, including water quality, in the upper Skokomish River.

- Road densities in the Skokomish River basin represent some of the highest found west of the Cascade Mountains in Washington, and roads throughout the core area are in need of repair.

- Agricultural and livestock practices affect foraging, migration, and overwintering habitat in the lower watershed. Significant effects to the floodplain, as well as bull trout habitat, are caused by blocking fish passage, altering stream morphology, and degrading water quality.

- Diversion of water for hydropower production has eliminated connectivity between bull trout habitat upstream from the dams and habitat in the lower North Fork Skokomish River, the mainstem Skokomish River, the South Fork Skokomish River, and Hood Canal.

- Diversion of water has reduced flows in the North Fork Skokomish River, which has reduced sediment transport capabilities and caused additional aggradation of the river.

- Incidental mortality of migrating bull trout caused by tribal gill-net fisheries, and recreational and tribal fisheries, poses a threat in the North Fork Skokomish River because of the low numbers of bull trout documented in recent years.

- Rural development in the lower watershed habitat has degraded water quality.

Core Areas – Puget Sound Management Unit

Chilliwack Core Area

The Chilliwack core area comprises those portions of the Chilliwack River (a transboundary system flowing from the United States northwest into British Columbia) and its major tributaries, including Silesia and Tomyhoi Creeks, and the Sumas River in United States. However, the British Columbia portion of the Chilliwack system is functionally part of the core area.

Adfluvial, fluvial, and potentially, resident and anadromous life history forms of bull trout occur in the Chilliwack core area. The adfluvial bull trout population in the Chilliwack core area occupies Chilliwack Lake in the upper Chilliwack River drainage.

Spawning and rearing in the Chilliwack core area probably occurs in all accessible reaches in the United States. Rearing bull trout occupy the mainstem Chilliwack River from Chilliwack Lake upstream to Easy Creek, where accessible habitat ends. Native char occur in the Little Chilliwack River, where habitat is essentially pristine and likely supports some level of bull trout spawning, although spawning has not been confirmed. The extent of spawning and rearing distribution in Silesia Creek is unknown. Migratory bull trout in this system spend all or part of their subadult and adult lives in the mainstem of the Chilliwack River, Chilliwack Lake, and Fraser River. Chilliwack Lake apparently is a very important foraging area.

The status of the bull trout population in a core area 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 2004a).

Number and Distribution of Local Populations

Three local populations have been identified in the U.S. portion of this core area: (1) Upper Chilliwack River (including Easy, Brush, and Indian Creeks), (2) Little Chilliwack River, and (3) Selesia Creek. An additional seven local populations have been identified in British Columbia. The three local populations identified in the U.S. are considered at intermediate risk of extirpation and adverse effects from random naturally occurring events (see "Life History"). When the seven local populations from the British Columbia are also considered, the risk of extirpation is diminished.

Adult Abundance

The Chilliwack core area likely supports between 500 and 750 adults in the three U.S. local populations. However, with inclusion of the local populations in Canada, the Chilliwack system likely supports more than 1000 adults. The Chilliwack River local population is likely near, or in excess of, 100 adults, which minimizes the deleterious effects of inbreeding. Numbers of adults in the remaining local populations and the risk from inbreeding are unknown. The bull trout population in the Chilliwack core area is considered unlikely to be at risk from genetic drift.

Productivity

Bull trout in the Chilliwack core area are considered at an increased risk of extirpation until sufficient information is collected to properly assess productivity.

Connectivity

Migratory bull trout likely are present in most of the local populations in the Chilliwack core area. Consequently, the Chilliwack core is at diminished risk of extirpation from isolation and habitat fragmentation.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, Federal actions occurring in the Chilliwack core area may have caused harm to, or harassment of, bull trout. These actions include statewide Federal restoration programs, which include riparian restoration, replacement of fish passage barriers and fish habitat improvement projects, and section 10(a)(1)(B) permits for HCPs addressing forest management practices. No section 10(a)(1)(A) permits have been issued in the Chilliwack core area for effects to bull trout from capture and handling.

The number of non-Federal actions occurring in the Chilliwack core area since the bull trout listing is unknown. The majority of the core area is in Federal ownership and in pristine condition. Consequently, it is unlikely many non-Federal actions have occurred in this core area.

Reasons for Decline

Habitat in the United States portion of the population is in excellent to pristine condition, except habitat affected by agricultural practices along the Sumas River. Threats to the bull trout in the Chilliwack core area occur primarily in Canada. In British Columbia, the status of the Chilliwack River stock of bull trout is categorized as at "presumed conservation risk" (i.e., current threats are believed to be significantly affecting the population or population is considered at risk) (BCMWLAP 2002).

Threats to bull trout in the Chilliwack core area include:

- Significant timber harvest has occurred throughout the drainage and is ongoing.
- Agricultural and livestock practices along the mainstem Chilliwack River and the Sumas River have significantly affected these river systems.
- Residential development and urbanization have affected foraging, migration, and overwintering habitat.
- Current fisheries management in British Columbia retains bull trout in Canada, reducing the number of spawners returning to the United States.

Lower Skagit Core Area

The Lower Skagit core area comprises the Skagit basin downstream of Seattle City Light's Diablo Dam, including the mainstem Skagit River and the Cascade, Sauk, Suiattle, White Chuck, and Baker Rivers, and the lake systems above Shannon and Baker Dams.

Bull trout occur throughout the Lower Skagit core area, including fluvial, adfluvial, resident, and anadromous life history forms. Resident life history forms, found in a number of locations in the core area, often co-occur with migratory life history forms. Adfluvial bull trout occur in Baker Lake and Gorge Lake. Fluvial bull trout forage and overwinter in the larger pools of the upper portion of the mainstem Skagit River and, to a lesser degree, in the Sauk River (WDFW et al. 1997; Kraemer, *in litt.* 2003)

Many bull trout extensively use the lower estuary and nearshore marine areas for extended rearing and subadult and adult foraging. Key spawning and early rearing habitat, found in the upper portion of much of the basin, is generally on federally protected lands, including North Cascades National Park, North Cascades Recreation Area, Glacier Peak Wilderness, and Henry M. Jackson Wilderness Area.

The status of the bull trout population in a core area 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 2004a).

Number and Distribution of Local Populations

Nineteen local populations were identified initially: 1) Bacon Creek, 2) Baker Lake, 3) Buck Creek, 4) Cascade River, 5) Downey Creek, 6) Forks of Sauk River, 7) Goodell Creek, 8) Illabot Creek, 9) Lime Creek, 10) Lower White Chuck River, 11) Milk Creek, 12) Newhalem Creek, 13) South Fork Cascade River, 14) Straight Creek, 15) Sulphur Creek, 16) Tenas Creek, 17) Upper South Fork Sauk River, 18) Upper Suiattle River, and 19) Upper White Chuck River. Although initially identified as potential local populations, Stetattle Creek and Sulphur Creek (Lake Shannon), each now meets the definition of local population based on subsequent observations of juvenile bull trout and prespawn migratory adult bull trout (R2 Resource Consultants and Puget Sound Energy 2005; J. Shannon, *in litt.* 2004). With 21 local populations, bull trout in the Lower Skagit core area are at diminished risk of extirpation and adverse effects from random naturally occurring events (see "Life History").

Adult Abundance

The Lower Skagit core area, with a spawning population of migratory bull trout that numbers in the thousands, is probably the largest population in Washington (C. Kraemer, *in litt.* 2001). Consequently, the bull trout population in this core area is not considered at risk from genetic drift. Fewer than 100 migratory adults, and a limited number of resident fish, use the Forks of the Sauk River local population; however, the migratory component appears abundant and is increasing (C. Kraemer, *in litt.* 2003). Although fewer than 100 adults probably occur in Tenas Creek, this local population is believed to be increasing. The Straight Creek population includes fewer than 100 migratory adults and an unknown number of resident fish (C. Kraemer, *in litt.* 2001), but the migratory component appears stable. The Lime Creek local population probably has fewer than 100 migratory adults, but resident and migratory components are considered abundant. The South Fork Cascade River local population probably has fewer than 100 migratory adults (C. Kraemer, *in litt.* 2001); however, resident and migratory components are considered stable. Adult abundances in Newhalem and Stettatle Creeks and Baker Lake are unknown. The majority of local populations in the core area include 100 adults or more. However, some local populations probably have fewer than 100 adults and may be at risk from inbreeding depression.

Productivity

Long-term redd counts in the index areas of the Lower Skagit core area generally indicate stable to increasing population trends.

Connectivity

The presence of migratory bull trout in most of the local populations indicates the bull trout in the Lower Skagit core area has a diminished risk of extirpation from habitat isolation and fragmentation. However, the lack of connectivity of the Baker Lake system and Stetattle Creek in the Gorge Lake system with other occupied sites in the core area is a concern.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, Federal actions occurring in the Lower Skagit core area may have caused harm to, or harassment of, bull trout. These actions include statewide Federal restoration programs, which 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. Capture and handling, and indirect mortality, during implementation of section 6 and section 10(a)(1)(A) permits have directly affected bull trout in the Lower Skagit core area.

The number of non-Federal actions occurring in the Lower Skagit core area since the bull trout listing is unknown. Activities conducted on a regular basis, such as emergency flood control, development, and infrastructure maintenance, affect riparian and instream habitat and probably have negatively affected bull trout.

Reasons for Decline

Threats to bull trout in the Lower Skagit core area include:

- Gorge and Baker Dams restrict connectivity of the Stetattle Creek and Baker Lake bull trout populations with the majority of other populations in the core area.

- Operations of the Lower Baker Dam occasionally have significantly affected water quantity in the lower Baker and Skagit Rivers.

- Agricultural practices, residential development, and the transportation network, with related stream channel and bank modifications, have caused the loss and degradation of foraging, migration, and overwintering habitats in mainstem reaches of the major forks and in a number of the tributaries.

- Nearshore foraging habitats have been, and continue to be, affected by agricultural practices and development activities.

<u>Nooksack Core Area</u>

The Nooksack core area comprises the Nooksack River and its tributaries, including the North, Middle, and South Fork Nooksack Rivers. Fluvial, anadromous and, possibly, resident life history forms of bull trout occur in the Nooksack core area. Bull trout spawning occurs in the North, Middle, and South Fork Nooksack Rivers and their tributaries. Post dispersal rearing, and subadult and adult foraging, probably occur throughout accessible reaches below barriers to anadromous fish. Overwintering likely occurs primarily in the lower mainstem reaches of the three forks and in the mainstem Nooksack River.

Both bull trout and Dolly Varden occur in the Nooksack core area, but the level of interaction between the two species and degree of overlap in their distribution is not known. However, limited genetic analysis and observational data suggest Dolly Varden in this core area inhabit stream reaches above barriers to anadromous fish, while bull trout primarily occupy the accessible stream reaches below the barriers.

The status the bull trout population in a core area 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 2004a).

Number and Distribution of Local Populations

Ten local populations have been identified: 1) Lower Canyon Creek, 2) Glacier Creek, 3) Lower Middle Fork Nooksack River, 4) Upper Middle Fork Nooksack River, 5) Lower North Fork Nooksack River, 6) Middle North Fork Nooksack River, 7) Upper North Fork Nooksack River, 8) Lower South Fork Nooksack River, 9) Upper South Fork Nooksack River, and 10) Wanlick Creek. Spawning areas in the local populations apparently are small and dispersed. With 10 local populations, this core area is considered at intermediate risk of local extirpation and adverse effects from random naturally occurring events (see "Life History").

Adult Abundance

The Nooksack core area probably supports fewer than 1,000 adults and is considered at risk of genetic drift. Eight of the local populations likely have fewer than 100 adults each, based on the relatively low number of migratory adults observed returning to the core area. The Glacier Creek local population has approximately 100 adults, based on incidental redd counts and available spawning habitats. The Upper North Fork Nooksack River local population may support 100 adults, based on the number of persistent, small numbers of spawning adults observed in tributaries and available side channel habitat. Although the deleterious effects of inbreeding are minimized in these two local populations, the other eight local populations with few adults are considered at risk of inbreeding depression.

Productivity

Bull trout in the Nooksack core area are considered at increased risk of extinction until sufficient information is collected to properly assess productivity.

Connectivity

There is connectivity among most of the local populations, except for the Middle Fork Nooksack River, which has poor fish passage. There are road culvert barriers in several local populations. Consequently, the Nooksack core area is considered at intermediate risk of extirpation from habitat isolation and fragmentation.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, Federal actions occurring in the Nooksack core area may have resulted in harm to, or harassment of, bull trout. These actions include statewide Federal restoration programs, which 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. Capture and handling and indirect mortality during implementation of section 6 and section 10(a)(1)(A) permits have directly affected bull trout in the Nooksack core area.

The number of non-Federal actions occurring in the Nooksack core area since the bull trout listing is unknown. Activities conducted on a regular basis, such as emergency flood control, development, and infrastructure maintenance, affect riparian and instream habitat and probably negatively affect bull trout.

Reasons for Decline

Threats to bull trout in the Nooksack core area include:

- Past timber harvest and harvest-related activities, such as roads, have caused the loss or degradation of a number of spawning and rearing areas within local populations, as well as foraging, migration, and overwintering habitats.

- Bellingham Diversion has significantly reduced, if not precluded, connectivity of the Upper Middle Fork Nooksack River local population with the rest of the core area.

- Agricultural practices, residential development, the transportation network and related stream channel and bank modifications have caused the loss and degradation of foraging, migration, and overwintering habitat in mainstem reaches of the major forks and in a number of tributaries.

- Marine foraging habitats have and continue to be greatly affected by urbanization along nearshore habitats in Bellingham Bay and the Strait of Georgia.

- The potential for brook trout and brook trout/Dolly Varden hybrids detected in many parts of the Nooksack core area to increase their distributions is a significant concern.

Puyallup Core Area

The Puyallup core area comprises the Puyallup, Mowich, and Carbon Rivers; the White River, which includes the Clearwater, Greenwater, and the West Fork White Rivers; and Huckleberry Creek. Glacial sources in several watersheds drain the north and west sides of Mount Rainier and significantly influence both water and substrate conditions in the mainstem reaches. The location of many of the headwater reaches of the basin in either Mount Rainier National Park or designated wilderness areas (Clearwater Wilderness, Norse Peak Wilderness) provides pristine habitat conditions.

Anadromous and fluvial/resident bull trout local populations occur in the White River and Puyallup River systems. The Puyallup core area has the southernmost bull trout population, and the only anadromous bull trout population, in the Puget Sound Management Unit. Consequently, maintaining the bull trout population in this core area is critical to maintaining the overall distribution of migratory bull trout in the management unit.

The status the bull trout population in a core area 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 2004a).

Number and Distribution of Local Populations

Five local populations occur in the Puyallup core area: (1) upper Puyallup and Mowich Rivers, (2) Carbon River, (3) upper White River, (4) West Fork White River, and (5) Greenwater River. The Clearwater River is identified as a potential local population, but the occurrence of reproduction there is unknown (USFWS 2004a).

Information about the distribution and abundance of bull trout in this core area is limited because observations have generally been incidental to other fish survey work. The anadromous life history form in the Puyallup core area probably uses Commencement Bay and other marine nearshore habitats along Puget Sound. Both anadromous and fluvial/resident bull trout local populations occur in the White River and Puyallup River systems.

Spawning occurs in the upper reaches of this basin where higher elevations produce cool temperatures required by bull trout. Based on current survey data, bull trout spawning in this core area occurs earlier (September) than typically observed in other Puget Sound core areas (Marks et al. 2002). The known spawning areas in local populations are few in number and not widespread.

Rearing likely occurs throughout the upper Puyallup, Mowich, Carbon, upper White, West Fork White, and Greenwater Rivers. However, sampling indicates most rearing is confined to the upper reaches of the basin. The mainstem reaches of the White, Carbon, and Puyallup Rivers probably provide the primary foraging, migration, and overwintering habitat for migratory bull trout.

With fewer than 10 local populations, the Puyallup core area is at intermediate risk of extirpation and adverse effects from randomly naturally occurring events.

Adult Abundance

Abundance estimates are not available for most local populations in the Puyallup core area. Fewer than 100 adults probably occur in local populations in the White River system, based on adult counts at the Buckley fish trap. Although these counts may not adequately account for fluvial migrants that might not migrate below the facility, these counts do indicate few anadromous bull trout return to local populations in the White River system.

Productivity

Bull trout in the Puyallup core area are considered at increased risk of extinction until sufficient information is collected to properly assess productivity.

Connectivity

Migratory bull trout are present in some local populations in the Puyallup core area. Although connectivity between the upper Puyallup and Mowich River's local population and other local populations has been improved recently, very low numbers of migratory fish pass at the Buckley Diversion. The low abundance of migratory life history forms limits the possibility for genetic exchange and local population re-establishment. Consequently, the Puyallup core area is at intermediate risk of extirpation from habitat isolation and fragmentation.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, the Service has issued Biological Opinions that exempted incidental take in the Puyallup River core area. These incidental take exemptions were in the form of harm and harassment, primarily from temporary sediment increases during in-water work, loss or alteration of habitat, and handling of fish. None of these projects were determined to result in jeopardy to the bull trout. The combined effects of actions evaluated under these Biological Opinions have resulted in short-term and long-term adverse effects to bull trout and degradation of bull trout habitat within the core area.

Implementation of section 6 and 10(a)(1)(A) permits have directly affected bull trout. As of May 2005, four juvenile bull trout were reported captured and handled in the Puyallup core area.

Amendments to the Washington Department of Natural Resource's Habitat Conservation Plan (USFWS 1998b) allow incidental take of bull trout associated with habitat degradation or loss from 29 miles of road construction and maintenance per year and from selective and thinning harvest of 158 acres per year. This amendment added the Coastal-Puget Sound Distinct Population Segment and the Columbia River Distinct Population Segment in the lower Columbia River downstream from Greenleaf and Hamilton Creeks.

Reasons for Decline

Threats to bull trout in the Puyallup core area include:

- Extensive past and ongoing timber harvest and associated road construction continue to affect bull trout spawning and rearing areas in the upper watershed.

- Agricultural practices continue to affect foraging, migration, and overwintering habitats for bull trout in the lower watershed.

- Dams and diversions have significantly affected migratory bull trout in the core area. Until passage was recently restored, the Electron Diversion Dam isolated bull trout in the upper Puyallup and Mowich Rivers for nearly 100 years and drastically reduced the abundance of migratory life history forms in the Puyallup River. Buckley Diversion and Mud Mountain Dam have significantly affected the White River system in the past by impeding or precluding adult and juvenile migration and degrading foraging, migration, and overwintering habitats in the mainstem. Despite improvements, some of these impacts continue, but to a lesser degree.

- Urbanization and residential development and the marine port have significantly reduced habitat complexity and quality in the lower mainstem rivers and associated tributaries and largely eliminated intact nearshore foraging habitats for anadromous bull trout in Commencement Bay.

- The presence of brook trout in many parts of the Puyallup core area and their potential to increase in distribution, including National Park waters, are considered significant threats to bull trout. Brook trout in the Upper Puyallup and Mowich Rivers local population is of highest concern because of past isolation and the level of habitat degradation.

- Until the early 1990s, bull trout fisheries probably significantly reduced the overall bull trout population. Current legal and illegal fisheries in the Puyallup core area may significantly limit recovery of the local population because of low numbers of migratory adults.

- Water quality has been degraded due to municipal and industrial effluent discharges resulting from development, particularly in Commencement Bay.

Snohomish-Skykomish Core Area

The Snohomish-Skykomish core area comprises the Snohomish, Skykomish, and Snoqualmie Rivers and their tributaries. Bull trout occur throughout the Snohomish River system downstream of barriers to anadromous fish. Bull trout are not known to occur upstream of Snoqualmie Falls, upstream of Spada Lake on the Sultan River, in the upper forks of the Tolt River, above Deer Falls on the North Fork Skykomish River, or above Alpine Falls on the Tye River.

Fluvial, resident, and anadromous life history forms of bull trout occur in the Snohomish River/Skykomish core area. A large portion of the migratory segment of this population is anadromous. There are no lake systems within the basin that support an adfluvial population. However, anadromous and fluvial forms occasionally forage in a number of lowland lakes connected to the mainstem rivers.

The mainstems of the Snohomish, Skykomish, North Skykomish, and South Fork Skykomish Rivers provide important FMO habitat for subadult and adult bull trout. The amount of key spawning and early rearing habitat is more limited, in comparison with many other core areas, because of the topography of the basin. Rearing bull trout occur throughout most of the accessible reaches of the basin and extensively use the lower estuary, nearshore marine areas, and Puget Sound for extended rearing.

The status of the bull trout population in a core area 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 2004a).

Number and Distribution of Local Populations

Four local populations have been identified: 1) North Fork Skykomish River (including Goblin and West Cady Creeks), 2) Troublesome Creek (resident form only), 3) Salmon Creek, and 4) South Fork Skykomish River. With only four local populations, bull trout in this core area are considered at increased risk of extirpation and adverse effects from random naturally occurring events (see "Life History").

Adult Abundance

The Snohomish-Skykomish core area probably supports between 500 and 1,000 adults. However, this core area remains at risk of genetic drift. About half of the spawners in the core area occur in the North Fork Skykomish local population. This is one of two local populations in the core area (the other is South Fork Skykomish) that support more than 100 adults, which minimizes the deleterious effects of inbreeding. The Troublesome Creek population is mainly a resident population with few migratory fish. Although adult abundance is unknown in this local population, it is probably stable due to intact habitat conditions. The Salmon Creek local population likely has fewer than 100 adults. Although spawning and early rearing habitat in the Salmon Creek area is in good to excellent condition, this local population is at risk of inbreeding depression because of the low number of adults. Monitoring of the South Fork Skykomish local population indicates increasing numbers of adult migrants. This local population recently exceeded 100 adults and is not considered at risk of inbreeding depression (C. Jackson, Washington Department of Fish and Wildlife, pers. comm. 2004). Fishing is allowed in this system.

Productivity

Long-term redd counts for the North Fork Skykomish local population indicate increasing population trends. Productivity of the Troublesome Creek and Salmon Creek local populations is unknown but presumed stable, as the available spawning and early rearing habitats are considered to be in good to excellent condition. In the South Fork Skykomish local population, new spawning and rearing areas are being colonized, resulting in increasing numbers of spawners. Sampling of the North Fork and South Fork Skykomish local population areas indicates the overall productivity of bull trout in the Snohomish-Skykomish core area is increasing.

Connectivity

Migratory bull trout occur in three of the four local populations in the Snohomish-Skykomish core area (North Fork Skykomish, Salmon Creek, and South Fork Skykomish). The lack of connectivity with the Troublesome Creek local population is a natural condition. The connectivity between the other three local populations diminishes the risk of extirpation of bull trout in the core area from habitat isolation and fragmentation.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, Federal actions occurring in the Snohomish-Skykomish core area have caused harm to, or harassment of, bull trout. These actions include statewide Federal restoration programs, which 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. Capture and handling during implementation of section 6 and section 10(a)(1)(A) permits have directly affected bull trout in the Snohomish-Skykomish core area.

The number of non-Federal actions occurring in the Snohomish-Skykomish core area since the bull trout listing is unknown. However, activities conducted on a regular basis, such as emergency flood control, development, and infrastructure maintenance, affect riparian and instream habitat and probably negatively affect bull trout.

Reasons for Decline

Threats to bull trout in the Snohomish-Skykomish core area include:

- Past timber harvest and harvest-related activities, such as roads, have degraded habitat conditions in the upper watershed.

- Agricultural and livestock practices, including blocking fish passage, altering stream morphology, and degrading water quality in the lower watershed (FMO habitat), have significantly affected the floodplain itself, as well as bull trout habitat.

- Illegal harvest or incidental hooking mortality may occur at several campgrounds where recreational fishing is allowed by WDFW.

- Water quality has been degraded by municipal and industrial effluent discharges and development.

- Nearshore foraging habitat has been, and continues to be, affected by development activities.

Stillaguamish Core Area

The Stillaguamish core area comprises the Stillaguamish River basin, including the North Fork and South Fork Stillaguamish Rivers and their tributaries. Major tributaries to the North Fork Stillaguamish River include the Boulder River and Deer, Little Deer, and Higgins Creeks. Canyon Creek, the only major tributary to the South Fork Stillaguamish River, has minor tributaries including Milardy, Deer, Coal, Palmer, Perry, and Beaver Creeks.

Bull trout in the Stillaguamish core area, which occur throughout the Stillaguamish River basin, primarily include anadromous and fluvial life history forms (USFWS 2004a). There are no known populations in the North Fork Stillaguamish River above the barrier to migration at river mile 37.5 (C. Kraemer, WDFW, *in litt.* 1999). No resident populations have been found above any of the natural migratory barriers on Deer or Higgins Creeks. No exclusively resident populations have been identified in this core area, but the South Fork Stillaguamish River population has a strong resident component coexisting with migratory forms.

The South Fork Stillaguamish River upstream of Granite Falls has supported anadromous bull trout since the construction of a fishway in the 1950s. Previously the falls were impassable to anadromous fish. Anecdotal information from fish surveys in the 1920s and 1930s, however, suggest that native char likely were present above Granite Falls prior to construction of the fishway (WDFW 1998).

Spawning habitat is generally limited in the Stillaguamish core area and, apparently, only the upper reaches provide adequate spawning conditions. Bull trout spawn in the upper reaches of the accessible portions of the upper North Fork Stillaguamish River and its tributaries, including Deer and Higgins Creeks. There has been no extensive juvenile sampling or evaluation of spawning success in the North Fork Stillaguamish River. Bull trout in the Upper Deer Creek local population spawn in Higgins Creek, and spawning may occur in upper Little Deer Creek as well. Bull trout spawn in the Boulder River below the impassible falls at river mile 3. Although unconfirmed, spawning and rearing probably occurs in the Squire Creek system, which is similar in size to Boulder River and also influenced by snowmelt. Boulder River may become an additional local population when more distribution information is available.

Spawning areas in the South Fork Stillaguamish River and its tributaries include Canyon, Millardy, Deer, Coal, Beaver (probable spawning), and Palmer Creeks.

In the South Fork Stillaguamish River, bull trout spawn and rear in Palmer, Perry, and Buck Creeks and the upper South Fork mainstem above Palmer Creek. Recent spawning surveys identified a major spawning area above the Palmer Creek confluence. Between 50 and 100 bull trout spawn in this reach. Electrofishing surveys also documented high densities of juveniles (D. Downen, WDFW, *in litt.* 2003). Spawning and early rearing habitat in the South Fork Stillaguamish River is considered to be in fair condition. Although bull trout spawn in the upper South Fork Stillaguamish River and other tributaries, available habitat is partially limited by gradient and competition with coho salmon. Upstream movement of bull trout from the lower river depends on proper functioning of the fish ladder at Granite Falls. Migratory and resident fish coexist on the spawning grounds.

Bull trout in the Canyon Creek local population use the upper South Fork Stillaguamish River for spawning and rearing. Although there have been isolated and incidental observations of spawning by migratory-size bull trout, electrofishing surveys have been unable to locate any juvenile or resident bull trout from this population. Difficulty in locating individuals from this population, despite repeated survey efforts, indicates there are very few bull trout in this population.

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 2004a).

Number and Distribution of Local Populations

Four local populations have been identified in the Stillaguamish core area: 1) Upper Deer Creek, 2) North Fork Stillaguamish River, 3) South Fork Stillaguamish, and 4) Canyon Creek The scarcity and spatial isolation of available spawning habitat limits the number of local populations in the Stillaguamish core area. With only four local populations, bull trout in this core area are considered at increased risk of extirpation and adverse effects from random, naturally occurring events (see "Life History").

Adult Abundance

The bull trout population in the Stillaguamish River basin is estimated at fewer than 1,000 adults. In the North Fork Stillaguamish River, as many as 100 adult bull trout have been observed holding near the mouth of the Boulder River. Surveys documented nearly 300 adult char between river miles 21 and 25 during fall 2001; fewer than 100 adults were counted in the remaining sample years between 1996 and 2003 (G. Pess, NMFS, *in litt.* 2003). Other limited snorkel surveys had similar results (M. Downen, pers. comm. 2003). These staging adult bull trout are assumed to spawn somewhere in the North Fork Stillaguamish River. Adult abundance in the Upper Deer Creek local population is considered low. The Boulder River population probably has fewer than 100 adults. Approximately 50 to 100 adults are present in the South

Fork Stillaguamish River, based on conservative estimates from spawning and electrofishing surveys (D. Downen, *in litt.* 2003).

Connectivity

Primary foraging, migration, and overwintering areas in the Stillaguamish River basin include the mainstems of the North Fork and South Fork Stillaguamish Rivers and the Stillaguamish River to the estuary. Foraging subadults and adults may be found in nearly all reaches of the basin below migratory barriers to the basin. Rearing individuals may use nearly all accessible reaches in higher elevation and coldwater portions of the basin. Anadromous forms in the Stillaguamish core area are presumed to use nearshore marine areas in Skagit Bay, Port Susan, and Possession Sound, but may also use areas even farther from their natal basin.

All native char habitat within the Stillaguamish River Basin is contiguous, and there is no evidence of reproductive isolation in the basin. However, because the local populations are somewhat isolated from one another, maintaining connectivity among them will be critical.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, Federal actions occurring in the Stillaguamish core area have caused harm to or harassment of bull trout. These actions include five statewide Federal restoration programs, which include riparian restoration, replacement of fish passage barriers, and fish habitat improvement projects. In addition, two federally funded transportation projects involving repair and protection of roads and bridges have been completed. Two section 10(a)(1)(B) permits have been issued for HCPs that address bull trout in this core area.

The number of non-Federal actions occurring in the Stillaguamish core area since the bull trout listing is unknown. However, activities conducted on a regular basis, such as emergency flood control, development, and infrastructure maintenance, affect riparian and instream habitat and probably negatively affect bull trout.

Reasons for Decline

Threats to bull trout in the Stillaguamish core area include the following:

- Channel widening and a significant reduction in primary pool abundance have seriously degraded habitat conditions in the North Fork and lower South Fork Stillaguamish Rivers.

- Spawning habitats in Deer and Canyon Creeks have been extremely degraded.

- Past timber harvest and harvest-related activities, such as roads, have degraded habitat in the Stillaguamish River basin. The loss of riparian cover, slope failures, stream sedimentation, increased stream temperatures, flooding, and loss of large woody debris have adversely affected bull trout in Deer Creek and in the South

Fork Stillaguamish River (WDFW 1997b; USFWS 2004a). Deer and Higgins Creeks currently violate State water quality standards for temperature.

- Agriculture and residential development have contributed to poor water quality in the lower Stillaguamish River basin. Excessive siltation caused by mud and clay slides on the North Fork Stillaguamish River near Hazel, Washington, and on the South Fork above Robe, contribute to poor water quality (Williams et al. 1975).

- Other limiting factors in the North Fork Stillaguamish River include loss of deep holding pools for adults and low summer flows (USFWS 2004a).

- Low flows and high temperatures during the summer affect holding habitat for anadromous migrants in the mainstem Stillaguamish River, especially in the lower river sloughs that have slow-moving water without significant riparian cover (WDFW 1997b).

Upper Skagit Core Area

The Upper Skagit core area comprises the Skagit River basin upstream of Diablo Dam, including Diablo Lake and most of Ross Lake. The upper Skagit River is a transboundary system that flows south from British Columbia into the United States. A significant portion of the upper Skagit River drainage lies within Canada. Much of the habitat in the core area is undisturbed because large portions of the watershed are located in North Cascades National Park, Pasayten Wilderness Area, and Skagit Valley Provincial Park.

Adfluvial, fluvial and, possibly, resident life history forms of bull trout occur in the Upper Skagit core area. This core area supports both bull trout and Dolly Varden.

The status of the bull trout population in a core area 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 2004a).

Number and Distribution of Local Populations

Thirteen local populations occur in the upper Skagit River. Having more than 10 local populations diminishes the risk of extirpation of bull trout in this core area. Seven of the local populations occur in the United States. Bull trout spawn and rear in at least eight streams in the United States: Ruby (including Canyon and Granite Creeks), Panther, Lightning, Big Beaver, Little Beaver, Silver, Pierce, and Thunder Creeks.

Adult Abundance

Adult abundance probably exceeds 1,000 adults in the Upper Skagit core area, including those portions of the drainage in British Columbia. Therefore, the bull trout population in this core area is not considered at risk from genetic drift. Each of the Ruby Creek and Lighting Creek local populations probably has at least 100 adults. Adult abundance and the risk of inbreeding in the remaining local populations are unknown.

Productivity

Bull trout in the Upper Skagit core area are considered at increased risk of extinction until sufficient information is collected to properly assess productivity.

Connectivity

The presence of migratory bull trout in the majority of the local populations indicates the bull trout in the Upper Skagit core area has a diminished risk of extirpation from habitat isolation and fragmentation. However, Diablo Lake supports only a single population of migratory bull trout and remains a concern. If connectivity between the Diablo Lake system and the rest of the Upper Skagit core area cannot be adequately restored at Ross Dam, establishment of additional local populations probably will be necessary to ensure persistence of bull trout in the Diablo Lake system.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, Federal actions occurring in the Upper Skagit core area may have caused harm to, or harassment of, bull trout. These actions include statewide Federal restoration programs, which include riparian restoration, replacement of fish passage barriers, and fish habitat improvement projects, and federally funded transportation projects involving repair and protection of roads and bridges. No section 6, section 10(a)(1)(A), or 10(a)(1)(b) permits have been issued in the Upper Skagit core area for effects to bull trout from capture and handling.

The number of non-Federal actions occurring in the Upper Skagit core area since the bull trout listing is unknown. Because most of the core area is in Federal ownership, few non-Federal actions likely have occurred in this core area.

Reasons for Decline

Threats to bull trout in the Upper Skagit Core Area include:

- Ross Dam restricts connectivity between the Thunder Creek local population and most of the core area.

- Past forest practices have some residual effects on bull trout populations in the United States, while past and ongoing forest practices remain a significant threat to some local populations in Canada.

- Brook trout are established in a number of tributaries to Ross Lake that are also used by bull trout. Brook trout apparently have replaced or displaced bull trout in some tributaries (e.g., Hozemeen Creek).

STATUS OF BULL TROUT CRITICAL HABITAT

This Biological 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 statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service (No. 03-35279) to complete the following analysis with respect to critical habitat.

Legal Status

The Service published a final critical habitat designation for the coterminous United States population of the bull trout on September 26, 2005 (70 FR 56212); the rule became effective on October 26, 2005. The scope of the designation involved the Klamath River, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments (also considered as interim recovery units). Rangewide, the Service designated 143,218 acres of reservoirs or lakes and 4,813 stream or shoreline miles as bull trout critical habitat (Table X).

Table X. Stream/shoreline distance and acres of reservoir or lakes designated as bull trout critical habitat by state.

	Stream/shoreline miles	Stream/shoreline kilometers	Acres	Hectares
Idaho	294	474	50,627	20,488
Montana	1,058	1,703	31,916	12,916
Oregon	27,322	11,057	27,322	11.057
Oregon/Idaho	17	27		
Washington	1,519	2,445	33,353	13,497
Washington (marine)	985	1,585		

Although critical habitat has been designated across a wide area, some critical habitat segments were excluded in the final designation based on a careful balancing of the benefits of inclusion versus the benefits of exclusion (see Section 3(5)(A) and Exclusions under Section 4(b)(2) in the final rule). This balancing process resulted in all proposed critical habitat being excluded in 9 proposed critical habitat units: Unit 7 (Odell Lake), Unit 8 (John Day River Basin), Unit 15 (Clearwater River Basin), Unit 16 (Salmon River Basin), Unit 17 (Southwest Idaho River Basins), Unit 18 (Little Lost River), Unit 21 (Upper Columbia River), Unit 24 (Columbia River), and Unit 26 (Jarbidge River Basin). The remaining 20 proposed critical habitat units were designated in the final rule. It is important to note that the exclusion of waterbodies from designated critical habitat does not negate or diminish their importance for bull trout conservation.

Conservation Role and Description of Critical Habitat

The conservation role of bull trout critical habitat is to support viable core area populations (70 FR 56212). 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. Critical habitat units generally encompass one or more core areas and may include foraging, migration, and overwintering areas, outside of core areas, that are important to the survival and recovery of bull trout.

Because there are numerous exclusions that reflect land ownership, designated critical habitat is often fragmented and interspersed with excluded stream segments. These individual critical habitat segments are expected to contribute to the ability of the stream to support bull trout within local populations and core areas in each critical habitat unit.

The primary function of individual critical habitat units 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); (2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish (Rieman and McIntyre 1993; MBTSG 1998); (3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (Rieman and McIntyre 1993; Hard 1995; Healey and Prince 1995; MBTSG 1998); and (4) are distributed throughout the historic range of the species to preserve both genetic and phenotypic adaptations (Rieman and McIntyre 1993; Hard 1995; MBTSG 1998; Rieman and Allendorf 2001).

The Olympic Peninsula and Puget Sound Critical Habitat Units are essential to the conservation of amphidromous bull trout, which are unique to the Coastal-Puget Sound bull trout population. These critical habitat units contain 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 overwintering, migration, and foraging.

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. Note that only the PCEs described in paragraphs (i), (vi), (vii), and (viii) apply to marine nearshore waters identified as critical habitat; and all except PCE (iii) apply to foraging, migration, and overwintering habitat identified as critical habitat.

The PCEs are as follows:

(i) Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72 °F (0 to 22 °C) but are found more frequently in temperatures ranging from 36 to 59 °F (2 to 15 °C). These temperature ranges may vary depending on bull trout life-history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude bull trout use are specifically excluded from designation;

(ii) Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures;

(iii) Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter;

(iv) A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation. This rule finds that reservoirs currently operating under a biological opinion that addresses bull trout provides management for PCEs as currently operated;

(v) Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source;

(vi) Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows;

(vii) An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish; and

(viii) Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.

Critical habitat includes the stream channels within the designated stream reaches, the shoreline of designated lakes, and the inshore extent of marine nearshore areas, including tidally influenced freshwater heads of estuaries.

In freshwater habitat, critical habitat includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high-water line. In areas where ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. 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. For designated lakes, the lateral extent of critical habitat is defined by the perimeter of the water body as mapped on standard 1:24,000 scale topographic maps.

In marine habitat, critical habitat includes the inshore extent of marine nearshore areas between mean lower low-water (MLLW) and minus 10 meters (m) mean higher high-water (MHHW), including tidally influenced freshwater heads of estuaries. This refers to the area between the average of all lower low-water heights and all the higher high-water heights of the two daily tidal levels. The offshore extent of critical habitat for marine nearshore areas is based on the extent of the photic zone, which is the layer of water in which organisms are exposed to light. Critical habitat extends offshore to the depth of 33 ft (10 m) relative to the MLLW.

Adjacent stream, lake, and 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 marine 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 altering the PCEs to such an extent that critical habitat would not remain functional to serve the intended conservation role for the species (70 FR 56212; USFWS 2004d). 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). Therefore, 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, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments.

Current 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.

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 (Rieman and McIntyre 1993; Dunham and Rieman 1999); (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; MBTSG 1998); (3) the introduction and spread of nonnative species as a result of fish stocking and facilitated by degraded habitat conditions, particularly for brook trout and lake trout, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary et al. 1993; Rieman et al. 2006); (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 foraging, migration, and overwintering habitat resulting from reduced prey base, roads, agriculture, development and dams.

ENVIRONMENTAL BASELINE (Bull Trout Critical Habitat)

Regulations implementing the Act (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. The action area considered in this BO includes the entire range of the Coastal-Puget Sound interim recovery unit.

Common to all the critical habitat units are the legacy effects from past land and water management practices on Federal and non-Federal lands that have degraded bull trout habitat and PCEs. Habitat conditions needed for bull trout recovery will require additional habitat restoration and threat abatement from land- and water-management practices affecting freshwater, estuarine, and/or marine habitats. The descriptions below describe the condition of designated critical habitat within individual critical habitat units within the Action Area of this consultation.

Status of Critical Habitat in the Action Area

Where the information was available, the condition of PCEs in each critical habitat unit were described using the Service's Bull Trout Matrix of Pathways and Indicators (Matrix), which includes the following habitat parameters: water quality, habitat access, habitat elements, channel conditions and dynamics, flow/hydrology, and watershed conditions. See Appendix E for the crosswalk between the Matrix pathways and the PCEs to further understand how the habitat baseline for critical habitat was developed.

Olympic Peninsula: Critical Habitat Unit 27

Critical habitat has been designated in streams and rivers in all core areas within this unit. On the Olympic Peninsula, a significant portion of the major river basins, particularly the upper river portions where most bull trout spawning and rearing occurs, lie within the Olympic National Park. Spawning and rearing critical habitat has been designated in these areas within the Park. However, FMO critical habitat conditions are degraded downstream of the park boundary (WSCC 2000, 2001). In the largely rural setting of the Olympic Peninsula, habitat effects are primarily related to past logging and associated roading and, to a lesser degree, dams and agricultural practices. Habitat conditions have improved to some extent over the past decade with more-protective forest practices and declining timber harvest on public lands. Although migratory corridors are still functional, especially on the west side of the Olympic Peninsula, critical habitat conditions related to suitable temperatures, floodplain connectivity, substrate, timing and magnitude of flows, and habitat complexity related to large woody material have been degraded by historical land-management practices. PCEs 1, 2, 4, 5, 6, and 7 within the designated critical habitat have likely been degraded, although the severity of degradation varies on site specific basis.

Puget Sound: Critical Habitat Unit 28

The urban rivers of Puget Sound have effects comparable to those on the Olympic Peninsula from past logging and logging roads in the upper reaches, but critical habitat has been further degraded in the lower floodplains. Intensive channelization to protect urban development and agricultural areas has resulted in permanent loss of floodplain functions in most of the lower rivers. The loss of riparian vegetation, increasing discharge of municipal and industrial wastewater and urban stormwater runoff, has resulted in degraded water quality. The Washington Department of Ecology (WDOE) has placed a large number of waterways throughout Puget Sound on the 303(d) list of impaired waters. In addition to affecting water quality through flow alterations, hydroelectric dams block migration and have isolated bull trout populations in several core areas while water-control structures in the floodplains have effectively eliminated most of the estuaries and wetlands that historically provided rearing and foraging areas. PCEs 1, 2, 3, 4, 5, 6 and 7 within the designated critical habitat have likely been degraded, although the severity of degradation varies on a site specific basis.

EFFECTS OF THE ACTION (Bull Trout)

In determining whether an action is likely to jeopardize the recovery and survival of a species, the Service analyzes the effect of the action, and the effect of other activities that are interrelated or interdependent with that action, in the context of the environmental baseline and anticipated cumulative effects. All actions are evaluated against and added to the environmental baseline.

Fish and salmonids in particular, have evolved life history strategies that depend on natural conditions found within a stream (Knutson and Naef 1997). Behaviors related to breeding, feeding, resting, and avoidance of predation have developed to work with natural stream flow conditions, rates of erosion and sedimentation, and inputs of organic materials including food sources and woody debris. When the rate and magnitude of various stream functions change substantially from natural levels, including changes resulting from human activities, fish populations may be reduced, species composition may change, and fish habitat quality and quantity may decline (Sullivan et al. 1987).

Bull trout are susceptible to a variety of conditions that can delay spawning, cause them to spawn in areas of less than favorable conditions, or prevent them from spawning at all. After spawning has occurred, many factors can impact the eggs while they are incubating in the gravel. They can be covered with silt, which stops the flow of oxygen-rich water and leads to death by suffocation or from the toxic effects caused by the inability of the water to remove metabolic wastes. Dissolved oxygen levels can drop to lethal levels. They can be dislodged from the gravel by in-water activities, placing them at the mercy of predators and the elements.

Rearing juveniles generally stay within their natal area and stay near the bottom and can suffer from the same impacts to their habitat as experienced by eggs. For example, if dissolved oxygen levels drop, fish may suffocate or may not be able to digest their food. Turbidity may provide cover from predation or lead to reduced size because they cannot find their food.

Sub-adults and adults move throughout their core areas and may move into the marine environment. The disruption or blockage of migratory behavior can adversely affect these fish. Sub-adults migrating downstream to the estuarine environment could experience blocked migratory routes due to in-water construction activities, or increased sedimentation could delay migration, decrease feeding, and increase predation.

The following analysis of effects will consider restoration activities that may affect bull trout or their habitat. In general, this analysis will be presented in three sections: 1) restoration activities that are not likely to adversely affect bull trout, 2) restoration activities that may adversely affect bull trout habitat through habitat alterations, and 3) restoration activities that may directly and adversely affect individual bull trout. RA 5 (Install/develop wildlife structures) and RA 14 (Install signs) will not affect bull trout and will not be discussed further. Also, no restoration activities will introduce non-native competitive species. Barriers will not be removed if bull trout occur above the barrier and a non-native competitive species occurs below it.

Activities Not Likely to Adversely Affect Bull Trout

Human presence at all project sites could occur through the design, implementation, and monitoring of projects. The majority of site visits will consist of human presence on the stream bank prior to project construction, during project construction, and post-project construction. Human activities at the site could include a walking visual evaluation of the site, the collection of data or information for project construction, presence during project construction, and the collection of data or information for post-project monitoring or evaluation. Work windows outlined in conservation measures and best management practices will be followed. Therefore, the potential disturbance of bull trout from human presence at project sites is insignificant.

RA 12 (Collect information/monitor) may result in disturbance to bull trout. This restoration activity will occur in/near aquatic environments but will not impact habitat. Potential disturbance issues associated with collecting information or monitoring will be addressed through the required implementation of BMP 19, designed to keep stream surveyors and others out of the actual stream channel in order to minimize disturbance to aquatic life. Given the typical project size, and the implementation of BMP 19, the potential disturbance is insignificant and RA 12 (Collect information/monitoring) "may affect, but is not likely to adversely affect" bull trout.

RA 15 (Deploy salmon carcasses) may result in disturbance to bull trout. Implementation of BMPs 38 – 42 will prevent diseases, viruses, drugs, and antibiotics from being spread through salmon carcass distribution. Implementation of BMP 19 will deter carcass deployers and others from entering stream channels in order to minimize disturbance to aquatic life. Given the typical project size and the implementation of BMP 19, the potential disturbance is insignificant and RA 15 (Deploy salmon carcasses) "may affect, but is not likely to adversely affect" bull trout.

RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA3 (Reduce upland sediment production/delivery), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 8 (Plant native vegetation), RA 9 (Promote native vegetation growth), RA 10 (Remove/setback hydraulic constrictions), RA 11

(Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures) may result in effects to bull trout related to habitat alteration, stranding, capture, and handling. The potential effects of these proposed restoration activities on bull trout are anticipated to be short-term (during the period of project implementation and through the first high water flow event post construction) and may affect eggs, juveniles (0+ - 1+), subadults, adults, or prey species, as described below.

Habitat Alterations

Impacts to bull trout habitat were evaluated using the Service's bull trout matrix of pathways and indicators (matrix) (USFWS 1998a). All of the restoration activities included in this consultation are intended to benefit watershed function and processes over the long term. These restoration projects are small in scale and an evaluation at the fifth or sixth field watershed level would mask the impacts to bull trout habitat. Therefore, for the purposes of this consultation, the relevant indicators in the matrix are evaluated at the project scale, rather than at the fifth or sixth field watershed level (Table 2). If a restoration activity maintains a relevant indicator at the project scale, we assume that relevant indicator will also be maintained at the fifth field and core area levels. All relevant indicators that are degraded at the project scale by the restoration activities would still be maintained at the fifth field and core area levels.

Also, for the purposes of this consultation, each watershed is assumed to be "functioning at risk." We recognize this is not the case for all watersheds where projects may occur, but without specific information, we have chosen to take a conservative approach. As restoration activities are planned, this assumption can be clarified and analysis of impacts to the relevant indicators revised as necessary.

Table 2. Checklist for Documenting Effects of Proposed Actions on Relevant Indicators.
NOTE: Numbers in the Table correspond to restoration activities.

	Effects of Action (s)		
Relevant Indicators	**Restore** [1]	**Maintain** [1]	**Degrade** [1]
Subpopulation Characteristics			
Subpopulation Size		1-15	
Growth and Survival	1, 2, 6, 11, 13, 15S	3, 4, 5, 7, 8, 9, 10, 12, 14	
Life History Diversity and Isolation	11, 13	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15	
Persistence and Genetic Integrity	11, 13	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15	
Water Quality			
Temperature	6L,8L, 9L, 10L	1L, 2L, 3, 4L, 5, 7, 11L, 12, 13L, 14, 15	1S, 2S, 4S, 6S, 8S, 9S, 10S, 11S, 13S

	Effects of Action (s)		
Relevant Indicators	**Restore** [1]	**Maintain** [1]	**Degrade** [1]
Sediment	3L, 4L, 6L, 7L, 8L, 9L, 10L, 11L	1L, 2L, 3S, 5, 8S, 9S, 12, 13L, 14, 15	1S, 2S, 4S, 6S, 7S, 10S, 11S, 13S
Chemical Contaminants and Nutrients	6, 8L, 9L	1, 2, 3, 4, 5, 7, 8S, 9S, 10, 11, 12, 13, 14, 15	
Habitat Access			
Physical Barriers	11, 13	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15	
Habitat Elements			
Substrate Embeddedness	1L, 2L, 3L, 4L, 6L, 7L, 8L, 9L, 10L, 11L	3S, 5, 8S, 9S, 12, 13L, 14, 15	1S, 2S, 4S, 6S, 7S, 10S, 11S, 13S
Large Woody Debris	1, 6L, 8L, 9L, 10L	2, 3, 4, 5, 6S, 7, 8S, 9S, 10S, 11, 12, 13, 14, 15	
Pool Frequency and Quality	1L, 3L, 6L, 8L, 9L, 10L	2L, 3S, 4L, 5, 7L, 8S, 9S, 11L, 12, 13L, 14, 15	1S, 2S, 4S, 6S, 7S, 10S, 11S, 13S
Large Pools	1L, 3L, 6L, 8L, 9L, 10L	2L, 3S, 4L, 5, 7L, 8S, 9S, 11L, 12, 13L, 14, 15	1S, 2S, 4S, 6S, 7S, 10S, 11S, 13S
Off-channel Habitat	2L, 10L	1, 3, 4, 5, 6, 7, 8, 9, 10S, 11, 12, 13, 14, 15	2S
Refugia	2L, 8L, 9L, 11	1, 2S, 3, 4, 5, 6, 7, 8S, 9S, 10, 12, 13, 14, 15	
Channel Conditions and Dynamics			
Wetted Width/Max. Depth Ratio	6L, 8L, 9L, 10	1, 2, 3, 4, 5, 6S, 7, 8S, 9S, 11, 12, 13,14,15	
Streambank Condition	6, 8L, 9L, 10	1L, 2L, 3, 4L, 5, 7, 11L, 12, 13, 14, 15	1S, 2S, 4S, 8S, 9S, 11S
Floodplain Connectivity	2, 10, 11	1, 3, 4, 5, 6, 7, 8, 9, , 12, 13, 14, 15	
Flow/Hydrology			

	Effects of Action (s)		
Relevant Indicators	**Restore** [1]	**Maintain** [1]	**Degrade** [1]
Changes in Peak/Base Flows	4, 7L, 10	1, 2, 3, 5, 6, 7S, 8, 9, 11, 12, 13, 14, 15	
Drainage Network Increase	7L	1, 2, 3, 4, 5, 6, 7S, 8, 9, 10, 11, 12, 13, 14, 15	
Watershed Conditions			
Road Density and Location	7	1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 14, 15	11
Disturbance History	3, 6, 7, 8L, 9L, 10	1, 2, 4, 5, 8S, 9S, 11, 12, 13, 14, 15	
Riparian Conservation Areas	6L, 8L, 9L, 10L	1L, 2L, 3, 4L, 5, 7L, 11L, 12, 13L, 14, 15	1S, 2S, 4S, 6S, 7S, 8S, 9S, 10S, 11S, 13S
Disturbance Regime	3, 6, 7, 8L, 9L, 10	1, 2, 4, 5, 8S, 9S, 11, 12, 13, 14, 15	
Species and Habitat			
Integration of Species and Habitat	1, 2, 6, 7, 8L, 9L, 10, 11, 13	3, 4, 5, 8S, 9S, 12, 14, 15	

1. Definition of terms

Degrade - A degrade determination on an "indicator" of the Matrix would imply that an action will negatively impact that "indicator." The impact can be either short term or long term, and has the effect of reducing the functionality of the "indicator."

Long-term - Impacts to the environment that will change the physical/biological status for a period of greater than one year. This definition may include permanent changes. Long-term impacts are expected to continue over a protracted time period, not just a single moment–in-time event. An example might be continuous ground disturbance which allows unchecked soil erosion for a prolonged time period. Designated by an "L" in the Matrix.

Maintain - A maintain determination on an "indicator" of the Matrix implies that an action will not change the function of an "indicator." An example might be some riparian planting activities where proper mitigation techniques are used and no sediment will actually enter the stream.

Restore - A restore determination on an "indicator" of the Matrix implies that an action will beneficially impact the function of an "indicator." An example would be an artificial barrier removal which allows fish to pass to spawning and rearing habitat.

Short-term - Impacts to the environment that will change the physical/biological status for a time period of 1 year or less. These are moment-in-time impacts that are then allowed to heal; therefore, in a year or less the impact will disappear. This definition does not include impacts that continue to occur over a period of 1 year. The rationale for this definition is that certain salmonid life stages are assumed to be more susceptible to adverse impacts than others. As an example, incubating eggs and fry in the gravel are susceptible to sedimentation which may reduce infiltration and oxygen transfer in the redd, and gravel disturbances which may crush or dislodge the eggs. Once the fry emerge from the gravel and become free swimming, similar sediment impacts would be less likely to cause mortality or seriously compromise individual fish. An example of a short-term impact would be a project where soil was disturbed during project implementation. Measures would be taken to minimize soil erosion, the disturbed area would be replanted, with the expectation that the area would be returned to a vegetated state within one growing season. Designated by an "S" in the Matrix.

Temperature

Temperature may be increased over the short term due to changes in water movement and surface area, disturbance or removal of riparian vegetation for construction access, or removal of non-native vegetation for replacement with native vegetation. However, the area of vegetation disturbance is restricted to 50 lineal feet per project and increases in temperature will be minimized by maintaining vegetated buffers as much as possible and by following construction and implementation BMPs designed to reduce disturbance of riparian vegetation. All sites will be revegetated with native species as soon as possible. Therefore, the short--term negative effects to temperature will be insignificant.

RA 1 (Install instream structures) and RA 2 (Improve secondary channel habitats) may include the placement of large woody debris or boulder structures. Large woody debris or boulder structures assist in the formation of pools or scour which may provide water temperature refugia and introduce cold hyporheic flow into the channel. The structures may also decrease temperature by providing shade to the stream. Reconnection to secondary channel habitat may result in temperature reduction if water from the secondary channel is colder than the main channel, or if cold hyporheic flow is introduced.

Lower temperatures will be restored over the long term following completion of the RA 6 (Reduce livestock impacts), RA 8 (Plant native vegetation), and RA 9 (Promote native vegetation growth). These activities lead to growth and improvement of riparian vegetation and increased riparian shade, thus contributing to reduced temperature and improved thermal and microclimate regulation. Riparian vegetation will eventually contribute large woody debris to the channel. RA 10 (Remove/setback hydraulic constrictions) will allow the channel to access its floodplain, form and maintain more natural channel geomorphology, and allow development of any side channels. A more naturally functioning main channel and side channels may introduce cold hyporheic flow and contribute to reducing or maintaining temperatures.

Sediment and Substrate Embeddedness

Sediment inputs to aquatic environments and substrate embeddedness may be increased over the short term by instream substrate disturbance, ground disturbance to streambanks, or disturbance to the riparian area during project construction or implementation of RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures). The effects of sediment to the aquatic environment and to bull trout will be minimized and controlled as much as possible by following BMPs designed to reduce the area of ground disturbance, properly dispose and stabilize excavated materials, maintain vegetation along stream channels, and use of sedimentation and erosion control structures. However, rain events may occur during and after the construction period, before disturbed areas are completely stabilized, and may mobilize sediment into the aquatic environment.

Sediment inputs and substrate embeddedness will be restored over the long term following completion of RA 3 (Reduce upland sediment production/delivery), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 8 (Plant native vegetation), RA 9 (Promote native vegetation growth), RA 10 (Remove/setback hydraulic constrictions), and RA 11 (Remove/replace structural barriers). These restoration activities will improve the recruitment, sorting, storage, and transport of sediment over the long term.

Chemical Contaminants and Nutrients

RA 6 (Reduce livestock impacts) will restore the matrix indicator "chemical contaminants and nutrients" at the project scale by eliminating or reducing fecal input to streams and wetlands. RA 8 (Plant native vegetation) and RA 9 (Promote native vegetation growth) will restore the matrix indicator "chemical contaminants and nutrients" over the long term by recovering watershed processes and functions associated with native plant communities.

Physical Barriers

Physical access will be restored by removing or modifying culverts or artificial structural barriers to improve fish passage and facilitate natural sediment, wood, and organic movement through the system.

Large Woody Debris

Installing instream structures will restore large woody debris at the project scale by increasing the number of pieces of wood per mile and improving channel and habitat diversity.

The future recruitment potential for large woody debris will be increased in the riparian area by planting and/or promoting native vegetation growth, reducing livestock impacts on existing and/or newly planted riparian areas, and removal/setback of hydraulic constrictions which will improve the channel to a more natural morphology and interaction with the floodplain that will allow large woody debris to be transported through the system in a more natural fashion.

Pool Frequency and Quality and Large Pools

Pool frequency and quality and large pools may be degraded over the short term by increased sediment input to pools from instream and bank disturbances during project construction. There is a potential for loss of pools associated with any structure that will be removed as part of the project activity, such as a plunge pool associated with a culvert identified for removal or replacement. BMPs designed to reduce sediment inputs will be implemented at all project sites, reducing the potential of short-term degradation to large pools and to pool frequency and quality.

These indicators may be restored over the long term as 1) instream structural complexity and diversity is increased by installing instream structures, 2) sediment input is reduced by RA 3 (Reduce upland sediment production/delivery) and RA 6 (Reduce livestock impacts), 3) the potential for future large woody debris recruitment is increased by planting and/or promoting native vegetation, and 4) removal/setback of hydraulic constrictions allows for a more natural channel morphology and interaction with the floodplain.

Off-channel Habitat

Off-channel habitat may be degraded over the short term by increased sediment input from instream and bank disturbances during construction activities associated with re-opening or enhancing off-channel or secondary habitat during project construction. BMPs designed to reduce sediment inputs will be implemented at all project sites.

Off-channel habitat will be restored over the long term following completion of the RA 2 (Improve secondary channel habitat) and RA 10 (Remove/setback hydraulic constrictions). Secondary channel habitat improvements may increase available rearing area, improve access to existing rearing areas, and provide protective cover and low flow refugia for fish.

Refugia

Site specific removal of structural barriers may result in better connections between refugia habitats and will contribute to a natural functioning aquatic and riparian ecosystem which may increase the potential for long-term restoration of refugia at the watershed scale. Over the long term, improving secondary channel habitats will increase the hydrologic capacity of side channels, increase channel diversity and complexity, provide resting and refugia areas for fish and wildlife species at various flows, and provide protective cover for fish and other aquatic species. Planting and/or promoting native vegetation may result in a natural functioning aquatic and riparian ecosystem, which could improve or restore refugia areas, or provide connection between existing refugia areas.

Wetted Width/Maximum Depth Ratio

Wetted width/maximum depth ratio will be restored over the long term by 1) re-establishing a functional riparian zone and preventing livestock from breaking down banks and disrupting the channel bed, 2) planting and/or promoting native vegetation that improves root strength and streambank stability and will eventually provide large woody debris to the stream corridor, and 3) removing or setting back of hydraulic constrictions to allow for the development of a natural channel morphology and increase interaction with the floodplain.

Streambank Condition

Streambank condition may be degraded over the short term during project construction or implementation by disturbing the riparian area and vegetation during structure installation or removal, or by removing non-native riparian vegetation and replanting with native vegetation. BMPs designed to minimize ground disturbance, such as use of appropriately sized equipment and erosion control equipment, will be implemented at all project sites.

RA 11 (Remove/replace structural barriers) may include placement of riprap around bridge footings for protection during flooding events. In addition, grade control structures made of either rock or wood may be placed within the channel to ensure fish passage until the channel stabilizes. Grade control structures or riprap may result in a channel constriction or a hard point, preventing normal channel migration from occurring in the future. However, these changes in streambank condition from a culvert hardened channel to a bridge/riprap hardened channel will not result in further degradation of streambank condition.

Generally, after project construction, there will be no further impacts to streambanks, and conditions will be maintained or improved over the long term. If the project is a culvert removal, streambank conditions will be restored over the long term because fill will be removed, streambanks will be sloped back to match those of upstream and downstream banks, and bare soil will be planted. Vegetation will be allowed to grow, contributing to root strength and streambank stability. Depending upon project location and design, replacing a culvert with a bridge may result in improvements to streambank condition and the channel migration zone. Streambank condition may also be improved in situations where native vegetation is planted up to and under the bridge.

Streambank condition will be restored at the project scale by removing or setting back hydraulic constrictions and by re-establishing a functional riparian zone as livestock are prevented from breaking down the bank and disrupting the channel.

Streambank condition will be restored over the long term by removing non-native vegetation for replacement with native vegetation and by planting native vegetation in areas where needed.

Floodplain Connectivity

Improving secondary channel habitat will restore floodplain connectivity as stream flows are redirected into adjoining flood plains or channels are reconnected with historic flood plains by removing hydrologic constrictions or barriers. Removal or replacement of structural barriers will support more natural channel geomorphology, promoting channel access to the floodplain. Once a culvert is removed or replaced, the transport of large woody debris and sediment will function more naturally, promoting channel access and interaction with the floodplain.

Changes in Peak/Base Flows

Re-establishment of wetland hydrology and removal and/or setback of hydraulic constrictions will return the project site to a more natural state in which storage capacity and retention time for runoff and storm and flood waters will be increased.

Improving road and trail conditions will restore peak/base flows over the long term by reducing or eliminating the amount of sediment entering the aquatic system, resulting in the reduction of sediment infilling of existing pools and increasing storage capacity within the system. Also, by obliterating or decommissioning roads, vegetation cover may increase and contribute to a more natural peak/base flow regime.

Drainage Network Increase

Drainage networks will be restored over the long term by elimination or reduction of road-side ditches during road decommissioning or obliteration. Road maintenance activities will maintain or improve the functioning of road ditch lines, potentially resulting in reduced sediment impacts to the aquatic environment.

Road Density and Location

RA 11 (Remove/replace structural barriers) may result in long-term increases in road density and location. Culvert replacement may result in an increased road width in order to address safety concerns. However, this need will not arise at all project sites, will only occur in locations where there was a road associated with the replaced culvert, and the amount of road width increase will be minimal. Even though there may be increases in road density, instream habitat conditions should not be altered because there will be no increases in drainage network and minimal increases in stormwater run-off associated with the road widening.

Road density and location will be restored by RA 7 (Improve road/trail conditions) as roads are obliterated, decommissioned, or relocated to a stable location.

Disturbance History and Disturbance Regime

Reducing upland sediment production/delivery and improving road/trail conditions will restore disturbance history and regime by preventing mass wasting, debris flows, and catastrophic failure through stabilization of areas upslope of aquatic and riparian habitats. Reduction of impacts from livestock can result in restoring riparian and stream corridors and reducing disturbance to those areas. Removing or setting back hydraulic constrictions will improve site conditions relative to disturbance in unstable or potentially unstable areas. Roads which run along the top of dikes or levees may be eliminated, along with any structures associated with the dike or levee, such as tidegates, which may allow for a more naturally functioning system and reduce any impacts from human-caused disturbance.

Promoting native vegetation growth will control or eliminate non-native invasive plant species, and maximize habitat processes and functions associated with native vegetation diversity, form, outputs, structure, and composition. At the project site, planting native vegetation will recover watershed processes and functions associated with native plant communities such as thermal and micro-climate regulation, hydrologic and nutrient cycling, channel formation and sediment storage, soil development and stability, and flood energy dissipation and filtering. Site conditions relative to disturbance in unstable or potentially unstable areas would be improved and protected. This will help to move watersheds to a "Properly Functioning" condition and result in a more natural rate of disturbance.

Riparian Conservation Areas

Riparian conservation areas may be degraded over the short term during project construction or implementation by disturbing the riparian area and vegetation during structure installation or removal, or by removing non-native riparian vegetation and replanting with native vegetation. BMPs designed to minimize ground disturbance, such as use of appropriately sized equipment and erosion control equipment, will be implemented at all project sites.

Reducing livestock impacts will protect, restore, or create riparian areas over the long term, which will lead to better functioning, more naturally based riparian conservation areas, and more connectivity between riparian conservation areas. Planting and/or promoting native vegetation will restore or create riparian areas leading to better functioning and more naturally based riparian conservation areas, and more connectivity between riparian conservation areas. Removal or setback of hydraulic constrictions will restore riparian conservation areas over the long term by re-establishing the dynamic equilibrium of natural streams and connections to the flood plain, either in part or fully, which is needed to support and interact with riparian areas.

Growth and Survival

Installing instream structures will improve channel and habitat diversity. Structures could provide instream spawning, rearing, and resting habitat and high flow refugia, lead to an increase of interstitial spaces, promote natural vegetation composition and diversity, reduce embeddedness in spawning gravels, reduce siltation in pools, reduce the width/depth ratio of the stream, restore historic hydrologic regimes, and deflect flows into adjoining floodplain areas. Habitat quality and connectivity will be improved, which will benefit growth and survival of bull trout.

Improving secondary channel habitat would increase the area available for rearing habitat, improve access to rearing habitat, increase the hydrologic capacity of side channels, increase channel diversity and complexity, provide resting areas for fish and wildlife species at various levels of flow, reduce flow velocities, and provide protective cover for fish and other aquatic species. Habitat quality and connectivity will be improved, which will benefit growth and survival of bull trout.

Reducing livestock impacts would eliminate or reduce livestock degradation of streams, streambanks, uplands, and riparian and wetland areas. This activity will improve vegetation, reduce soil compaction and erosion, reduce fecal input to streams and wetlands, and improve riparian habitat function. Habitat quality and connectivity would be improved. These improvements would benefit growth and survival of bull trout.

Removing or replacing structural barriers will improve fish passage, prevent streambank and roadbed erosion, facilitate natural sediment and wood movement, and eliminate or reduce excess sediment loading. Project activities will eliminate or reduce dynamic changes in stream flow patterns through culverts that cause streambank erosion, undermine road beds, and contribute to the washout of culverts. Restoring fish passage either by culvert removal or replacement with a properly functioning culvert will allow access to more habitat, and will also improve the quality of existing habitat. Bull trout growth and survival will benefit from improvement of, and less disturbance to habitat and from increased habitat access. Projects should result in better quality habitat and better connected habitat, which would support higher levels of growth and survival over the long term, as more projects are completed within a watershed.

Installing or modifying fish passage structures will improve fish passage and allow access to more habitat. Bull trout growth and survival will benefit from increased habitat access. Projects should result in better connected habitat, which would support higher levels of growth and survival over the long term, as more projects are completed within a watershed.

Growth and survival would be restored over the short term by deploying salmon carcasses. Marine derived nutrients from returning adult salmon spawners have been shown to be important for productivity levels of the streams to which they return (Kline et al. 1997, Larkin and Slaney 1997). Fish carcasses can be directly consumed by fish or reduced by bacteria, invertebrates, and fungi (Piorkowski 1995). If carcasses are not totally consumed, nutrients are released into the system and support increased phytoplankton and periphyton blooms (Richey et al.1975), invertebrate diversity, numbers and growth rates (Piorkowski 1995, Walter et al. 1998) and fish growth rates (Bilby et al. 1994). Improved growth rate and the outcome of larger size may positively impact survival later in life (Hartmann and Scrivener 1990, Ward and Slaney 1988).

Life History Diversity and Isolation

Removing or replacing structural barriers will result in less disturbed, better quality habitat, with improved connection or access to more habitat. Installing or modifying fish passage structures will result in access to more habitat or better connected habitat. Project activities will result in better functioning migratory corridors and rearing habitat, and will allow connection of previously isolated populations. This will reduce isolation and allow an improved expression of life history patterns, and may support expansion of existing patterns.

Persistence and Genetic Integrity

Removing or replacing structural barriers will result in less disturbed, better quality habitat, with improved connections or access to more habitat. Installing or modifying fish passage structures will result in access to more or better connected habitat. These activities will benefit connectivity between subpopulations, improve species persistence, and promote their genetic integrity by providing better connected, more accessible habitats.

Integration of Species and Habitat

The projects included in the PBA are generally small projects, each affecting no more than 0.5 mile of stream, riparian, or upland habitat. All projects are designed and implemented to improve conditions in the watershed and benefit fish and their habitats. Some, if not most, of these projects will have positive effects on habitat quality and connectivity at the scale of stream reaches. Projects that are designed in a watershed context to reduce source areas for sedimentation inputs, restore riparian functions and processes, and help bring the natural disturbance regime and disturbance history into balance, are examples of activities and projects that may improve habitat quality and connectivity and help watersheds move towards the "functioning appropriately" category. Specifically, RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures) will remove, setback, or modify instream structures that will restore bull trout into areas of suitable habitat.

Summary of Habitat Alteration

There is a potential for disturbance to the riparian area during project construction or implementation of RA 8 (Plant native vegetation) and RA 9 (Promote native vegetation growth). These activities could include removal of non-native vegetation to be replaced with native vegetation. Construction and implementation practices at all sites will follow all BMPs and will be designed to reduce impacts to existing native riparian vegetation as much as possible, by using existing travel pathways, minimizing entry points through the riparian area, and maintaining vegetated buffers as much as possible. If vegetation is removed, all sites will be revegetated with native species as soon as possible. Given the allowable activities, the typical project size, and implementation of BMPs, the short-term negative impact to temperature should be insignificant. Therefore, RA 8 (Plant native vegetation) and RA 9 (Promote native vegetation growth) "may affect, but are not likely to adversely affect" bull trout and will not be considered further in this BO.

RA 3 (Reduce upland sediment production/delivery) will result in the short-term maintenance and long-term restoration of sediment production, substrate embeddedness, and the quality and quantity of large pools. Therefore, RA 3 (Reduce upland sediment production/delivery) "may affect, and is likely to beneficially affect" bull trout and will not be considered further in this BO.

All activities that degrade a relevant indicator at the project scale in the short term will either maintain or restore that indicator in the long term. All relevant indicators will be maintained at the fifth field and core area scales. RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures) may result in a short-term degradation of bull trout habitat from sediment inputs that can reduce water quality by increasing turbidity; increasing substrate embeddedness; reducing pool frequency and quality; and reducing the number/quality of large pools in the project area and for some distance downstream. For the purposes of this consultation, we will assume these downstream habitat alterations to extend the same distance (600 ft) as turbidity (See discussion below). Therefore, we anticipate bull trout habitat may be degraded throughout the project site and up to 600 ft downstream during construction and for a period of up to 1 year after construction. Even though any sedimentation that reaches the aquatic environment is expected to be minimal and short-term in duration as a result of the implementation of the conservation measures and BMPs outlined for each restoration activity, these restoration activities "may affect, and are likely to adversely affect" bull trout.

RA 11 (Remove/replace structural barriers) may result in a long-term degradation of bull trout habitat from increased road densities if roads are widened for safety concerns. However, road density increases will be minimal and will not result in impacts to instream habitat conditions because there will be no increases in drainage network and minimal increases in stormwater run-off associated with the road widening.

RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 6 (Reduce livestock impacts), RA 11 (Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures) will improve the growth and survival of bull trout in both the short- and long-term by improving habitat quality and connectivity and improving fish growth rates.

RA 11 (Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures) will improve the life history diversity and isolation of bull trout in both the short- and long-term by providing better functioning migratory corridors and rearing habitat and allowing connection of previously isolated populations.

RA 11 (Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures) will improve the persistence and genetic integrity of bull trout in both the short- and long-term by providing better connected, more accessible habitat.

Effects to Individuals

In-water work windows or in-water operating periods, are time periods when salmonids and other fish species are at a stage in their life cycle when they are least sensitive to disturbances. This is typically the non-spawning or egg incubating period. This allows the fish to either move away from impacts or to better cope with short-term, minimal changes to the habitat and/or decreased water quality. Because bull trout have many life history forms (resident, fluvial, adfluvial, and anadromous), it is difficult to develop work-timing windows that will fully protect their different life history stages. Each stage of their life history requires special needs to ensure successful survival.

Activities implemented in accordance with the PBA will follow in-water work windows found in the WDFW Gold and Fish Pamphlet (WDFW 1999) (or more up to date, Service approved information) and the specific bull trout work period(s) identified in Appendix B. However, bull trout spawning occurs from August through November, migration may begin as early as April for migratory bull trout, and resident and juvenile bull trout remain in spawning and rearing habitat year-round. Therefore, the use of the in-water work windows will not avoid direct effects to migrating, spawning, or rearing bull trout and their prey species, but the effects will be minimized.

Proposed restoration activities may occur in any waterway outside of Forest Service or National Park Service lands in the Coastal-Puget Sound interim recovery unit. Therefore, restoration activities have the potential to impact bull trout eggs, juveniles, subadults, or adults that may be spawning, rearing, migrating, foraging, or overwintering within, upstream, or downstream of project sites. In the absence of site-specific information, we assume restoration activities 1) within a local population may occur within or upstream of bull trout spawning and rearing habitat and may affect all bull trout age classes and their breeding, feeding, or sheltering, 2) within FMO habitat associated with a core area may affect adult and subadult bull trout and their breeding, feeding, or sheltering, and 3) within identified FMO habitat outside of a core area may affect adult and subadult bull trout and their breeding, feeding, or sheltering. Effects to individual bull trout may occur as a result of habitat alterations, displacement, stranding, capture, or handling.

Habitat Alterations

Temperature

For long-term persistence, salmonids, and especially bull trout, need a stream temperature regime that ensures sufficient amounts of cold water are present at the locations and during the times needed to complete their life cycle. Temperature is most frequently recognized as the primary factor limiting bull trout distribution (Dunham and Chandler, 2001, Reiman and McIntyre 1993). Probability of occurrence for juvenile bull trout in Washington is relatively high (75 percent) where maximum daily temperatures do not exceed approximately 11-12 °C (Dunham et al. 2001). Water temperature also seems to be an important factor in determining early survival; with cold water temperatures resulting in higher egg survival and faster growth rates for juveniles (Pratt 1992).

Although bull trout require a narrow range of cold water temperatures to rear, migrate, and reproduce, they also occur in larger, warmer river systems that may cool seasonally and provide important migratory corridors and forage bases. Bull trout typically prefer water temperatures ranging between 10 °C — 12 °C (McPhail and Murray 1979, Buchanan and Gregory 1997) for migratory corridors. When bull trout migrate through stream segments with higher water temperatures, they tend to seek areas offering thermal refuge such as confluences with cold tributaries (Swanberg 1997), deep pools or locations with surface and groundwater exchanges in alluvial hyporheic zones (Frissell 1999). Water temperatures above 15 °C are believed to limit bull trout distribution, which partially explains their generally patchy distribution within a watershed (Fraley and Shepard 1989, Rieman and McIntyre 1995).

Increases in stream temperatures can cause increased susceptibility to disease or other sublethal effects such as displacement by avoidance, or can cause direct mortality (McCullough et al. 2001, Bonneau and Scarnechia 1996). Increased competition with species more tolerant of warm stream temperatures may also negatively impact bull trout (Rieman and McIntyre, 1993, Craig and Wissmar 1993 *in* USDI 1997, MBTSG 1998). Brook trout, which can hybridize with bull trout, may be more competitive than bull trout and displace them, especially in degraded drainages containing fine sediment and higher water temperatures (Clancy 1993, Leary et al. 1993).

Given the size of the restoration actions, and the BMPs implemented, activities covered by this programmatic consultation are not likely to be of a scale large enough to change water temperatures. However, in the absence of site-specific information, we assume there is a potential for short-term temperature increases, and that these increases may temporarily disturb or displace bull trout in the project areas. However, any disturbance or displacement of bull trout should be minimal and short-term, and is not anticipated to significantly impair bull trout behavior.

Sediment

In-water work can be expected to temporarily increase suspended sediments in the water. Increased suspended sediments and the introduction of sediment in excess of natural amounts can have multiple adverse effects on channel conditions and processes resulting in effects on bull trout survival, the food web, and water quality conditions, such as water temperature and dissolved oxygen (Rhodes et al. 1994). Fine sediments can influence incubation survival and emergence success (Weaver and White 1985) but may also limit access to substrate interstices that are important cover during rearing and overwintering (Goetz 1994; Jakober 1995).

Restoration activities typically will not occur in intact and undisturbed areas of a watershed (i.e. likely bull trout spawning habitat). In-water activities will generally occur between July and September, which is typically outside of the spawning or egg incubating period. However, this timing may exacerbate impacts to juveniles, sub-adults, and adults because protective mucous secretions are inadequate during the summer months when natural stream sediment levels are low. Therefore, sediment introduction during this time may increase bull trout risk to stress and disease (Bash et al. 2001).

RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures) may increase turbidity levels in the project areas and downstream, but any sedimentation that reaches the aquatic environment is expected to be minimal and short-term in duration as a result of the implementation of the conservation measures and BMPs outlined for each restoration activity. Bull trout are most likely to be exposed to fine sediments mobilized during implementation of instream restoration activities, primarily as water is reintroduced into the stream and during the first fall/winter precipitation events that mobilize unsettled sediment.

Any restoration activities that result in fine sediments settling in bull trout spawning habitat can reduce the available interstitial spaces in the gravels available for eggs and can suffocate eggs, if they are present. In most cases, restoration activities will not occur in or above bull trout spawning habitat, and work during the appropriate in-water work windows will reduce the likelihood of eggs being present in or below the project site during project implementation. However, projects that are implemented within a local population may be in or above bull trout spawning habitat and spawning may occur after project implementation, but prior to the first fall/winter precipitation event during which eggs could be exposed to fine sediments settling in spawning habitat.

Adult, subadult, or juvenile bull trout that remain in the plume-affected area may be subjected to gill damage, reduced feeding efficiency, and increased stress. Some bull trout are likely to be displaced from the area until high sediment levels have subsided, thereby disrupting their normal breeding, feeding, and sheltering behaviors. These impacts are expected to be short-term and the duration and concentration of the turbidity should not be sufficient to produce lethal effects on adult, subadult, or juvenile bull trout that either remain in the plume-area or are displaced. The effects of sediment on adult, subadult, and juvenile bull trout may consist of the type of short-term physiological and behavioral effects described in Table 3 and Appendix C.

Table 3. Summary of adverse affects to bull trout resulting from elevated sediment levels.

Sediment Impacts to Fish	Summary of Adverse Affects Related to Sediment Impacts
Gill Trauma	Clogs gills which impedes circulation of water over the gills and interferes with respiration
Prey base	Disrupts both habitat for and reproductive success of macroinvertebrates and other salmonids (bull trout prey) that spawn and rear downstream of the construction activities
Feeding efficiency	Reduces visibility and impacts feeding rates and prey selection
Habitat	Fills pools, simplifies and reduces suitable habitat
Physiological	Increases stress, resulting in decreased immunological competence, growth and reproductive success
Behavioral	Results in avoidance and abandonment of preferred habitat

The Washington Department of Ecology's Water Quality Certification program anticipates and authorizes turbidity increases 100 to 300 feet from the farthest downstream point of construction (mixing zone), depending on the stream flow at the time of construction. Tables 2 and 3 in Appendix C provide the turbidity water quality standards for various classes of surface waters and stream flows in the State of Washington. The turbidity mixing zone and allowable turbidity exceedance vary, depending upon the surface water class and the amount of stream flow at time of construction.

For example, surface waters with ≤ 10 cfs flow at the time of construction, have a turbidity mixing zone that extends 100 feet downstream of an activity. Turbidity is not to exceed 5 Nephelometric turbidity units (NTU) over background turbidity when background turbidity is ≤ 50 NTU. If background turbidity is > 50 NTU, then turbidity shall not exceed background turbidity by > 10 percent.

Table 5 in Appendix C summarizes the project-specific water quality monitoring data received by the Service for individual projects. The monitoring data indicate that, in some cases, activities similar to the restoration activities to be implemented under this consultation exceeded turbidity water quality standards up to 600 feet downstream. It is difficult to predict the level of increased turbidity for the full program of restoration activities to be implemented under this consultation. However, during individual project planning, the implementing biologist will use the analytical framework for evaluating adverse effects to bull trout from turbidity (Appendix C) based on site-specific characteristics and will record the anticipated increase in turbidity on the PBACF. In the interim, for the purposes of this analysis and in the absence of site specific information, we assume that projects with a "may affect, likely to adversely affect" determination will cause increased turbidity up to 600 feet from the farthest downstream point of construction.

We therefore conclude that 1) if there is spawning habitat within the project area or within 600 ft downstream, the spawning habitat may be degraded and/or eggs may be suffocated, and 2) adult, subadult, and juvenile bull trout may suffer from short-term non-lethal physiological and behavioral effects as a result of mobilization of fine sediments in the water column. However, the amount and duration of the fine sediment mobilization is expected to be short term and is not expected to create long-term increased substrate embeddedness or decrease the number or quality of large pools.

Displacement

Restoration activities that involve in-water work could result in the displacement and/or disruption in the normal activities of bull trout in the project areas. Temporary displacement could result in lost foraging opportunities, increased chance of predation (for juveniles), or drive fish into habitat that is less than optimal, thereby increasing stress and reducing general health. However, the extent of these impacts is expected to be short term and not lead to a significant impairment of behaviors.

Stranding, Capture, and Handling

Direct effects to bull trout may include potential disturbance, harassment, injury, or mortality from stranding, capture (including electrofishing), or handling associated with the stream dewatering portions of RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 4 (Restore wetland hydrology), RA 7 (Improve road/trail conditions), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures). A section 10(a)(1)(A) is typically required for the direct take of listed species from recovery actions. However, to reduce the level of incidental take that would otherwise occur if bull trout were not relocated from areas which are to be dewatered, these activities will be included under this section 7 consultation.

Restoration activities that involve dewatering stream segments will implement and follow the Dewatering and Fish Capture Protocol (Appendix A), which is designed to minimize impacts to bull trout from stranding, capture, and handling by establishing a priority order for use (minnow traps, seining, and dip nets) and only using electroshocking when necessary if the project occurs within a bull trout Core Area or FMO habitat. This Protocol directs that all fish capture operations will be conducted by or under the supervision of an experienced fishery biologist, and all staff working with the seining operation must have the necessary knowledge, skills, and abilities to ensure the safe handling of bull trout. Additionally, this Protocol directs that bull trout must be handled with extreme care and kept in water at all times during transfer procedures in order to prevent the added stress of an out-of-water transfer. Such transfers may be conducted using a sanctuary net that holds water during transfer. The fish removed from the dewatered reach will be released as near as possible to the isolated reach in a pool or area that provides cover and flow refuge.

Following the in-water work windows (Appendix B) minimizes the risk to bull trout because bull trout are less likely to be present in the stream reach during the construction period. In order to better evaluate effects to resident and/or juvenile bull trout that may be present in local population areas year-round, dewatering in local population areas will be evaluated under a separate consultation. The gradual dewatering approach would allow fish to move downstream as the water in the channel is reduced, and should enhance the efficacy of fish capture and removal and thus reduce, but not eliminate, the risk of mortality. Even with implementation of the Protocol and in-water work windows, there is a potential that a small number of bull trout or their prey may avoid being captured and relocated and may die because they remain undetected in stream margins under vegetation or gravels during installation of water diversions and dewatering of the stream channels. However, sub-adult and adult bull trout, because of their larger size, are easier to detect and capture using seines or dip nets during the dewatering process, thereby reducing the likelihood that sub-adult or adult fish will be exposed to the effects of electroshocking or become stranded. However, bull trout prey species, because of their small size, may be able to avoid capture, and could be injured or killed during electroshocking or could become stranded and remain undetected on or in the dewatered streambed.

Some bull trout may choose to move into the pools that remain in the project area after the gradual dewatering, rather than move downstream with the flow. If fish concentrate in these pools, smaller bull trout may be preyed upon. It is uncertain how often this will occur and what the extent of the predation will be. However, as many fish as possible will be captured after the flow has been reduced by 2/3 and before the project area is left overnight. Furthermore, dewatering will not occur in local population areas where small bull trout are most likely to occur. In addition, the project area will be left in a stable, low flow condition overnight in order to allow fish to leave the project area on their own during the night.

Capture and subsequent handling of fish that remain in the project site will be implemented with minnow traps, seining, dip nets, and electroshocking. Any impacts from the capture and handling of bull trout would be short term in duration, occurring for 1 or 2 days per project. Handling stress, trauma from seines and dip nets, and electroshocking may result in injury and death. While injury and death due to handling stress and the use of seines and dip nets are believed to be uncommon, mortality may be delayed and less detectable. Therefore, adult and subadult bull trout may be killed or injured as a result of handling stress or trauma received during capture using minnow traps, seining, or dip nets. Implementation of the Dewatering and Fish Capture Protocol should reduce or eliminate the likelihood of bull trout being killed or injured.

Electroshocking can result in mortality and/or direct injuries to fish, including spinal hemorrhages, internal hemorrhages, fractured vertebra, spinal misalignment, and separated spinal columns (Hollender and Carline 1994; Dalbey et al. 1996; Thompson et al. 1997). Injury reports from studies using a backpack style 60 Hertz (HZ) direct current (DC) pulse electroshockers document spinal injuries sustained from electroshocking that have impacted on average 13-37 percent of adult fish in various studies (Thompson et al. 1997; Dalbey et al. 1996; Hollendar and Carline 1994). Hemorrhage injuries impacted 13-34 percent of adult fish in various studies (Thompson et al. 1997; Hollendar and Carline 1994). These studies also found that longer fish had a higher probability of being injured from electroshocking (Thompson et al. 1997; Dalby et al. 1996; Hollendar and Carline 1994). Rainbow trout with moderate to severe injuries had markedly lower growth and body condition after 335 days than fish with no or low spinal injuries (Dalbey et al. 1996). Dalbey et al. (1996) speculate that in a dynamic stream environment (rather than a pond) skeletal damage could possibly have an even greater negative effect on growth and survival.

Very few of the fish collected by Thompson et al. (1997) exhibited external signs of injury although a higher percentage of rainbow and brown trout were injured by electroshocking than would have been suspected from external examination. Dalbey et al. (1996) found that rainbow trout X-rayed soon after capture exhibited no detectable signs of spinal injury, but later showed calcification indicative of old injuries when X-rayed again after 335 days in a pond. Hollender and Carline (1994) found hemorrhages and spinal compressions in the smallest fish were small and difficult to see and might have been overlooked. Therefore, their reported injury rate (average of 22 percent) may be a conservative estimate. Most studies have focused on injuries exhibited in adults, but stress from electroshocking can be a problem for juveniles (P. Bisson, U. S. Forest Service; S. Parmenter, California Department of Fish and Game, pers. comm. cited *in* Nielson 1998).

Bull trout that do not move out of the project site during the gradual dewatering and are not captured using minnow traps, seines, or dip-nets will be exposed to electroshocking. The Service anticipates most adult and sub-adult bull trout will be not be exposed to electroshocking, but up to 37 percent of those that are exposed are likely to be killed or injured. Bull trout prey are unlikely to be killed during electroshocking, but may be injured as a result of stress.

In order to best determine the extent of adverse effects to bull trout as a result of stranding, capture, and handling, it is necessary to know at what densities they inhabit a stream. Bull trout densities are highly variable. Some of the factors influencing their densities are subpopulation characteristics, location in the water body, and time of year. Reported bull trout densities range widely depending on fish abundance, sampling methodology, and sampling efficiency. Densities have been reported in several ways making comparisons difficult. For example, densities have been reported per 100 meters $(m)^2$, from as low as 0.03 fish to as high as 37.5 fish per 100 m^2 (McPhail and Baxter 1996). Densities have also been reported from 0.02 fish to 42.5 fish per 100 m (Peterson et al. 2001; Bonar et al. 1997). Due to the high variation in bull trout density estimates and the high variability of the Core Areas and FMO habitat included in this consultation, the Service does not believe it is wise to assign a specific density estimate in order to evaluate the impacts to bull trout. Therefore, we will not estimate the number of bull trout that may be injured or killed due to stranding, capture, or handling. Rather, we will assume all bull trout associated with a project area could potentially be injured or killed as a result of capture and handling or stranding, but that most bull trout would voluntarily leave the project area during the gradual dewatering.

Following the in-water work windows minimizes the likelihood of migratory or spawning bull trout presence in project areas and following the Dewatering and Fish Capture Protocol 1) will lead to slow and sequential dewatering of the reach, allowing bull trout to recede with the water rather than be trapped in the project area and subject to stranding, capture, or handling, 2) will reduce the use of electroshocking when dewatering and removing bull trout from project areas, and 3) will reduce impacts to bull trout from electroshocking through the use of qualified personnel.

Based upon the above information, the Service concludes 1) subadult and adult bull trout that do not move out of the project area during the gradual dewatering are easier to see and will most likely be captured by seining or dip nets, and may suffer increased stress or trauma, but should not become stranded, 2) subadult and adult bull trout that evade capture by seining or dip nets will be exposed to electroshocking and may be killed or injured, and 3) bull trout prey species that do not move out of the project area during the gradual dewatering may be captured by seining, dip nets, or electroshocking and may suffer increased stress or trauma and those that evade capture could become stranded and die.

Extent of effects to individual bull trout from habitat alteration, displacement, stranding, capture, and handling

Because of the lack of certainty regarding location and scale (temporal and spatial) of restoration projects proposed each year, we cannot accurately predict 1) which individual bull trout core area or FMO areas would be impacted; 2) the total number of bull trout core areas or FMO areas impacted; or 3) how often a bull trout core area or FMO area would be impacted. Therefore, for the Coastal-Puget Sound bull trout interim recovery unit, the PBA estimated the maximum number of restoration projects that will occur in any given year over the life of the consultation (8 years) in each bull trout core area covered by the PBA that "may affect and are likely to adversely affect" bull trout. No more than two restoration projects that "may affect and are likely to adversely affect" bull trout will occur within any local population area in any given year. Any additional projects within a local population area that "may affect and are likely to adversely affect" bull trout require further consultation and approval from the Consultation and Technical Assistance Division and Listing and Recovery Division biologists identified as bull trout species leads.

Restoration activities that take place in FMOs outside of core areas may affect adult or subadult bull trout that are foraging, migrating, or overwintering. However, 1) bull trout are primarily found in the mainstem rivers of these FMOs, where projects are unlikely to be implemented, 2) the number of bull trout that use these FMOs is small, 3) bull trout are less likely to be present during the in-water work windows when projects will be implemented, 4) the scale of the restoration activities included in the PBA is limited, and 5) the BMPs that will be implemented have been designed to reduce impacts to bull trout and their habitat. Therefore, bull trout that occur in these FMOs are unlikely to be exposed to impacts generated by restoration activities and, if exposed, effects are expected to be insignificant. Therefore, restoration activities in FMOs outside of core areas, "may affect, but are not likely to adversely affect" bull trout.

Short-term Extent of Effects

In order to determine the maximum extent of short-term effects to bull trout within each core area, we determined the average project size to be 574 ft of stream and the maximum project size to be 2,640 ft of stream. Based upon past restoration projects, the PBA determined that 75 percent of the maximum number of "likely to adversely affect" restoration activities over the length of this consultation (8 years) within a core area could be up to 574 ft in length and the other 25 percent could be up to 2,640 ft in length. Then, the maximum downstream sediment impacts (600 ft per project) were added in order to obtain the total number of river miles per core area in which bull trout may be impacted by habitat alteration, displacement, capture, handling, or stranding. For example, the maximum number of likely to adversely affect restoration activities predicted to occur over the life of the PBA in the Skokomish River core area is four. Therefore, the total number of river miles in the Skokomish River core area in which bull trout may be affected is 1.28 miles (3 projects up to 574 ft)+(1 project up to 2,640 ft)+(4 projects x 600 ft). The one exception to this method is the Elwha River core area, for which we determined one project to be up to 574 ft in length and the other to be up to 2,640 ft in length (See Appendix D).

Each core area contains local population areas and FMO habitat. The total number of river miles anticipated to be impacted within each core area was divided among the local population areas and FMO habitat based upon information supplied in the PBA. Of the 12 core areas in which restoration activities may take place, 4 core areas will have impacts within 1 or more local population areas and the remainder of the anticipated impacts will occur within FMO habitat (Table 4). Activities occuring in a local population may affect eggs, juvenile, subadult, or adult bull trout. However, there are 4 local populations where restoration activities may occur, but bull trout eggs will not be affected because spawning is unlikely to occur in the portion of the local population included in the PBA (see Table 4). Activities occuring in FMO habitat of a core area may affect subadult or adult bull trout.

Table 4. Maximum Number of Restoration Projects that "May Affect, Likely to Adversely Affect" Bull Trout and the Extent of Anticipated Effects due to Habitat Alteration, Stranding, Capturing, or Handling in Feeding, Migration and Overwintering (FMO) Habitat and Local Population Areas (LPA). Refer to Appendix D for supporting information.

Management or Recovery Unit	FMO or Core Area	Population Status within Core Areas	Total River Miles subject to effects	Local Population Area(s) (LPA) or FMO habitat in Core Areas	Extent of Anticipated Total Impacts due to Habitat Alteration, Displacement, Stranding, Capturing, or Handling (River Miles)	Extent of Project Area subject to habitat alteration, stranding, capture, or handling effects (miles)	Extent of anticipated downstream increased turbidity (miles)	Bull Trout Life Stage Potentially Impacted by Restoration Activities
Olympic Peninsula	Hood Canal and independent tributaries FMO up to the National Forest boundary		0		0	0	0	
	Strait of Juan de Fuca and independent tributaries FMO up to the National Park boundary		0		0	0	0	
	Pacific Ocean and independent coastal tributaries FMO (areas of National Park are not included)		0		0	0	0	

Table 4. Maximum Number of Restoration Projects that "May Affect, Likely to Adversely Affect" Bull Trout and the Extent of Anticipated Effects due to Habitat Alteration, Stranding, Capturing, or Handling in Feeding, Migration and Overwintering (FMO) Habitat and Local Population Areas (LPA). Refer to Appendix D for supporting information.

Management or Recovery Unit	FMO or Core Area	Population Status within Core Areas	Total River Miles subject to effects	Local Population Area(s) (LPA) or FMO habitat in Core Areas	Extent of Anticipated Total Impacts due to Habitat Alteration, Displacement, Stranding, Capturing, or Handling (River Miles)	Extent of Project Area subject to habitat alteration, stranding, capture, or handling effects (miles)	Extent of anticipated downstream increased turbidity (miles)	Bull Trout Life Stage Potentially Impacted by Restoration Activities
Olympic Peninsula cont.	Lower Chehalis River/Grays Harbor and independent tributaries FMO		0		0	0	0	
	Skokomish River Core Area, including North and South Forks from the mouth up to the National Forest or National Park boundaries	At increased risk of local extirpation, genetic drift, and inbreeding depression	1.28	**LPA** None with the area covered by the PBA	0	0	0	
				FMO Skokomish River	1.28	0.83	0.45	Subadults and Adults
	Dungeness River Core Area up to the National Forest boundary	At increased risk of local extirpation and genetic drift	1.92	**LPA** Middle Dungeness River and tributaries up to river mile 24 and including Silver, Gold, and Canyon Creeks	0	0	0	
				FMO Dungeness River	1.92	1.24	0.68	Subadults and Adults

Table 4. Maximum Number of Restoration Projects that "May Affect, Likely to Adversely Affect" Bull Trout and the Extent of Anticipated Effects due to Habitat Alteration, Stranding, Capturing, or Handling in Feeding, Migration and Overwintering (FMO) Habitat and Local Population Areas (LPA). Refer to Appendix D for supporting information.

Management or Recovery Unit	FMO or Core Area	Population Status within Core Areas	Total River Miles subject to effects	Local Population Area(s) (LPA) or FMO habitat in Core Areas	Extent of Anticipated Total Impacts due to Habitat Alteration, Displacement, Stranding, Capturing, or Handling (River Miles)	Extent of Project Area subject to habitat alteration, stranding, capture, or handling effects (miles)	Extent of anticipated downstream increased turbidity (miles)	Bull Trout Life Stage Potentially Impacted by Restoration Activities
Olympic Peninsula cont.	Elwha River Core Area up to the National Forest or National Park boundary	At increased risk of local extirpation and genetic drift	0.84	**LPA** Little River (potential local population)	0	0	0	
				FMO Elwha River	0.84	0.61	0.23	Subadults and Adults
	Hoh River Core Area up to the National Forest or National Park boundaries	At increased risk of local extirpation and genetic drift	0.64	**LPA** South Fork Hoh River and tributaries	0	0	0	
				FMO Hoh River	0.64	0.41	0.23	Subadults and Adults
	Queets River Core Area up to the National Park boundary	At increased risk of local extirpation and genetic drift	0.64	**LPA** None within the area covered by the PBA	0	0	0	
				FMO Queets River	0.64	0.41	0.23	Subadults and Adults
	Quinault River Core Area up to the National Forest or National Park	At increased risk of local extirpation and genetic drift	3.2	**LPA** None within the area covered by the PBA	0	0	0	
				FMO Quinault	3.2	2.07	1.14	Subadults and

Table 4. Maximum Number of Restoration Projects that "May Affect, Likely to Adversely Affect" Bull Trout and the Extent of Anticipated Effects due to Habitat Alteration, Stranding, Capturing, or Handling in Feeding, Migration and Overwintering (FMO) Habitat and Local Population Areas (LPA). Refer to Appendix D for supporting information.

Management or Recovery Unit	FMO or Core Area	Population Status within Core Areas	Total River Miles subject to effects	Local Population Area(s) (LPA) or FMO habitat in Core Areas	Extent of Anticipated Total Impacts due to Habitat Alteration, Displacement, Stranding, Capturing, or Handling (River Miles)	Extent of Project Area subject to habitat alteration, stranding, capture, or handling effects (miles)	Extent of anticipated downstream increased turbidity (miles)	Bull Trout Life Stage Potentially Impacted by Restoration Activities
	boundary			River				Adults
Puget Sound	Samish River FMO		0		0	0	0	
	Lake Washington FMO including the following: Lower Cedar River: Sammamish River; Lakes Washington, Sammamish and Union; and Ship Canal		0		0	0	0	
	Lower Green River FMO		0		0	0	0	
	Lower Nisqually River FMO		0		0	0	0	

Table 4. Maximum Number of Restoration Projects that "May Affect, Likely to Adversely Affect" Bull Trout and the Extent of Anticipated Effects due to Habitat Alteration, Stranding, Capturing, or Handling in Feeding, Migration and Overwintering (FMO) Habitat and Local Population Areas (LPA). Refer to Appendix D for supporting information.

Management or Recovery Unit	FMO or Core Area	Population Status within Core Areas	Total River Miles subject to effects	Local Population Area(s) (LPA) or FMO habitat in Core Areas	Extent of Anticipated Total Impacts due to Habitat Alteration, Displacement, Stranding, Capturing, or Handling (River Miles)	Extent of Project Area subject to habitat alteration, stranding, capture, or handling effects (miles)	Extent of anticipated downstream increased turbidity (miles)	Bull Trout Life Stage Potentially Impacted by Restoration Activities
	Marine Areas of Puget Sound FMO		0		0	0	0	
Puget Sound cont.	Chilliwack River Core Area up to the National Forest boundary	The U.S. portion is at intermediate risk of local extirpation, but likely not at risk from genetic drift. Inbreeding depression risk has yet to be determined.	0.64	**LPA** None within the area covered by the PBA	0	0	0	
				FMO Chilliwack River	0.64	0.41	0.23	Subadults and Adults
	Nooksack River Core Area up to the National Forest boundary	At increased risk of local extirpation, genetic drift, and inbreeding depression	6.4	**LPAs with no Impacts -** Glacier Creek, Lower Canyon Creek, Middle North Fork Nooksack River,Upper Middle Nooksack River	0	0	0	

Table 4. Maximum Number of Restoration Projects that "May Affect, Likely to Adversely Affect" Bull Trout and the Extent of Anticipated Effects due to Habitat Alteration, Stranding, Capturing, or Handling in Feeding, Migration and Overwintering (FMO) Habitat and Local Population Areas (LPA). Refer to Appendix D for supporting information.

Management or Recovery Unit	**FMO or Core Area**	**Population Status within Core Areas**	**Total River Miles subject to effects**	**Local Population Area(s) (LPA) or FMO habitat in Core Areas**	**Extent of Anticipated Total Impacts due to Habitat Alteration, Displacement, Stranding, Capturing, or Handling (River Miles)**	**Extent of Project Area subject to habitat alteration, stranding, capture, or handling effects (miles)**	**Extent of anticipated downstream increased turbidity (miles)**	**Bull Trout Life Stage Potentially Impacted by Restoration Activities**
Puget Sound cont.	Nooksack River Core Area up to the National Forest boundary cont.			**LPA with Impacts** (25%) - Lower North Fork Nooksack, Lower Middle Fork Nooksack River (*spawning unlikely to occur in portion of local population included in the PBA*), Lower South Fork Nooksack River	1.6	1.25	0.35	Eggs, juveniles, subadults, and adults
				FMO (75%) Nooksack River	4.8	3.74	1.06	Subadults and Adults
	Lower Skagit River Core Area up to the National Forest or National Park boundary	At diminished risk of local extirpation, not at risk from genetic drift or inbreeding depression	3.2	**LPA** Illabot Creek	0	0	0	
				FMO Lower Skagit River	3.2	2.07	1.14	Subadults and Adults

Table 4. Maximum Number of Restoration Projects that "May Affect, Likely to Adversely Affect" Bull Trout and the Extent of Anticipated Effects due to Habitat Alteration, Stranding, Capturing, or Handling in Feeding, Migration and Overwintering (FMO) Habitat and Local Population Areas (LPA). Refer to Appendix D for supporting information.

Management or Recovery Unit	FMO or Core Area	Population Status within Core Areas	Total River Miles subject to effects	Local Population Area(s) (LPA) or FMO habitat in Core Areas	Extent of Anticipated Total Impacts due to Habitat Alteration, Displacement, Stranding, Capturing, or Handling (River Miles)	Extent of Project Area subject to habitat alteration, stranding, capture, or handling effects (miles)	Extent of anticipated downstream increased turbidity (miles)	Bull Trout Life Stage Potentially Impacted by Restoration Activities
Puget Sound cont.	Stillaguamish River Core Area up to the National Forest boundary	At increased risk of local extirpation, genetic drift, and inbreeding depression	6.4	**LPA** South Fork Canyon Creek	0	0	0	
				LPA (10%) North Fork Stillaguamish River	0.64	0.5	0.14	Eggs, juveniles, subadults, and adults
				LPA Upper Deer Creek	0	0	0	
				FMO (90%) Stillaguamish River	5.76	4.49	1.27	Subadults and Adults
	Snohomish/ Skykomish Rivers Core Area up to the National Forest boundary	At increased risk of local extirpation, genetic drift, and inbreeding depression	3.2	**LPA** (10%) South Fork Skykomish River	0.32	0.25	0.07	Eggs, juveniles, subadults, and adults
				FMO (90%) Snohomish/ Skykomish Rivers	2.88	2.28	0.6	Subadults and Adults

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Management or Recovery Unit	FMO or Core Area	Population Status within Core Areas	Total River Miles subject to effects	Local Population Area(s) (LPA) or FMO habitat in Core Areas	Extent of Anticipated Total Impacts due to Habitat Alteration, Displacement, Stranding, Capturing, or Handling (River Miles)	Extent of Project Area subject to habitat alteration, stranding, capture, or handling effects (miles)	Extent of anticipated downstream increased turbidity (miles)	Bull Trout Life Stage Potentially Impacted by Restoration Activities
Puget Sound cont.	Puyallup River Core Area up to the National Forest or National Park boundary	At intermediate risk of local extirpation and increased risk from genetic drift and inbreeding depression	6.4	**LPA** (10%) Carbon River (*spawning unlikely to occur in portion of local population included in the PBA*), Clearwater River (*potential*), Greenwater River, Upper Puyallup and Mowich Rivers, Upper White River (*spawning unlikely to occur in portion of local population included in the PBA*), West Fork River (*spawning unlikely to occur in portion of local population included in the PBA*)	0.64	0.50	0.14	Eggs, juveniles, subadults, and adults
				FMO (90%) Puyallup River	5.76	4.49	1.27	Subadults and Adults

Table 4. Maximum Number of Restoration Projects that "May Affect, Likely to Adversely Affect" Bull Trout and the Extent of Anticipated Effects due to Habitat Alteration, Stranding, Capturing, or Handling in Feeding, Migration and Overwintering (FMO) Habitat and Local Population Areas (LPA). Refer to Appendix D for supporting information.

Management or Recovery Unit	FMO or Core Area	Population Status within Core Areas	Total River Miles subject to effects	Local Population Area(s) (LPA) or FMO habitat in Core Areas	Extent of Anticipated Total Impacts due to Habitat Alteration, Displacement, Stranding, Capturing, or Handling (River Miles)	Extent of Project Area subject to habitat alteration, stranding, capture, or handling effects (miles)	Extent of anticipated downstream increased turbidity (miles)	Bull Trout Life Stage Potentially Impacted by Restoration Activities
TOTALS			**34.76**		**34.76**	**25.55**	**9.23**	
TOTALS Summed by LPA and FMO			LPA – Puget Sound		3.20	2.50[1]	0.70	Eggs, juveniles, subadults, and adults
			FMO – Olympic Peninsula		8.52	5.57	2.96	Subadults and Adults
			FMO – Puget Sound		23.04	17.48	5.57	Subadults and Adults

[1] Only subject to habitat alteration effects, as dewatering within local population areas is not covered by the programmatic consultation.

Summary

A local population area supports spawning and early rearing of bull trout and may be particularly susceptible to restoration activities that are anticipated to degrade habitat components in the short term, depending on the location of the activity. Projects which occur within a local population area may present an unacceptable risk to that particular core area of bull trout until additional spawning areas or potential local populations are re-established. RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures) may occur within any one of the local populations as identified in Table 4. Over the life of the PBA (8 years), bull trout associated with 1) 0.64 river miles within five local populations in the Puyallup River core area, 2) 1.6 river miles within three local populations within the Nooksack River core area, 3) 0.64 river mile in the North Fork Stillaguamish local population area, and 4) 0.32 river mile in the South Fork Skykomish local population area may be adversely affected as a result of short-term degradation of spawning and rearing habitat (3.20 river miles); potential loss of eggs from sediment (3.20 river miles); and non-lethal short-term physiological and behavioral effects to juveniles, subadults, and adults from sediment (3.20 river miles). Spawning will not be affected within four of the local population areas because spawning is unlikely to occur in the portion of the local population area included in the PBA (Table 4).

FMO habitat within a core area supports subadult and adult bull trout foraging and sheltering. RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures) may occur within FMO habitat associated with a core area and may negatively affect subadult and adult bull trout as a result of short-term degradation of habitat (31.56 river miles); non-lethal short-term physiological and behavioral effects from sediment (31.56 river miles); and the stress or trauma associated with displacement, capture, and handling of subadults and adults (23.05 river miles). Over the life of the PBA (8 years), bull trout associated with up to 31.56 river miles within FMO habitat may be adversely affected. However, no more than 5.76 miles of FMO habitat will be affected in any one core area and the maximum amount of river miles affected will not be continuous, as the largest project allowed will not exceed 0.5 mile.

Over the life of the PBA (8 years), bull trout associated with up to 34.76 river miles within core areas in the Coastal-Puget Sound interim recovery unit may be negatively affected. These effects will be distributed among 12 core areas. All of the effects to bull trout in the Olympic Peninsula core areas will occur only within FMO habitat. The effects to bull trout in the Puget Sound core areas may occur within local population areas or FMO habitat.

Negative effects to bull trout in local population areas and FMO habitat will be minimized because of the following:

Habitat degradation will be short-term and habitat will be improved over the long term as a result of the restoration activities and their associated BMPs. The BMPs are designed to minimize project impacts. Some examples include the use of existing roads or travel paths for access to project sites, minimizing sedimentation by using sediment and erosion control practices or by using appropriate sized equipment, minimizing impacts to riparian vegetation by limiting entry and retaining undisturbed vegetated buffer zones and replanting those areas where disturbance is necessary;

Bull trout spawning activities are typically associated with the most intact and undisturbed areas of a watershed. Restoration activities covered under this programmatic consultation typically will not occur in intact and undisturbed areas. Application of the in-water work windows will reduce the likelihood of activities occuring during spawning and/or early rearing;

Conservation measures F1 and BT3 and the general and project specific BMPs will provide some protection for bull trout in FMO habitat;

The Dewatering and Fish Capture Protocol will allow bull trout to move out of the project area with the receding water, which reduces the number of fish that will be subject to capture, handling, or stranding and reduces the stress or trauma related to capture techniques; and

The estimate of 600 ft of downstream habitat degradation and/or increased turbidity may be an over-estimation.

The long-term effects of the restoration activities will aid bull trout recovery and enhance the likelihood of survival for bull trout in the Coastal-Puget Sound interim recovery unit by improving the number, distribution, and reproductive potential of bull trout. Restoration activities are expected to result in the following long-term benefits:

Restoration of bull trout habitat by improving the condition of relevant habitat indicators;

Improved growth and survival of bull trout by improving habitat quality and connectivity and improving fish growth rates;

Improved life history diversity and isolation by providing better functioning migratory corridors and rearing habitat and allowing connection of previously isolated populations; and

Improved persistence and genetic integrity by providing better connected, more accessible habitat.

EFFECTS OF THE ACTION (Bull Trout Critical Habitat)

For the purposes of this consultation, we assume all of the proposed restoration activities will occur in bull trout critical habitat and could impact PCEs. All of the PCEs, except for PCE 7 (Abundant food base), are similar or equivalent to the bull trout matrix habitat indicators evaluated in the preceding Habitat Alteration section (also see Appendix E). Therefore, for our analysis of effects to PCEs, we will assume that if a restoration activity is anticipated to restore, maintain, or degrade an indicator, the corresponding PCE will be affected in the same manner. We conducted our analysis of bull trout effects by evaluating the indicators at the project scale. We will also conduct our analysis of effects to PCEs at the same scale.

Appendix E presents a generic crosswalk between the matrix indicators and PCEs and the rationale for how PCEs can be thoroughly addressed through the matrix. Appendix E also includes a crosswalk table specific to the restoration activities. The following section presents the indicators that we believe correspond to each PCE and a brief summary of how each PCE may be affected by the restoration activities. In the cases where this analysis includes or ignores an indicator in the generic crosswalk, the rationale for the change is provided. A more thorough evaluation of effects to the indicators was presented in the Habitat Alteration section.

PCE 1 (Water temperature) is closely linked to the following indicators: temperature, large pools, refugia, wetted width/maximum depth ratio, streambank condition, floodplain connectivity, changes in peak/base flows, road density and location, and riparian conservation areas. Water temperature may be negatively impacted for up to 1 year by restoration activities that change water movement and surface area or remove riparian vegetation. However, in order to reduce short-term negative impacts to water temperature, construction and implementation practices will follow all BMPs, be designed to reduce impacts to existing native riparian vegetation, use existing travel pathways, minimize entry points through the riparian areas, maintain vegetated buffers, and revegetate with native species if vegetation has to be removed. Therefore, given the allowable activities, the typical project size, and the required BMPs, the short-term negative impact to temperature should be insignificant at the project scale.

Road density and location is included in the generic crosswalk because it can affect temperature. It is not included in this analysis because most of the road work will not take place in riparian areas. For those restoration activities that do take place in riparian areas, vegetation removal would be the cause for changes in temperature, and this is addressed by the analysis of other indicators (see previous paragraph).

Water temperature will be positively impacted over the long term by restoration activities that protect and restore riparian vegetation, promote channel/floodplain connections, or form and maintain natural channel geomorphology.

PCE 2 (Complex stream channels) is closely linked to the following indicators: large woody debris, pool frequency and quality, large pools, off-channel habitat, refugia, wetted width/maximum depth ratio, streambank condition, floodplain connectivity, disturbance history, riparian conservation areas, and disturbance regime. Complex stream channels may be negatively impacted for up to 1 year by restoration activities that 1) result in sedimentation impacts to pools or off-channel habitat or 2) disturb or remove vegetation along streambanks or in riparian areas. In order to reduce short-term negative impacts to stream channels, construction and implementation practices will follow all BMPs, be designed to reduce sediment inputs and impacts to existing native riparian vegetation, use appropriately sized heavy equipment, use existing travel pathways, minimize entry points through the riparian areas, maintain vegetated buffers, and revegetate with native species if vegetation has to be removed. Given the typical project size and implementation of required BMPs, negative effects due to removal of riparian vegetation should be insignificant at the project scale. Even though negative impacts will be reduced to the extent practicable, restoration activities that mobilize sediment may adversely affect complex stream channels in the short term.

Complex stream channels may be adversely affected over the long term by RA 11 (Remove/replace structural barriers) when riprap is placed around bridge footings for protection during flooding events. In addition, grade control structures made of either rock or wood may be placed within the channel to ensure fish passage until the channel stabilizes. Grade control structures or riprap may result in a channel constriction or a hard point, preventing normal channel migration from occurring in the future. However, these changes in streambank condition from a culvert-hardened channel to a bridge/riprap-hardened channel will not result in further degradation to the streambank condition. Even though this PCE may be adversely affected at the project scale, we don't anticipate the complexity of the stream channel to be reduced to the extent that it no longer provides a variety of depths, velocities, and instream structures.

Complex stream channels will be positively impacted over the long term by restoration activities that increase the amount of LWD in the channel, increase or maintain off-channel habitat, protect and/or restore riparian vegetation, reconnect the channel to the floodplain, or restore access to tidal areas.

PCE 3 (Substrates of sufficient amount, size and composition in spawning and early rearing areas) is closely linked to the following indicators: sediment, substrate embeddedness, large woody debris, pool frequency and quality, and streambank condition. Substrates of sufficient amount, size, and composition in spawning and early rearing areas may be negatively impacted for up to 1 year by restoration activities that mobilize sediment within a local population area. However, mobilization of sediment will be minimized and controlled as much as possible by the implementation of BMPs designed to control erosion, reduce the area of ground disturbance, dispose of excavated materials properly and ensure their stabilization, and maintain or replant vegetation along stream channels. Even though negative impacts will be reduced to the extent practicable, restoration activities that mobilize sediment may adversely affect the amount, size, or composition of substrates in spawning and early rearing areas in the short term.

Substrates of sufficient amount, size, and composition will be positively impacted over the long term by restoration activities that install instream structures, improve or increase off-channel habitats, reconnect floodplain and tidal areas, protect or restore riparian vegetation, diminish the impacts of roads and trails, or remove or replace structural barriers. These activities will have long-term positive impacts on the sorting, storage, and transport of sediment in stream channels, by restoring natural processes and functions.

PCE 4 (Natural hydrograph) is closely linked to the following indicators: floodplain connectivity, changes in peak/base flows, drainage network increase, road density and location, disturbance history, riparian conservation areas, and disturbance regime. Restoration activities that remove riparian vegetation may negatively impact riparian conservation areas; however the amount of vegetation removal will be small and should not impact the natural hydrograph. RA 11 (Remove/replace structural barriers) may result in a long-term increase in road density; however, the natural hydrograph should not be altered because there will be no increases in drainage network and minimal increases in stormwater run-off associated with the road widening.

The natural hydrograph will be positively impacted over the long term by restoration activities that improve or increase off-channel habitats, reduce upland sediment delivery and livestock impacts, restore wetland hydrology, remove or set back hydraulic constrictions, restore or protect riparian vegetation, improve road and trail conditions, or remove or replace structural barriers.

PCE 5 (Springs, seeps, and groundwater sources) is closely linked to the following indicators: chemical contaminants and nutrients, substrate embeddedness, off-channel habitat, streambank condition, floodplain connectivity, changes in peak/base flows, drainage network increase, road density and location, and riparian conservation areas. Restoration activities that remove riparian vegetation may negatively impact riparian conservation areas; however, the amount of vegetation removal is limited to 50 lineal feet and should not impact springs, seeps, or groundwater. Restoration activities that mobilize sediment and that increase substrate embeddedness may reduce flow from groundwater sources, thereby negatively affecting this PCE. RA 11 (Remove/replace structural barriers) may result in a long-term increase in road density; however, springs, seeps, and groundwater should not be altered because there will be no increases in drainage network associated with the road widening.

Springs, seeps, and groundwater sources will be positively impacted over the long term by restoration activities that improve off-channel habitat, protect channel and riparian habitat from livestock impacts, increase channel complexity, restore or protect riparian vegetation, or install instream structures. The generic crosswalk does not include off-channel habitat in the analysis of this PCE. However, re-opening or enhancing off-channel or secondary habitats can reconnect springs, seeps, or groundwater to the main channel and provide additional sources of cold water.

PCE 6 (Migratory corridors) is closely linked to the following indicators: temperature, sediment, chemical contaminants and nutrients, physical barriers, refugia, wetted width/maximum depth ratio, and changes in peak/base flows. Migratory corridors may be negatively impacted for up to 1 year by restoration activities that mobilize sediment, disturb the riparian area, or remove vegetation. Impacts to migratory corridors will be minimized by implementation of BMPs and activities will be designed to reduce and minimize sedimentation, reduce impacts to existing native riparian vegetation, minimize ground disturbance, properly dispose of excavated materials, and revegetate with native species if vegetation is removed. Given the typical project size and implementation of required BMPs, negative effects due to removal of riparian vegetation should be insignificant at the project scale. Even though negative impacts will be reduced to the extent practicable, restoration activities that mobilize sediment may adversely affect the migratory corridors.

Restoration activities that require the stream to be dewatered may block access through migratory corridors. However, these blockages will be temporary and will occur during the in-water work windows when movement of bull trout through the area is less likely to occur.

Migratory corridors will be positively impacted over the long term by restoration activities that protect or restore riparian vegetation, protect channel streambanks from livestock degradation, improve channel/floodplain interaction, improve water storage and retention, reduce sedimentation, reduce chemical contaminant or nutrient inputs, or remove or improve passage through man-made physical barriers.

PCE 7 (Abundant food base) is closely linked to the following indicators: temperature, sediment, chemical contaminants and nutrients, substrate embeddedness, pool frequency and quality, floodplain connectivity, and riparian conservation areas. Abundant food base may be negatively impacted for up to 1 year by restoration activities that disturb the streambed, mobilize sediment, or remove riparian vegetation. Impacts to the food base will minimized by implementation of BMPs. Given the typical project size and implementation of required BMPs, negative effects due to removal of riparian vegetation should be insignificant at the project scale. Even though negative impacts will be reduced to the extent practicable, some restoration activities that disturb the streambed or mobilize sediment may adversely affect the foodbase for up to 1 year during and after project construction. However, we do not anticipate prey resources will be reduced to such an extent that bull trout will not be able to forage in the project area after construction.

An abundant food base will be positively impacted over the long-term by restoration activities that protect or restore riparian vegetation, create and support complex channel habitats, or reduce sediment inputs.

PCE 8 (Permanent water of sufficient quantity and quality such that normal reproduction, growth and survival are not inhibited) is closely linked to the following indicators: temperature, sediment, chemical contaminants and nutrients, floodplain connectivity, changes in peak/base flows, drainage network increase, disturbance history, and disturbance regime.

Water quality may be negatively impacted for up to 1 year by restoration activities that remove riparian vegetation or mobilize sediment. In order to reduce short-term negative impacts to water quality, construction and implementation practices will 1) follow required BMPs, 2) be designed to reduce impacts to existing native riparian vegetation, sediment inputs, and area of ground disturbance, 3) dispose of excavated materials properly 4) use sedimentation and erosion control structures, 5) use existing travel pathways and minimize entry points through riparian areas, 6) maintain vegetated buffers, and 7) revegetated with native species if vegetation has to be removed. Given the typical project size and implementation of required BMPs, negative effects due to removal of riparian vegetation should be insignificant at the project scale. Even though negative impacts will be reduced to the extent practicable, restoration activities that mobilize sediment may adversely affect water quality in the short term.

Water quality and quantity will be positively impacted over the long term by restoration activities that protect and restore of riparian vegetation; improve channel habitat structure and diversity; improve the channel/floodplain connection and formation; maintain a more natural channel geomorphology, storage capacity or retention time; reduce sedimentation; reduce chemical contaminant and nutrient inputs; reduce impacts from uplands roads and trails; or improve hyporheic and groundwater connections.

Summary

The potential negative impacts to the PCEs will be short-term in nature, primarily from sediment inputs. The purpose and intent of the restoration activities covered by this programmatic consultation is to restore the long-term function and processes of aquatic and riparian ecosystems, to promote long-term benefits to fish and wildlife species, and to support the recovery of fish and wildlife species and their habitats. Aquatic species, such as bull trout, depend on these fully functional ecosystems for long-term survival. Restoration activities that re-establish the function of these ecosystems and the connectivity within these ecosystems enable bull trout to express all life history forms and facilitate genetic exchange between neighboring bull trout populations. In addition, the restoration and reconnection of habitats previously accessed by bull trout will provide long-term refugia from stochastic events, reducing the risk of local extinction.

PCEs 1, 2, 4, 5, 6, 7, and 8 may be negatively impacted over the short term by removal of riparian vegetation. However, given the typical project size and implementation of required BMPs, the negative effects from removal of riparian vegetation should be an insignificant effect on these PCEs. PCEs 2, 3 (only in local population areas), 5, 6, 7, and 8 may be negatively impacted over the short term by mobilization of sedimentation during project construction and post-project high flow events. Over the long term, all PCEs will either be maintained or restored.

RA 5 (Install/develop wildlife structures), RA 12 (Collect information/monitor), RA 14 (Install signs), and RA 15 (Deploy salmon carcasses) will maintain critical habitat function for bull trout over the short- and long-term. Implementation of these activities will not impact the PCEs and will have no effect to bull trout critical habitat.

RA 3 (Reduce upland sediment production/delivery) will be conducted above the ordinary high water mark and outside of the aquatic and riparian area. This activity will have positive effects on all PCEs except temperature, which will be maintained. Therefore, this restoration activity is not likely to adversely affect bull trout critical habitat.

RA 8 (Plant native vegetation) and RA 9 (Promote native vegetation growth) may result in short-term negative impacts to PCEs by removing riparian vegetation. However, based on the typical project size, the project description of allowable activities, and the implementation of BMPs, these short-term negative effects are insignificant. These restoration activities will have long-term benefits to all PCEs. Therefore, these restoration activities are not likely to adversely affect bull trout critical habitat.

When RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures) are implemented in FMOs outside of core areas, critical habitat for adult or subadult bull trout foraging, migrating, or overwintering may be negatively affected over the short term by mobilizing sediment during project construction and post-project during high flow events. However, 1) bull trout critical habitat was primarily designated in the mainstem rivers of these FMOs, where projects are unlikely to be implemented, 2) the scale of the restoration activities included in the PBA is limited, and 3) the BMPs that will be implemented have been designed to reduce impacts to bull trout habitat. Therefore, bull trout critical habitat that is designated in these FMOs is unlikely to be exposed to impacts generated by restoration activities and, if exposed, effects are expected to be insignificant. Therefore, restoration activities in FMOs outside of core areas, "may affect, but are not likely to adversely affect" bull trout critical habitat.

RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures) may result in short-term negative impacts to PCEs by removing riparian vegetation. However, based on the typical project size, the project description of allowable activities, and the implementation of BMPs, these short-term negative effects are insignificant.

RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), and RA 13 (Install/modify fish passage structures) may negatively affect PCEs 2, 3, 5, 6, 7, and 8 over the short term by mobilizing sediment during project construction and post-project during high flow events. The short-term sediment effects may adversely effect PCEs within the project area and downstream for up to 600 ft. Therefore, these restoration activities are likely to adversely affect bull trout critical habitat. The geographic extent of the adverse effects is the same as the extent calculated for bull trout in the previous section (Table 4). Therefore, 8.52 miles of bull trout critical habitat within the Olympic Peninsula CHU and 26.24 miles within the Puget Sound CHU may be adversely affected by short-term mobilization of sediment over the life of the PBA (8 years). However, these short-term adverse effects to the Olympic Peninsula CHU and the Puget Sound CHU will be minimized because the effects are not anticipated to degrade bull trout critical habitat for more than 1 year in any location, the project designs and BMPs will reduce the effects to the extent practicable, and the effects will not be contiguous within any one core area.

Degradation of bull trout critical habitat will be short term and the critical habitat will be improved over the long term as a result of implementation of RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 3 (Reduce upland sediment production/delivery), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 8 (Plant native vegetation), RA 9 (Promote native vegetation growth), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove structural barriers), RA 13 (Install/modify fish passage structures), and their associated BMPs, which are designed to minimize project impacts. Overall, the function of the Olympic Peninsula and Puget Sound CHUs will be improved by the restoration activities implemented within the guidelines set out in the PBA. Therefore, these two CHUs will continue to provide for the conservation of bull trout.

CUMULATIVE EFFECTS (Bull Trout and Bull Trout Critical Habitat)

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Biological 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 effects of non-Federal actions on bull trout and bull trout critical habitat cannot be precisely estimated or quantified due to the variety of State, Tribal, and local actions that may occur over the time-period covered by this PBA. There are generally four broad categories of impacts that could occur within the action area: 1) growth and development, 2) forest management, 3) habitat rehabilitation and restoration projects, and 4) other habitat-altering actions.

Growth and Development

Washington's population grew by 1,027,474 people between 1990 and 2000 to a total of 5,589,143 people in 2000 (Washington State Data Book 2006). Growth on the west side of the Cascades in the Puget Sound area accounted for 50 percent of the total population growth in the 1990s down from 75 percent in the 1980s (U.S. Census Bureau 2000). Clark, San Juan, and Grant Counties had the fastest growing populations. San Juan County grew by 40 percent (U.S. Census Bureau 2000). In Washington the top 10 counties with regards to highest populations in 1999 are the following in order, highest to lowest: King, Pierce, Snohomish, Spokane, Clark, Kitsap, Yakima, Thurston, Whatcom, and Benton (U.S. Census Bureau 2000). Since January of 1990, 14 new cities have been created in Washington State (U.S. Census Bureau 2000). Approximately 50,089 housing permits were issued in Washington in 2004 (Washington State Data Book 2006). It is likely that population growth and development since 1999 has continued to exhibit a similar pattern and will continue to do so into the future. On the western side of Washington, population growth and residential development are centered in the Puget Trough area in Seattle, Tacoma, Olympia, and Vancouver. These areas will continue to expand east toward the foothills of the Cascade Mountains, west toward the Kitsap Peninsula and north and south along the I-5 corridor.

Residential and commercial development tends to occur in low elevation, low gradient floodplains, or foothills. This type of development permanently converts suitable habitats and provides little to no benefits to bull trout. Habitat fragmentation, habitat loss, and habitat degradation are expected to continue as development creates a demand for new public services and facilities. Disturbances caused by human development have had, and will continue to have a cumulative impact on bull trout and bull trout critical habitat.

Forest Management

Washington State encompasses 66,582 square miles. Approximately 14,063 square miles are under Federal management, leaving approximately 52,519 square miles of non-Federal land. Of these, approximately 8 million acres or 12,500 square miles are private and corporate owned forest land (i.e. not Federal and not managed by the Washington Department of Natural Resources). In comparison, Federal lands covered under the Northwest Forest Plan in Washington State total 13,811 square miles.

On the 12,500 square miles of private and corporate timberlands in Washington State, intensive forest management practices would leave these lands in early seral stages (e.g., 40 to 50 years of age on the west side) with few structures such as snags, down logs, large trees, and variable vertical layers. Intensive forest management generally results in adverse impacts such as loss of older forest habitats and habitat structures, increased fragmentation of forest age classes, loss of large contiguous and interior forest habitats, decreased water quality, degradation of riparian and aquatic habitats, and increased displacement of individuals.

Statewide timber harvest in 2002 was 3,582 million board feet (Washington State Data Book 2006). This harvest level is down 134 million board feet from figures in 2001. Since 1986, timber harvest levels have been decreasing from a high of 6,556 million board feet to 3, 582 million board feet (Washington State Data Book 2006). In

Washington, there are seven HCPs for non-Federal landowners that address the conservation of bull trout, including the Washington Department of Natural Resources.

Other non-Federal landowners may take steps to curtail or avoid land management practices that would harm or harass bull trout, or seek incidental take exemptions through section 10(a)(1)(B) of the Act. However, there is no certainty that this will occur. Therefore, the Service assumes future non-Federal actions in Washington are likely to continue over the next several years at similar intensities as in recent years and these actions will cumulatively affect bull trout. The Service anticipates the majority of cumulative effects will occur within bull trout foraging, migratory, and overwintering habitats where the greatest concentration of non-Federal lands occur.

In 2000, State forest practice regulations were significantly revised following the Forest and Fish agreement (FFR 1999, WFPB 2001). These regulations increased riparian protection, unstable slope protection, recruitment of large wood, and improved road standards over the old regulations. Because there is biological uncertainty associated with some of the prescriptions, the Forest and Fish agreement relies on an adaptive management program for assurance that the new rules will meet the conservation needs of bull trout. The updated regulations will reduce the level of future timber harvest impacts to bull trout streams on private lands. However, most legacy threats from past forest practices will likely continue to be a threat for decades.

Habitat Rehabilitation and Restoration Projects

From 2000 through 2004, the State of Washington and the Federal Government have made approximately $165 million funds available for local groups to work towards the restoration and recovery of salmon and bull trout (Governor's Salmon Recovery Office, 2004). The local groups have contributed over $60 million over that time period. The Salmon Recovery Funding Board, established in July of 1999, is responsible for evaluating projects for funding. Project types have included land acquisition, fish barrier removal, upland work, road work and riparian and instream habitat improvements. Local organizations and volunteer efforts have donated over 145,000 hours each year to restoration efforts and been involved in over 480 local projects (Governor's Salmon Recovery Office, 2004). Since 1999, this effort has removed 1,480 barriers to fish passage, opening up more than 1,600 miles of streams, and have acquired approximately 10,896 acres of habitat to protect and conserve salmonids (Governor's Salmon Recovery Office, 2004). It is likely that both Federal and State funding for salmon and bull trout habitat restoration will continue into the future. Local groups are becoming more sophisticated in their technical skills and abilities, and are starting to take a watershed approach to understanding what habitat related issues exist in their watersheds and what the best-available science is telling them about how to effectively address these issues. Restoration project techniques and skills should continue to improve over time, and groups should have evolved to address watershed-level issues rather than site-specific issues. Additionally, local groups are identifying and acquiring key parcels of land that support salmon habitat and removing the potential for future development of those parcels. This effort and the funds provided for it should lead to an improvement in riparian and aquatic habitats in Washington State, and over the long-term should benefit the riparian- and aquatic-dependent species addressed in this PBA. Because State and Federal funding is co-mingled in this process, it is difficult to distinguish between State and federally-funded actions. A significant number of these projects will require Federal permits and will be reviewed through section 7 of the ESA.

Other Habitat-Altering Actions

Agriculture

Farmlands tend to occur in low elevation, low gradient areas in the action area. In Western Washington it is likely that most suitable habitat conversion to agricultural lands occurs along valleys and in the Puget Trough. From 1969 to 2002, farmland acres decreased from 17,559,187 acres to 15,318,008 acres, a decrease of 2,241,179 acres (Washington State Data Book, 2006). Residential and commercial development will likely continue to occur in current agriculture areas, resulting in a permanent loss of those habitats to development.

Other

Other management actions can occur in and adjacent to suitable habitats. These actions include recreation, grazing, fishing, hunting, gathering, water withdrawal, effluent discharges, and mineral extraction. Various impacts to bull trout and their habitat from these actions include: removal of native vegetation; change in vegetative species composition; introduction of invasive nonnative species; degradation of water quantity and quality; erosion of streambanks; increased risks to salmon and bull trout stock viability; declines of salmon carcasses for nutrient cycling; and displacement or capture during fishing activities.

Summary of Cumulative Effects

Increasing development and sprawl in Western Washington will continue to be a contributor to the decline of bull trout and bull trout critical habitat in the action area. Forest habitat conditions will improve in some places and continue at their current level of degradation in other places, dependent upon the level of implementation of the Forest and Fish regulations or development of habitat conservation plans by landowners. Habitat rehabilitation and restoration projects will likely have some short-term negative impacts; however, over the long-term these activities are likely to benefit bull trout and bull trout critical habitat. Actions on State, Tribal and private lands such as urban development and the associated increase in impervious surfaces, logging, road building, agricultural conversion, water withdrawals, fishing, mineral extraction, and recreation will continue to contribute to population declines and degradation of bull trout critical habitat.

CONCLUSION

Bull Trout

The implementing regulations for section 7 of the Act at 50 CFR § 402 define "jeopardize the continued existence of" as "an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, and distribution of that species."

After reviewing the current status of bull trout, the effects of the proposed PBA, and the cumulative effects, it is the Service's biological opinion that the PBA, as proposed, is not likely to jeopardize the continued existence of the bull trout. Our determination is based on the following reasons:

> The short-term (likely 1 year or less) adverse effects to bull trout reproduction associated with a total of 3.20 river miles within 11 local populations of 4 core areas over 8 years will not be contiguous and will be minimized through the implementation of BMPs and the use of the Dewatering and Fish Capture Protocol. Habitat conditions conducive to spawning and rearing will be improved over the long term as a result of restoration activities. The timing of project implementation should not delay or impair reproduction in any local population area. Therefore, restoration activities should not appreciably reduce reproduction in any core area or within the Coastal-Puget Sound interim recovery unit.
>
> Restoration activities may result in the suffocation of eggs or death or injury of adult and subadult bull trout within 12 core areas. However, the timing of project implementation and implementation of BMPs and the Dewatering and Fish Capture Protocol will minimize these effects to the extent that the number of bull trout in any core area or within the Coastal-Puget Sound interim recovery unit will not be appreciably reduced.
>
> Restoration activities may displace bull trout during project implementation. However, this displacement will be short term and restoration activities will provide better functioning migratory corridors and rearing habitat and will provide access to previously isolated habitat. Therefore, restoration activities will improve, not reduce, the distribution of bull trout in core areas within the Coastal-Puget Sound interim recovery unit.

In summary, and for the reasons listed above, the proposed action is not expected to result in an appreciable reduction in the likelihood of survival and recovery of bull trout within the Coastal-Puget Sound interim recovery unit, or within the coterminous range of the species, through reductions in the number, distribution, and/or reproduction of bull trout.

Bull Trout Critical Habitat (Olympic Peninsula and Puget Sound critical habitat units)

This Biological Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 C.F.R. 402.02. Instead, we relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service (No. 03-35279) to complete the analysis with respect to critical habitat.

After reviewing the current status of bull trout critical habitat, the effects of the proposed PBA, and the cumulative effects, it is the Service's biological opinion that the PBA, as proposed, is not likely to destroy or adversely modify designated bull trout critical habitat. Our determination is based on the following reasons:

> The short-term (likely 1 year or less) adverse effects to 8.52 miles within the Olympic Peninsula CHU and 26.24 miles within the Puget Sound CHU will not be contiguous and will be minimized through appropriate project designs and implementation of the BMPs.
>
> Habitat conditions conducive to all bull trout life stages will be improved over the long term as a result of the restoration activities.

In summary, the proposed restoration activities are not expected to alter the function of designated critical habitat, within the affected critical habitat units or at the coterminous scale, to serve the intended conservation role for the species.

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 further defined by the Service as an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR § 17.3). *Harass* is further defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR § 17.3).

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

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

AMOUNT OR EXTENT OF TAKE

The take exempted in this Incidental Take Statement is associated with restoration activities implemented in compliance with the PBA.

Bull Trout Coastal-Puget Sound Interim Recovery Unit

The incidental take of individual bull trout from actions that affect occupied habitat is difficult to quantify due to the indirect relationship between habitat impacts and fish injury and mortality, and the temporal variation in the distribution of potentially affected individual bull trout in the action area.

The Service anticipates incidental take of bull trout will be difficult to detect or quantify for the following reasons: 1) low likelihood of finding dead or injured juveniles, subadults, or adults; 2) delayed mortality; 3) rapid rate of fish decomposition; and 4) high probability of scavenging by predators. Given the relationship between adverse effects to bull trout habitat and the incidental take of bull trout, the amount or extent of take can be expressed in terms of the extent of affected habitat. On that basis, the Service anticipates that the following forms and amount of take will occur as a result of implementing the PBA:

Incidental take of bull trout eggs in the form of ***harm*** is anticipated as a result of suffocation after mobilization of sediment during the first fall/winter rain events following project construction associated with RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), or RA 13 (Install/modify fish passage structures). The extent of this take is anticipated to be a total of 3.20 river miles (project area and downstream) within 6 local population areas of the Nooksack River, Stillaguamish River, Snohomish/Skykomish Rivers, and Puyallup River core areas over the life of the PBA (8 years) (see Table 4 for specific local population areas' extent of take).

Incidental take of adult and subadult bull trout in the form of ***harm*** is anticipated through physical injury or death caused by capture and handling during stream dewatering associated with RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), or RA 13 (Install/modify fish passage structures). The extent of this take is anticipated to be a total of 23.05 river miles (project area only) within the FMO of 12 core areas (identified in Table 4) over the life of the PBA (8 years) (see Table 4 for specific extent of take).

Incidental take of juvenile bull trout in the form of ***harassment*** is anticipated to occur as a result of sediment generated during project construction and/or mobilized during the first fall/winter rain events associated with RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), or RA 13 (Install/modify fish passage structures). The extent of this take is anticipated to occur in a total of 3.20 river miles (project area and downstream) within 10 local population areas and 1 potential local population in the Nooksack River, Stillaguamish River, Snohomish/Skykomish Rivers, and Puyallup River core areas over the life of the PBA (8 years) (see Table 4 for specific extent of take).

Incidental take of adult and subadult bull trout in the form of ***harassment*** is anticipated to occur as a result of sediment generated during project construction and/or mobilized during the first fall/winter rain events associated with RA 1 (Install instream structures), RA 2 (Improve secondary channel habitats), RA 4 (Restore wetland hydrology), RA 6 (Reduce livestock impacts), RA 7 (Improve road/trail conditions), RA 10 (Remove/setback hydraulic constrictions), RA 11 (Remove/replace structural barriers), or RA 13 (Install/modify fish passage structures). The extent of this take is anticipated to occur in a total of 34.76 river miles (project area and downstream) within the 12 core areas (identified in Table 4) over the life of the PBA (8 years) (see Table 4 for specific extent of take).

EFFECT OF THE TAKE

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

See the Effects section for a discussion of how the proposed PBA would impact the reproduction, numbers, and distribution of bull trout within the Coastal-Puget Sound interim recovery unit and how PCEs within the Olympic Peninsula and Puget Sound critical habitat units would be impacted.

REASONABLE AND PRUDENT MEASURES

The PBA has been designed to minimize effects to the extent possible. Therefore, no reasonable and prudent measures, other than monitoring and reporting, have been included.

1. Monitor, and report on, the impacts of implementation of the proposed Restoration Activities.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Service must comply with the following terms and conditions, which implements the reasonable and prudent measure described above and outlines required reporting/monitoring requirements. This term and condition is non-discretionary.

The following term and condition is necessary for the implementation of RPM 1:

In order to monitor the impacts of implementation of the proposed Restoration Activities, the Service shall prepare an annual report summarizing the completed activities and their impacts to bull trout (50 CFR § 402.14(i)(3)). The report shall be submitted to the Division of Consultation and Technical Assistance of the Western Washington Fish and Wildlife Office no later than December 31 of each year. The report shall list and describe:

1) The total incidental take reported in previous years;

2) The total number and type of restoration activities implemented during the current calendar year, categorized by core area and local population;

3) The total number or river miles affected per core area and local population, subdivided by total project area and total downstream area affected;

4) The total number of river miles dewatered by core area and local population; and

5) The total number of bull trout captured/relocated and/or killed by age class (juvenile and subadult/adult) in each local population and core area.

If, during the course of the PBA, the level of incidental take is exceeded, reinitiation should be requested with the CTA Division, and a review of the reasonable and prudent measures provided. Restoration Division staff must immediately provide an explanation of the causes of the taking and review with CTA Division staff the need for possible modification of the reasonable and prudent measure.

The nearest U.S. Fish and Wildlife Service Law Enforcement Office is to be notified within 3 working days upon locating a dead, injured or sick endangered or threatened species specimen. 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 Services's Western 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 Service is not providing any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the PBA. 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.

If you have any questions regarding this BO, please contact Deanna Lynch (360) 753-9545 or John Grettenberger (360) 753-6044, of my staff.

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APPENDIX A
DEWATERING AND FISH CAPTURE PROTOCOL

1) All work to facilitate habitat restoration shall occur in isolation from flowing waters except for the following:

a. Install and remove stream isolation structures (coffer dams, bypass flow devices, pumps, and screens).

b. Remove fish by seining, dip nets, minnow traps, or electrofishing.

c.. Place wood and rock structures (that do not require in-water excavation).

2) Bull trout presence in vicinity of the project. Use the following dichotomous key to determine which dewatering protocol and timing window you need to implement for your project. This key references information within the *Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout Volumes I and II* (USFWS 2004a,b), and the *Draft Recovery Plan for the Columbia River Distinct Population Segment of Bull Trout* (USFWS 2002).

1. Is the project located within a documented or potential bull trout Local Population Area (spawning and early rearing - See Table 1)?
    a) Yes – Dewatering in a documented or potential bull trout Local Population Area is not covered under this programmatic consultation. Consult with a FWS bull trout biologist/CTA staff on appropriate timing window, and complete an individual section 7 consultation for the project.
    b) No – go to 2

2. Is the project located within a bull trout Foraging, Migration, or Overwintering (FMO) habitat area inside or outside of a Core Area (see Table 2)?
    a) Yes – go to 3
    b) No – use "Protocol for Dewatering Outside High Likelihood Bull Trout Areas" (p.11); and use PBA Appendix F.1 *Inwater Work Windows for Bull Trout* (WDFW Gold and Fish Pamphlet) or PBA Appendix F.2 *Bull Trout Work Periods for Marine and Estuarine Waters, Lake Union and Ship Canal, Lake Washington, Sammamish Basin and Columbia River Mainstem* if applicable, or the instream work timing window in the WDFW Hydraulic Project Approval permit. If more up-to-date information on in-water work windows becomes available and is approved by FWS, the more up-to-date information will be used.

3. Is the stream flow at the time of project construction anticipated to be greater than or equal to 5 cfs **and** is the dewatered stream length (not including the culvert and plunge pool length, if present) greater than or equal to 33 ft?
    a) No - use "Protocol for Dewatering Outside High Likelihood Bull Trout Areas" (p.11); and consult with a FWS bull trout biologist/CTA staff on appropriate timing window.

b) Yes - use "Protocol for Dewatering Within High Likelihood Bull Trout Areas" (p.8); and consult with a FWS bull trout biologist/CTA staff on appropriate timing window.

Table 1: List of bull trout local populations and potential local populations by core area (those portions within Washington), within the area covered by this programmatic consultation. List is by management unit: Olympic Peninsula; Puget Sound; Lower, Middle and Upper Columbia River Basins; Umatilla-Walla Walla River Basins; Snake River Basin; Grande Ronde River Basin; and Northeast Washington River Basins.

Management or Recovery Unit	FMO Area	Core Area	Local Population Area
Olympic Peninsula		Skokomish River, including North and South Forks from the mouth up to the National Forest or National Park boundaries	
	Hood Canal and independent tributaries up to the National Forest boundary		
		Dungeness River up to the National Forest boundary	Middle Dungeness River and tributaries
	Strait of Juan de Fuca and independent tributaries up to the National Park boundary		
		Elwha River up to the National Forest or National Park boundary	Little River (potential local population)
	Pacific Ocean and independent coastal tributaries (areas of National Park are not included)		
		Hoh River up to the National Forest or National Park boundaries	South Fork Hoh River and tributaries
		Queets River up to the National Park boundary	
		Quinault River up to the National Forest or National Park boundary	
	Lower Chehalis River/Grays Harbor and independent tributaries		

Management or Recovery Unit	FMO Area	Core Area	Local Population Area
Puget Sound		Chilliwack River up to the National Forest boundary	
		Nooksack River up to the National Forest boundary	Glacier Creek
			Lower Canyon Creek
			Lower North Fork Nooksack
			Lower Middle Fork Nooksack River
			Lower South Fork Nooksack River
			Middle North Fork Nooksack River
			Upper Middle Fork Nooksack River
	Samish River		
		Lower Skagit River up to the National Forest or National Park boundary	Illabot Creek
		Stillaguamish River up to the National Forest boundary	Canyon Creek
			North Fork Stillaguamish River
			Upper Deer Creek
		Snohomish/Skykomish Rivers up to the National Forest boundary	South Fork Skykomish River
	Lake Washington including the following: Lower Cedar River: Sammamish River; Lakes Washington, Sammamish and Union; and Ship Canal		
	Lower Green River		
		Puyallup River up to the National Forest or National Park boundary	Carbon River
			Clearwater River
			Greenwater River
			Upper Puyallup and Mowich Rivers
			Upper White River West Fork White River
	Lower Nisqually River		
	Marine Areas of Puget Sound		

Management or Recovery Unit	FMO Area	Core Area	Local Population Area
Lower Columbia River Basin		Lewis River up to the National Forest boundary	Cougar Creek
			Pine Creek
		Klickitat River up to the National Forest boundary	West Fork Klickitat River
Middle Columbia River Basin	Mainstem Columbia River	Yakima River up to the National Forest or National Park boundary	Mainstem Yakima River (Keechelus to Easton Reach)
			Ahtanum Creek (North, South and Middle Forks)
			Naches River tributaries (American River, Rattlesnake Creek and Crow Creek)
			North Fork Teanaway River
			Kachess Lake tributaries (Box Canyon Creek and the upper Kachess River)
			Upper CleElum River
Upper Columbia River Basin	Mainstem Columbia River	Wenatchee River up to the National Forest boundary	Nason Creek (including Mill Creek)
			Chiwaukum Creek
			Chewawa River (including Chikamin, Phelps, Rock, Alpine, Buck and James Creeks)
			White River (including Canyon and Panther Creeks)
			Peshastin Creek (including Ingalls Creek)
		Entiat River up to the National Forest boundary	Mainstem Entiat River
			Mad River
		Methow River up to the National Forest boundary	Gold Creek
			Twisp River
			Chewuch River
			Wolf Creek

Management or Recovery Unit	FMO Area	Core Area	Local Population Area
Northeast Washington		Pend Oreille River up to the National Forest boundary	Le Clerc Creek
Umatilla-Walla Walla River Basin		Walla Walla River up to the National Forest boundary	Mill Creek and tributaries
			Touchet River and tributaries
Snake River Basin	Mainstem Snake River	Asotin Creek up to the National Forest boundary	North fork Asotin Creek including Cougar Creek
		Tucannon River up to the National Forest boundary	Upper Tucannon River (river kilometer 78 to 93) and tributaries (Bear, Sheep, Cold, Panjab, Meadow, Little Turkey and Turkey Creeks
Grande Ronde River Basin		Grande Ronde River	Wenatchee Creek

Table 2: List of bull trout Foraging, Migration, and Overwintering Habitat Areas located outside of Core Areas, in the Olympic Peninsula and Puget Sound Management Unit covered by this Programmatic Consultation. Refer to Draft Key Habitat for Bull Trout Recovery Maps for further clarification.

Management Unit	Foraging, Migration, and Overwintering Habitat Outside of Core Areas
Olympic Peninsula	Hood Canal and independent tributaries up to the National Forest Boundary
	Strait of Juan de Fuca and independent tributaries up to the National Park Boundary (includes Bell, Morse, Ennis, Siebert Creeks)
	Pacific Ocean and independent coastal tributaries (areas of National Park are not included; includes Goodman, Mosquito, Cedar, Steamboat, Kalaloch and Joe Creeks, Raft, Moclips and Copalis Rivers)
	Lower Chehalis River/Grays Harbor and independent Tributaries (includes Humptulips, Wishkah, Wynoochee and Satsop Rivers)
Puget Sound	Samish River
	Lake Washington including the following: lower Cedar River; Sammamish River; Lakes Washington, Sammamish, and Union; and Ship Canal
	Lower Green River
	Lower Nisqually River including the Nisqually River estuary and McAllistor Creek
	Marine areas including North Puget Sound, Main Basin, Whidbey Basin, and South Puget Sound
Middle Columbia River Basin	Mainstem Columbia River
Upper Columbia River Basin	Mainstem Columbia River
Snake River Basin	Mainstem Snake River

Protocol for Dewatering Within High Likelihood Bull Trout Areas

A. Fish Capture – General Guidelines

1. Fish Capture Methods
    a. Minnow traps. Optional. Traps may be left in place prior to dewatering and may be used in conjunction with seining. Once dewatering starts, minnow traps should only be used if there is someone present to check the traps every few hours, and remove the traps once the water level becomes too low.
    b. Seining. Required. Use seine with mesh of such a size to ensure entrapment of the residing ESA-listed fish and age classes.
    c. Dip nets. Required. Use in conjunction with other methods as area is dewatered.
    d. Electrofishing. Required. Use electrofishing in addition to other means of fish capture to ensure the effective capture of fish. Applicants shall adhere to NMFS Backpack Electrofishing Guidelines (PBA Appendix N).

2. Fish capture operations will be conducted by or under the supervision of a fishery biologist experienced in such efforts and all staff working with the seining operation must have the necessary knowledge, skills, and abilities to ensure the safe handling of all ESA-listed fish.

3. The applicant must obtain any other Federal, State and local permits and authorizations necessary for the conduct of fish capture activities.

4. A description of any capture and release effort will be included in a post-project report, including the name and address of the supervisory fish biologist, methods used to isolate the work area and minimize disturbances to ESA-listed species, stream conditions before and following placement and removal of barriers; the means of fish removal; the number of fish removed by species and age class; conditions of all fish released; and any incidence of observed injury or mortality.

5. Storage and Release. ESA-listed fish must be handled with extreme care and kept in water at all times during transfer procedures. The transfer of ESA-listed fish must be conducted using a sanctuary net that holds water during transfer, whenever necessary, to prevent the added stress of an out-of-water transfer. A healthy environment for non-ESA listed fish shall be provided by large buckets (5-gallon minimum to prevent overcrowding) and minimal handling of fish. Release fish as near as possible to the isolated reach in a pool or area that provides cover and flow refuge.

B. Dewater Instream Work Area and Fish Capture

Fish screen. Except for gravity diversions that have gradual and small outfall drops directly into water, all water intake structures must have a fish screen installed, operated, and maintained in accordance with the NMFS Juvenile Fish Screen Criteria and the Addendum to the NMFS Pump Intake Screen Guidelines (PBA Appendices C and D).

The sequence for stream flow diversion will be:
Note: this sequence will take one 24-hour period prior to construction to complete. We suggest you start early in the morning the day before project construction is scheduled and leave the reach dewatered overnight according to instruction below.

1. Install flow conveyance devices (pumps, discharge lines, gravity drain lines, conduits, and channels), but do not divert flow.
2. Install upstream barrier. Allow water to flow over upstream barrier.
3. Reduce flow over upstream barrier by one-third for a minimum of 6 hours. Inspect dewatered areas for remaining fish and remove them.
4. Reduce flow over upstream barrier by an additional one-third for a minimum of 6 hours. Inspect dewatered areas for remaining fish and remove them.
5. Capture as many remaining fish as possible using hand held dip-nets.
6. Leave the project area in a stable, low flow condition, overnight, allowing fish to leave the area volitionally.
7. In the morning, capture any remaining fish using hand held dip-nets.
8. Divert upstream flow completely.
9. Install downstream barrier if necessary (only in low gradient, backwatered reaches).
10. If water remains within the work area; electrofish, seine, and dip net the project area until catch rates have reached no fish for three consecutive passes. Move rocks as needed to flush fish and effectively electrofish the work area.
11. If needed, pump water out of isolated pools within the project area to a temporary storage and treatment site or into upland areas and filter through vegetation prior to reentering the stream channel. Continue to electrofish, seine, and dip net while pumping.
12. If fish continue to be captured, shut pump off before average water depths reach 1 foot. Continue to electrofish, seine, and/or dip net until no fish are caught for three consecutive passes.
13. Pump dry and check substrate for remaining fish.
14. Continue to pump water from the project area as needed for the duration of the project.

The diversion structure is typically a temporary dam built just upstream of the project site with sand bags that are filled with clean gravel and covered with plastic sheeting. A portable bladder dam or other non-erosive diversion technologies may be used to contain stream flow; however, mining of stream or floodplain rock cannot be used for diversion dam construction. In most cases, a pipe will carry the stream flow from the diversion dam around the project site to a location immediately downstream of the construction zone. It may be necessary to have temporary equipment access through the riparian area to the site of the dewatering structure. Impacts to the riparian area will be minimized to the greatest extent feasible.

The temporary bypass system must consist of non-erosive techniques, such as a pipe or a plastic-lined channel, both of which must be sized large enough to accommodate the predicted peak flow rate during construction. In cases of channel rerouting, water can be diverted to one side of the existing channel.

Dissipate flow at the outfall of the bypass system to diffuse erosive energy of the flow. Place the outflow in an area that minimizes or prevents damage to riparian vegetation. If the diversion inlet is a gravity diversion and is not screened to allow for downstream passage of fish, place diversion outlet in a location that facilitates gradual and safe reentry of fish into the stream channel.

C. Rewater Instream Work Area

Remove stream diversion and restore stream flow. Heavy machinery operating from the bank may be used to aid in removal of diversion structures. Slowly re-water the construction site to prevent loss of surface water downstream as the construction site streambed absorbs water and to prevent a sudden increase in stream turbidity. Look downstream during re-watering to prevent stranding of aquatic organisms below the construction site.

All stream diversion devices, equipment, pipe, and conduits will be removed and disturbed soil will be restored after the diversion is no longer needed.

Dewatering Outside High Likelihood Bull Trout Areas

If bull trout are captured at any time during the dewatering process, immediately notify a FWS bull trout biologist and obtain guidance to either continue to dewater and remove fish or stop activities and re-water the project site.

Normal guidance, depending on site specific circumstances, will be to continue to dewater and remove fish, paying close attention to additional bull trout.

A. Fish Capture – General Guidelines

1. Fish Capture Methods
    a. Minnow traps. Optional. Traps may be left in place prior to dewatering and may be used in conjunction with seining. Once dewatering starts, minnow traps should only be used if there is someone present to check the traps every few hours, and remove the traps once the water level becomes to low.
    b. Seining. Required. Use seine with mesh of such a size to ensure entrapment of the residing ESA-listed fish and age classes.
    c. Dip nets. Required. Use in conjunction with other methods as area is dewatered.
    d. Electrofishing. Optional. Use electrofishing only where other means of fish capture may not be feasible. Applicants shall adhere to NMFS Backpack Electrofishing Guidelines (PBA Appendix N).

2. Fish capture operations will be conducted by or under the supervision of a fishery biologist experienced in such efforts and all staff working with the seining operation must have the necessary knowledge, skills, and abilities to ensure the safe handling of all ESA-listed fish.

3. The applicant must obtain any other Federal, State and local permits and authorizations necessary for the conduct of fish capture activities.

4. A description of any seine and release effort will be included in a post-project report, including the name and address of the supervisory fish biologist, methods used to isolate the work area and minimize disturbances to ESA-listed species, stream conditions before and following placement and removal of barriers; the means of fish removal; the number of fish removed by species; conditions of all fish released; and any incidence of observed injury or mortality.

5. Storage and Release. Fish must be handled with extreme care and kept in water to the maximum extent possible during transfer procedures. A healthy environment for the stressed fish shall be provided by large buckets (5 gallon minimum to prevent overcrowding) and minimal handling of fish. The transfer of any ESA-listed fish must be conducted using a sanctuary net that holds water during transfer, to prevent the added stress of an out-of-water transfer. Release fish as near as possible to the isolated reach in a pool or area that provides cover and flow refuge.

B. Dewater Instream Work Area and Fish Capture

Fish screen. Except for gravity diversions that have gradual and small outfall drops directly into water, all water intake structures must have a fish screen installed, operated, and maintained in accordance with the NMFS Juvenile Fish Screen Criteria and the Addendum to the NMFS Pump Intake Screen Guidelines (PBA Appendices C and D).

The sequence for stream flow diversion would be as follows:

1. Install flow conveyance devices (pumps, discharge lines, gravity drain lines, conduits, and channels), but do not divert flow.
2. Seine, dip net, or electrofish through the entire project area in a downstream direction, starting at the upstream end; thereby moving fish out of the project area.
3. Install upstream barrier and divert upstream flow completely.
6. Capture any remaining fish using hand held dip-nets.
8. Install downstream barrier if necessary (only in low gradient backwatered reaches).
9. If water remains within the work area; seine, dip net, or electrofish the project area until catch rates have reached no fish for three consecutive passes.
10. Pump water out of isolated pools within the project area to a temporary storage and treatment site or into upland areas and filter through vegetation prior to re-entering the stream channel. Continue to seine, dip net, or electrofish while pumping.
11. If fish continue to be captured, shut pump off *before* average water depths reach 1 foot. Continue to seine, dip net, or electrofish until no fish are caught for three consecutive passes.
12. Pump dry and check substrate for remaining fish and remove them.
13. Continue to pump water from the project area as needed for the duration of the project.

The diversion structure is typically a temporary dam built just upstream of the project site with sand bags that are filled with clean gravel and covered with plastic sheeting. A portable bladder dam or other non-erosive diversion technologies may be used to contain stream flow; however, mining of stream or floodplain rock cannot be used for diversion dam construction. In most cases, a pipe will carry the stream flow from the diversion dam around the project site to a location immediately downstream of the construction zone. It may be necessary to have temporary equipment access through the riparian area to the site of the dewatering structure. Impacts to the riparian area will be minimized to the greatest extent feasible.

The temporary bypass system must consist of non-erosive techniques, such as a pipe or a plastic-lined channel, both of which must be sized large enough to accommodate the predicted peak flow rate during construction. In cases of channel rerouting, water can be diverted to one side of the existing channel.

Dissipate flow at the outfall of the bypass system to diffuse erosive energy of the flow. Place the outflow in an area that minimizes or prevents damage to riparian vegetation. If the diversion inlet is a gravity diversion and is not screened to allow for downstream passage of fish, place diversion outlet in a location that facilitates gradual and safe reentry of fish into the stream channel.

C. Rewater Instream Work Area

Remove stream diversion and restore stream flow. Heavy machinery operating from the bank may be used to aid in removal of diversion structures. Slowly re-water the construction site to prevent loss of surface water downstream as the construction site streambed absorbs water and to prevent a sudden increase in stream turbidity. Look downstream during re-watering to prevent stranding of aquatic organisms below the construction site.

All stream diversion devices, equipment, pipe, and conduits will be removed and disturbed soil will be restored after the diversion is no longer needed.

Literature Cited

USFWS (U.S. Fish and Wildlife Service). 2002. Bull trout (*Salvelinus confluentus*) draft recovery plan. Chapter One. Fish and Wildlife Service, Portland, Oregon. 137 pp.

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APPENDIX B
BULL TROUT WORK PERIODS FOR MARINE AND ESTUARINE WATERS, LAKE UNION AND SHIP CANAL, LAKE WASHINGTON, AND SAMMAMISH BASIN

MARINE AND ESTUARINE[1] WATERS

SPECIFIC AREA	NO INWATER WORK	ALLOWABLE INWATER WORK
Marine Waters (including Puget Sound) [2]	**2/16 through 7/15**	7/16 through 2/15
Duwamish Waterway	**2/16 through 9/30**	10/1 through 2/15

[1] estuaries may be provided separate windows in the future
[2] marine water timing may change in the future

LAKE UNION AND SHIP CANAL

SPECIFIC AREA	NO INWATER WORK	ALLOWABLE INWATER WORK
Ship Canal (from the Chittenden Locks to the east end of the Mountlake cut)	**4/16 through 9/30**	10/1 through 4/15
Lake Union	**4/16 through 9/30**	10/1 through 4/15

LAKE WASHINGTON

SPECIFIC AREA	NO INWATER WORK	ALLOWABLE INWATER WORK
South of I-90 within 1 mile of Mercer Slough or Cedar River	**1/1-7/15 and 8/1-11/15**	7/16 through 7/31and 11/16 through 12/31
South of I-90 further than 1 mile from Mercer Slough or Cedar River	**1/1 through 7/15**	7/16 through 12/31
Between I-90 and SR 520	**5/1 through 7/15**	7/16 through 4/30
North of SR 520, between SR 520 and a line drawn due west from Arrowhead Point	**3/16 through 7/15**	7/16 through 3/15
North of SR 520, north of a line drawn due west from Arrowhead Point	**2/2 through 7/15 and 8/1 through 11/15**	7/16 through 7/31 and 11/16 through 2/1

SAMMAMISH BASIN

SPECIFIC AREA	NO INWATER WORK	ALLOWABLE INWATER WORK
Mainstem Sammamish River	**August 1 - November 15 and 2/2 through 7/15**	7/16 through 7/31 and 11/16 through 2/1
Lake Sammamish - further than ½ mile from Issaquah Creek	**January 1 through July 15**	7/16 through 12/31
Lake Sammamish - within ½ mile of Issaquah Creek	**August 1 - November 15 and January 1 - July 15**	7/16 through 7/31 and 11/16 through 12/31
Issaquah Creek	**August 1 through June 14**	June 15 through July 31
Lower Cedar River	**July 1 through August 31**	Sept. 1 through June 30

APPENDIX C

SEDIMENTATION

The general impacts of sedimentation within an aquatic system are well known. When a biologist reviews a biological assessment or biological evaluation under section 7 of the Endangered Species Act, effects are evaluated based on the data or information provided. In most cases, specific information is not supplied by the action agency, or is not available for the biologist to conduct a thorough review and make that vital link between the project and the effect on listed fishes, specifically bull trout (*Salvelinus confluentus*) and their habitat.

Specific information needed by a biologist is related to the physical and biological effects of sediment in a stream. The physical questions include the following:

1. Will the project increase sediment input into the stream?
2. How much sediment will result and for what duration?
3. How far downstream will the sediment move?

Based on these physical questions, the biological effects to listed fish species can then be determined. The biological questions include the following:

1. What life stage(s) are affected by the sediment input?
2. What levels of sedimentation cause adverse effects?
3. What are the biological effects of sediment on fish and their habitat?

SEDIMENT CLASSIFICATIONS AND DEFINITIONS

Sediment within a stream can be classified into a variety of different categories: turbidity, suspended sediment, bedload, deposited sediment, and wash load (Waters 1995; Bash et al. 2001). A geomorphologist may classify sediment differently than a fisheries biologist. Sediment category definitions include:

- Turbidity - Optical property of water which results from the suspended and dissolved materials in the water that cause light to be scattered rather than transmitted in straight lines. Turbidity is measured in nephelometric turbidity units (NTUs). Measurements of turbidity can quickly estimate the amount of sediment within a sample of water.
- Suspended sediment - Represents the actual measure of mineral and organic particles transported in the water column. Suspended sediment is measured in mg/l and is an important measure of erosion, and is linked to the transport of nutrients, metals, and industrial and agricultural chemicals through the river system.
- Bedload - Consists of larger particles on the stream bottom that move by sliding, rolling, or saltating along the substrate surface. Bedload is measured in tons/day, or tons/year.
- Deposited sediment - The intermediate sized sediment particles that settle out of the water column in slack or slower moving water. Based on water velocity and turbulence, these intermediate size particles may be suspended sediment or bedload.

- Wash load - Finest particles in the suspended load that are continuously maintained in suspension by the flow turbulence; therefore, significant quantities are not found in the bed.

Suspended sediment, turbidity, and deposited sediment are not mutually exclusive as to particle size, because they will overlap considerably depending on velocity, turbulence, and gradient (MacDonald et al. 1991; Waters 1995). Turbidity cannot always be correlated with suspended solid concentrations due to the effects of size, shape, and refractive index of particles (Bash et al. 2001). Turbidity and suspended sediment affect the light available for photosynthesis, visual capability of aquatic animals, gill abrasion and physiological effects to fish. Suspended and deposited sediment affect the habitat available for macroinvertebrates, quality of gravel for fish spawning, and amount of habitat for fish rearing (Waters 1995).

Particle size is also important. Particle diameters less than 6.4 mm are generally defined as "fines" (Bjornn et al. 1977; Bjornn and Reiser 1991; Shepard et al. 1984; Hillman et al. 1987; Chapman 1988; Reiman and McIntyre 1993; Castro and Reckendorf 1995; MBTRT 1998). The quantity of "fines" within a stream ecosystem is usually associated with the degradation of a fish population (Castro and Reckendorf 1995).

INFORMATION SOURCES

To determine the overall impact of a project on bull trout, and to specifically understand whether increased sediment may adversely affect bull trout, the biologist will need to review specific information relating to the watershed and stream in which the project is located.

The following documents are important to review:

1. Washington State Conservation Commission's Limiting Factors Analysis. The 1998 Washington State Legislative session produced a number of bills aimed at salmon recovery. One bill was to identify the limiting factors to salmonid populations within watersheds in Washington State. Limiting factors are defined as "conditions that limit the ability of habitat to fully sustain populations of salmon." Limiting factors analyses have been developed for numerous watersheds. The status of the limiting factors analyses for each Water Resource Inventory Area (WRIA) can be found at http://salmon.scc.wa.gov. The Division of Listing and Recovery has final copies of completed documents.

2. Washington Department of Fish and Wildlife's (1998) Salmonid Stock Inventory (SaSI). The Washington Department of Fish and Wildlife (WDFW) inventoried bull trout and Dolly Varden (*S. malma*) stock status throughout the State. The intent of the inventory is to help identify available information and to guide future restoration planning and implementation. SaSI defines the stock within the watershed, life history forms, status, and factors affecting production. Spawning distribution and timing for different life stages are provided (migration, spawning, etc.), if known.

3. U.S. Fish and Wildlife Service's (USFWS 1998a) Matrix of Diagnostics/Pathways and Indicators (MPI). The MPI was designed to facilitate and standardize determination of project effects on bull trout. The MPI provides a consistent, logical line of reasoning to aid in determining when and where adverse affects occur and why they occur. The MPI provides levels or values for different habitat indicators to assist the biologist in determining the level of effects or impacts to bull trout from a project and how these impacts may cumulatively change habitat within the watershed.

4. Individual Watershed Resource Publications. Other resources may be available within a watershed that will provide information on habitat, fish species, and recovery and restoration activities being conducted. Local groups can provide valuable information specific to the watershed.

5. Washington State Department of Ecology (DOE) Water Quality Database. The DOE has long and short-term water quality data for different streams within the State. Data can be found at www.ecy.wa.gov/programs/eap/fw_riv/rv_main. Clicking on a stream or entering a stream name will provide information on current and past water quality data. This information will be useful for determining the specific turbidity/suspended sediment relationship for that stream (more information below).

6. DOE Stream Conditions Database. The DOE has also been collecting benthic macroinvertebrates and physical habitat data to describe conditions under natural and anthropogenic disturbed areas. Data can be found at www.ecy.wa.gov/programs/eap/fw_benth/93-98. Clicking on a stream or entering a stream name will provide habitat and macroinvertebrate data.

7. U.S. Forest Service (USFS) Watershed Analysis Documents. The USFS is required by the Record of Decision for Amendments to the USFS and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl to conduct a watershed analysis for watersheds located on USFS lands. The watershed analysis determines the existing condition of the watershed and makes recommendations for future projects that move the landscape towards desired conditions. Watershed analysis documents are available from individual National Forests or from the Western Washington Fish and Wildlife Office, Forest Plan Branch.

8. U.S. Fish and Wildlife Service Bull Trout Recovery Plans and Critical Habitat Designations. The draft Bull Trout Recovery Plan for the Coastal-Puget Sound Distinct Population Segment (DPS) and the final critical habitat designations provide current species status, habitat requirements, and limiting factors for bull trout within specific individual recovery units. These documents are available from the Western Washington Fish and Wildlife Office and the Service's web page (www.fws.gov).

These documents and websites provide information on stream and watershed conditions as of 2005. This information is critical to understanding baseline conditions and determining future sediment impacts to the aquatic system. A stream has a natural amount of sediment that is transported through the system. This amount of sediment is based on numerous factors:

precipitation, topography, geology, streamflow, riparian vegetation, stream geomorphological characteristic, human disturbance, etc. (Bash et al. 2001). However, baseline or background levels need to be analyzed with respect to the limiting factors within the watershed.

Different watersheds have different levels of turbidity or suspended sediment. A glaciated stream will have higher sediment levels than a spring-fed stream. Aquatic organisms are adapted to the natural variation in sediment load that occurs seasonally within their stream habitat (ACMRR 1976; Birtwell 1999). Field experiments have found a thirty-fold increase in tolerance of fish to suspended solids between August and November when naturally occurring concentration are expected to be high (Cederholm and Reid 1987). The question at hand is whether additional input of sediment may result in increased bull trout impacts.

Sediment levels in excess of natural amounts can have multiple adverse effects on channel conditions and bull trout (Rhodes et al. 1994). The effect can be fatal at high levels. Low levels may result in sublethal effects such as loss or reduction of foraging capability, reduced growth, reduced resistance to disease, increased stress, and interference with orientation in homing and migration (McLeay et al. 1987; Newcombe and McDonald 1991; Bash et al. 2001).

Work-timing windows are usually incorporated into projects to minimize construction impacts to fish. Work-timing windows are time periods when salmonids are at a stage in their life cycle when they are least sensitive to disturbances or are least likely to be present. This is typically outside of the spawning or egg incubating period. Work-timing windows allow the fish to either move away from impacts or to better cope with short-term, minimal changes to the habitat and/or decreased water quality. The work-timing windows are usually in July through September. This time may reduce impacts to spawning fish and egg incubating periods, but may exacerbate impacts to juveniles, sub-adults, and adults. Protective mucous secretions are inadequate during the summer months, when natural sediment levels are low in a stream system, and thereby sediment introduction at this time may increase fish risk to stress and disease (Bash et al. 2001).

BIOLOGICAL EFFECTS OF SEDIMENT ON BULL TROUT

Classification of Sediment Effects

In the absence of detailed local information on population dynamics and habitat use, any increase in the proportion of fines in substrates should be considered a risk to the productivity of an environment and to the persistence of associated bull trout populations (Rieman and McIntyre 1993). Specific effects of sediment on fish and their habitat can be put into three classes that include (Newcombe and MacDonald 1991; Waters 1995; Bash et al. 2001):

Lethal: Direct mortality to any life stage, reduction in egg-to-fry survival, and loss of spawning or rearing habitat. These effects damage the capacity of the ecosystem to produce fish and future populations.

Sublethal: Reduction in feeding and growth rates, decrease in habitat quality, reduced tolerance to disease and toxicants, respiratory impairment, and physiological stress. While not leading to immediate death, may produce mortalities and population decline over time.

Behavioral: Avoidance and distribution, homing and migration, and foraging and predation. Behavioral effects change the activity patterns or alter the kinds of activity usually associated with an unperturbed environment. Behavior effects may lead to immediate death or population decline or mortality over time.

Environmental factors affecting sediment impacts on individual fish include duration of exposure, frequency of exposure, toxicity, temperature, life stage of fish, angularity and size of particle, severity/magnitude of pulse, time of occurrence, general condition of biota, and availability of and access to refugia (Bash et al. 2001). Aquatic systems are complex interactive systems, and isolating the effects of sediment on fish populations is difficult (Castro and Reckendorf 1995). Determining which environmental variables act as limiting factors has made it difficult to establish the specific effects of sediment impacts on fish populations (Chapman 1988). For example, excess fines in the spawning gravels may not lead to smaller populations of adults if the amount of juvenile winter habitat limits the number of juveniles that reach adulthood. Often there are multiple independent variables with complex inter-relationships that can influence population size.

The ecological dominance of a given species is often determined by environmental variables. A chronic input of sediment could tip the ecological balance in favor of one species in a mixed salmonid population, or in species communities composed of salmonids and nonsalmonids (Everest et al. 1987). Bull trout have more spatially restrictive biological requirements than other salmonids at both the individual and population levels (USFWS 1998b). Therefore, they are especially vulnerable to environmental changes such as sediment deposition.

Bull trout are apex predators that prey on a variety of species including terrestrial and aquatic insects and fish (Reiman and McIntyre 1993). Fish are common in the diet of individual bull trout that are over 110 millimeters or longer. Large bull trout can feed almost exclusively on fish. Therefore, when analyzing impacts of sediment on bull trout, it is very important to consider other fish species. While sediment may not directly impact bull trout, the increased sediment input may affect the spawning and population levels of Chinook and coho salmon, cutthroat trout, and steelhead, which are potential prey species for bull trout. The following effects of sediment are not just bull trout specific. All salmonids can be affected similarly.

Direct Effects

Gill Trauma

High levels of suspended sediment and turbidity can cause fish mortality by damaging and clogging gills. Fish gills are delicate and easily damaged by abrasive silt particles (Bash et al. 2001). As sediment begins to accumulate in the gill filaments, fish excessively open and close their gills to expunge the silt. If irritation continues, mucus is produced to protect the gill surface, which may impede the circulation of water over the gills and interfere with fish respiration (Bash et al. 2001). Gill flaring or coughing abruptly changes buccal cavity pressure and is a means of clearing the buccal cavity of sediment. Gill sediment accumulation may result when fish become too fatigued to continue clearing particles via the cough reflex (Servizi and Martens 1991).

Spawning, Redds, Eggs, and Alevins

When suspended sediment deposits in a redd, it can reduce water flow, smothering eggs or alevins or impeding fry emergence, depending on the sediment particle sizes of the spawning habitat (Bjornn and Reiser 1991). Sediment particle size determines the pore openings in the redd gravel. With small pore openings, more suspended sediments are deposited and water flow is reduced compared to large pore openings.

Egg survival depends upon a continuous supply of well oxygenated water through the streambed gravels (Cederholm and Reid 1987). Eggs and alevins are generally more susceptible than adults to stress from suspended solids. Accelerated sedimentation can reduce the flow of water; and therefore, oxygen to eggs and alevins which can decrease egg survival, decrease fry emergence rates (Cederholm and Reid 1987; Chapman 1988; Bash et al. 2001), delay development of alevins (Everest et al. 1987), reduce growth, and cause premature hatching and emergence (Birtwell 1999). Fry delayed in their timing of emergence are less able to compete for environmental resources than other fish that have undergone normal development and emergence (intra- or interspecific competition) (Everest et al. 1987).

Several studies have documented that fine sediment can reduce the reproductive success of salmonids. Natural egg-to-fry survival of coho salmon, sockeye and kokanee has been measured at 23, 23, and 12 percent, respectively (Slaney et al. 1977). Substrates containing 20 percent fines can reduce emergence success by 30-40 percent (MacDonald et al. 1991). A decrease of 30 percent in mean egg-to-fry survival can be expected to reduce salmonid fry production to extremely low levels (Slaney et al. 1977).

Bull trout generally have a specific spawning habitat requirement; and therefore, spawn in a small percentage of the stream habitat available to them (MBTRT 1998). However, they seem to be more tolerant of sedimentation during development and emergence than other salmonids. Survival of bull trout embryos through emergence appears to be unaffected when the percentage of fines comprise up to 30 percent of the streambed. At levels above 30 percent, embryo survival, through emergence, drop off sharply. For example, for substrates with 40 percent fine material, embryo survival drops to below 20 percent (Shepard et al. 1984).

Indirect Effects

Macroinvertebrates

Macroinvertebrates are a significant food source for salmonids. Turbidity and suspended solids can affect macroinvertebrates in multiple ways through increased invertebrate drift, feeding impacts, respiratory problems, and loss of habitat (Cederholm and Reid 1987). Salmonids favor certain groups of macroinvertebrates, such as mayflies, caddisflies, and stoneflies. These species prefer large substrate particles in riffles and are negatively affected by fine sediment (Everest et al. 1987; Waters 1995).

The effect of light reduction from turbidity has been well documented as increasing invertebrate drift (Waters 1995; Birtwell 1999). This may be a behavioral response associated with the night-active diel drift patterns of macroinvertebrates. While increased turbidity results in increased macroinvertebrate drift, it is thought that the overall invertebrate populations would not fall below the point of severe depletion (Waters 1995).

Increased suspended sediment can abrade the respiratory surface of macroinvertebrates and interfere with food uptake for filter-feeders (Birtwell 1999). Increased suspended sediment levels tend to clog feeding structures and reduce feeding efficiencies, which results in reduced growth rates, increased stress, or death of the invertebrates (Newcombe and MacDonald 1991). Invertebrates living in the substrate are also subject to scouring or abrasion which can damage respiratory organs (Bash et al. 2001).

Benthic invertebrates inhabit the stream bottom. Therefore, any modification of the streambed by deposited sediment will most likely have a profound effect upon the benthic invertebrate community (Waters 1995). Increased sediment can affect macroinvertebrate habitat by filling interstitial space and rendering attachment sites unsuitable. This may cause invertebrates to seek a more favorable habitat (Rosenberg and Snow 1975). The degree to which substrate particles are surrounded by fine material was strongly correlated with macroinvertebrate abundance and composition (Birtwell 1999). At an embeddedness of one-third, insect abundance can decline by about 50 percent, especially for riffle-inhabiting taxa (Waters 1995).

Feeding Efficiency

Increased turbidity and suspended sediment can affect salmonid feeding rates, reaction distance, and prey selection (Bash et al. 2001). Changes in feeding behavior are primarily related to the reduced visibility in turbid water. Effects on feeding ability are important as salmonids must meet energy demands to compete with other fishes for resources and to avoid predators.

Distance of prey capture and prey capture success both were found to decrease significantly when turbidity was increased (Berg and Northcote 1985). Waters (1995) states that the loss of visual capability, leading to reduced feeding, is one of the major sublethal effects of high suspended sediment. Increases in turbidity was reported to decrease the percentage of prey captured (Bash et al. 2001). At 0 NTUs, 100 percent of the prey items were consumed. At 20 to 60 NTUs, significant delay in the response of fish to prey was observed. At 10 NTUs, fish were frequently unable to capture prey species; at 60 NTUs, only 35 percent of the prey items were captured. Loss of visual capability and capture of prey leads to depressed growth and reproductive capability.

Sigler et al. (1984) found that a reduction in growth occurred in steelhead and coho salmon when turbidity was as little as 25 NTUs. The slower growth was presumed to be from a reduced ability to feed; however, other complex mechanisms, such as the quality of light, may also affect feeding success rates. Redding et al. (1987) found that suspended sediment may inhibit normal feeding activity, as a result of a loss of visual ability or as an indirect consequence of increased stress.

Habitat Effects

Compared to other salmonids, bull trout have more specific habitat requirements that appear to influence their distribution and abundance (Reiman and McIntyre 1993). All life history stages are associated with complex forms of cover including large woody debris, undercut banks, boulders, and pools. Other habitat characteristics important to bull trout include channel and hydrologic stability, substrate, temperature, and the presence of migration corridors (Reiman and McIntyre 1993).

The physical effects of sediment in streams include degradation of spawning and rearing habitat, simplification and damage to habitat structure and complexity, loss of habitat, and decreased connectivity between habitat (Bash et al. 2001). Biological implications of this habitat damage include underutilization of stream habitat, abandonment of traditional spawning habitat, displacement of fish from their habitat, and avoidance of habitat (Newcombe and Jensen 1996).

As sediment enters a stream, it is transported downstream under normal fluvial processes and deposited in areas of low shear stress (MacDonald and Ritland 1989). These areas are usually behind obstructions, near banks (shallow water), or within interstitial spaces. This episodic filling of successive storage compartments continues in a cascading fashion downstream until the flow drops below the threshold required for movement or all pools have reached their storage capacities (MacDonald and Ritland 1989). As sediment load increases, the stream compensates by geomorphologic changes in increased slope, increased channel width, decreased depths, and decreased flows (Castro and Reckendorf 1995). These processes, in turn, contribute to increased erosion and sediment deposition which further degrade salmonid habitat.

Loss of acceptable habitat and refugia, as well as decreased connectivity between habitat reduces the carrying capacity of streams for salmonids (Bash et al. 2001). In systems lacking adequate number, distribution, and connectivity of habitat, fish may travel longer distances or use less desirable habitat and may encounter a variety of other conditions that can increase biological demands.

The addition of fine sediment (less than 6.4 mm) to natural streams during summer, decreased abundance of juvenile Chinook salmon in almost direct proportion to the amount of pool volume lost to fine sediment (Bjornn et al. 1977; Bash et al. 2001). Similarly, the inverse relationship between fine sediment and densities of rearing Chinook salmon indicate how high sediment loads effect important winter habitat (Bjornn et al. 1977). As fine sediments filled the interstitial spaces between the cobble substrate, juvenile Chinook salmon were forced to leave preferred habitat and to utilize cover that may be more susceptible to ice scouring, predation, and decreased food availability (Hillman et al. 1987). Deposition of sediment on substrate may lower winter carrying capacity for bull trout (Shepard et al. 1984). Food production in the form of aquatic invertebrates may also be reduced.

Juvenile bull trout densities are highly influenced by substrate composition (Shepard et al. 1984; Reiman and McIntyre 1993; MBTRT 1998). During the summer, juvenile bull trout hold positions close to the stream bottom and often seek cover within the substrate itself. When streambed substrate contains more than 30 percent fine materials, juvenile bull trout densities drop off sharply (Shepard et al. 1984). Any loss of interstitial space or streambed complexity through the deposition of sediment would result in a loss of summer and winter habitats (MBTRT 1998). The reduction in rearing habitats ultimately reduces the potential number of recruited juveniles and ultimately reduces population numbers (Shepard et al. 1984).

Although fish avoidance in response to increased sediment may be an initial adaptive survival strategy, displacement from cover could be detrimental. The possible consequences of fish moving from preferred habitat to avoid increasing levels of suspended sediment may not be beneficial if displacement is to sub-optimal habitat, where they also become stressed and more vulnerable to predation (Birtwell 1999).

Physiological Effects

Sublethal levels of suspended sediment may cause undue physiological stress to fish, reducing the ability of the fish to perform vital functions (Cederholm and Reid 1987). At the individual fish level, stress can reduce growth, increase disease, and reduce the ability to tolerate additional stress (Bash et al. 2001). At the population level, the effects of stress may include reduced spawning success, increased larval mortality, reduced recruitment to succeeding life stages, and therefore, overall population declines (Bash et al. 2001).

Tolerance to suspended sediment may be the net result of a combination of physical and physiological factors related to oxygen availability and uptake by fish (Servizi and Martens 1991). The energy needed to perform repeated coughing (see Gill trauma section) increases metabolic oxygen demand. Metabolic oxygen demand is related to water temperature. As temperatures increase, so does metabolic oxygen demand, but the concentration of oxygen available in the water decreases. Therefore, fish tolerance of suspended sediment may be primarily related to the capacity of the fish perform work associated with the cough reflex. However, as sediment increases, fish have less capability to do work, and therefore less tolerance for suspended sediment (Serizi and Martens 1991).

Redding et al. (1987) observed higher mortality in young steelhead trout exposed to a combination of suspended sediment (2500 mg/l) and a bacterial pathogen, than when exposed to the bacteria alone. Physiological stress in fishes appears to decrease immunological competence, growth, and reproductive success (Bash et al. 2001).

Behavioral Effects

Increased turbidity and suspended sediment may also cause behavior changes in salmonids. Avoidance, distribution, and migration may be affected. Many behavioral effects result from changes in stream habitat as well (see Habitat Effects section). As suspended sediment concentration increases, habitat may be lost which results in abandonment and avoidance of preferred habitat. Stream reach emigration is a bioenergetic demand that may affect the growth or reproductive success of the individual fish (Bash et al. 2001). Sediment pulses result in downstream migration of fish, which disrupts social structures, and causes downstream displacement of other fish (McLeay et al. 1987; Bash et al. 2001). Loss of territoriality and the breakdown of social structure can lead to secondary effects of decreased growth and feed rates, which may lead to mortality (Berg and Northcote 1985; Bash et al. 2001).

To the contrary, when not motivated by excess sediment, downstream migration by bull trout can provide access to more prey, better protection from avian and terrestrial predators, and alleviate potential intraspecific competition or cannibalism in rearing areas (MBTRT 1998). Benefits of migration from tributary rearing areas to larger rivers or estuaries may be increased growth potential. Increased sedimentation may result in premature or early migration of both juveniles and adults, or avoidance of habitat and migration of nonmigratory resident bull trout. Such migration exposes fish to many new hazards, including passage of sometimes difficult and unpredictable physical barriers, increased vulnerability to predators, exposure to introduced species, exposure to pathogens, and the challenges of new and unfamiliar habitats (MBTRT 1998).

High turbidity can also delay migration back to spawning sites, although turbidity alone does not seem to affect homing. Delays in spawning migration and associated energy expenditure may reduce spawning success and therefore population size (Bash et al. 2001).

EFFECTS DETERMINATION

The point at which adverse effects to fish occur from a specific project can be difficult to determine without adequate data. There are numerous variables that affect the determination, and for which data may be unavailable. These include project specific sediment input, existing sediment conditions, stream conditions (velocity, depth, etc.) during construction, weather or climate conditions (precipitation, wind, etc.), fish presence or absence (bull trout plus prey species), effectiveness of the best management practices employed, plus many others.

The Western Washington Fish and Wildlife Office (WWFWO) is currently drafting protocol to obtain specific project related sediment data. This protocol will be used to identify project related sediment input during construction, as well as long-term sedimentation that may result after completion of the project (i.e. high-flow events, channel adjustments, etc.). Following the protocol will provide consistent information on project-related sediment input to assist in evaluating effects and quantifying incidental take in biological opinions.

Newcombe and Jensen (1996) provide a basis for determining when a project will be "likely to adversely affect" bull trout. They conducted a literature review of pertinent documents on sediment effects to salmonids and nonsalmonids, and developed a model that calculated the severity of effect (SEV) based on the suspended sediment dose (exposure) and concentration.

A 15-point scale is used to qualitatively rank the effects of sediment on fish (Table 1). Specific SEV levels will be used to determine when a project is "likely to adversely affect" bull trout.

The following procedure will be used:

1. Select either a. or b. below.

a. Based on water quality monitoring data, determine the amount of sediment and the duration of sediment input into the stream. (Currently not enough data are available to use this step. As more project specific data becomes available this step will be used).

b. Use State water quality standards. Because action agencies must meet State water quality standards you can use the standard for determining sediment input into the stream. The Washington State water quality standards for turbidity are provided in Table 2.

The State water quality standard allows for a mixing zone downstream of the project site. The point of compliance is based on stream discharge (Table 3).

The water quality standard must be converted from turbidity (NTUs) to suspended solids (mg/l). A ratio of 1:1 to 1:5 has been derived for converting turbidity to suspended solids (Birtwell 1999). Washington Department of Ecology or U.S. Geological Survey data should be used to determine specific turbidity suspended solid ratios for the stream on which the project will be conducted (see Documents and Background Information section). If site specific ratios can not be determined use worse case ratio of 1:4 or 1:5.

2. Based on the background information gathered, determine what life stage(s) of bull trout will be affected by sedimentation (see Documents and Background Information section). Use Figures 1 through 4 to determine what SEV level will result for the life stage affected by the project.

3. Use Table 4 to determine what ESA determination is made for the life stage affected.

Table 1. Scale of the severity (SEV) of ill effects associated with excess suspended sediment

SEV	Description of Effect
	Nil effect
0	No behavioral effects
	Behavioral effects
1	Alarm reaction
2	Abandonment of cover
3	Avoidance response
	Sublethal effects
4	Short-term reduction in feeding rates; short-term reduction in feeding success
5	Minor physiological stress; increase in rate of coughing; increased respiration rate
6	Moderate physiological stress
7	Moderate habitat degradation; impaired homing
8	Indications of major physiological stress; long-term reduction in feeding rate; long-term reduction in feeding success; poor condition
	Lethal and paralethal effects
9	Reduced growth rate; delayed hatching; reduced fish density
10	0-20% mortality; increased predation; moderate to severe habitat degradation
11	> 20 – 40% mortality
12	> 40 – 60% mortality
13	> 60 – 80% mortality
14	> 80 – 100% mortality

4. If a LAA determination is made, then the basis for the rationale for "take" occurring is based on the SEV value obtained. The rationale is not just for that specific level (SEV = 6), but includes previous SEVs as well.

5. Table 5 summarizes the project-specific water quality monitoring data received by the Service for individual projects and indicates that, in some cases, adverse effects that rise to the level of "incidental take" may occur up to at least 600 feet downstream of project locations. Water quality monitoring data can indicate, by analogy, typical levels of sediment impacts for different project types, and can be used to estimate the minimum extent of impact. The data include the distance from the project where water quality sampling occurred and the maximum NTU levels observed. Additional monitoring data will be incorporated when available.

Table 2 - Turbidity water quality standards for various classes of surface waters in the State of Washington.

Washington State Classes for Surface Waters	**Turbidity Characteristic**
Class AA (extraordinary)	Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is ≤ 50 NTU or have > 10 percent increase in turbidity when the background turbidity is > 50 NTU.
Class A (excellent)	Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is ≤ 50 NTU or have > 10 percent increase in turbidity when the background turbidity is > 50 NTU
Class B (good)	Turbidity shall not exceed 10 NTU over background turbidity when the background turbidity is ≤ 50 NTU or have > 20 percent increase in turbidity when the background turbidity is > 50 NTU

Table 3 - Turbidity mixing zones for turbidity water quality standards.

Waterbody Type	Point of Compliance
Stream:	
≤ 10 cfs Stream Flow at Time of Construction	100 ft downstream of activity causing turbidity exceedance
>10 cfs up to 100 cfs Stream Flow at Time of Construction	200 ft downstream of activity causing turbidity exceedance
> 100 cfs Stream Flow at Time of Construction	300 ft downstream of activity causing turbidity exceedance

Figure 1 - Severity-of-ill-effect scores for juvenile and adult salmonids.

Juvenile and Adult Salmonids
Average severity-of-ill-effect scores

Concentration (mg/l)	Hours 1	Hours 3	Hours 7	Days 1	Days 2	Days 6	Weeks 2	Weeks 7	Months 4	Months 11	Months 30
162755	10	11	11	12	12	13	14	14	-	-	-
59874	9	10	10	11	12	12	13	13	14	-	-
22026	8	9	10	10	11	11	12	13	13	14	-
8103	8	8	9	10	10	11	11	12	13	13	14
2981	7	8	8	9	9	10	11	11	12	12	13
1097	6	7	7	8	9	9	10	10	11	12	12
403	5	6	7	7	8	9	9	10	10	11	12
148	5	5	6	7	7	8	8	9	10	10	11
55	4	5	5	6	6	7	8	8	9	9	10
20	3	4	4	5	6	6	7	8	8	9	9
7	3	3	4	4	5	6	6	7	7	8	9
3	2	2	3	4	4	5	5	6	7	7	8
1	1	2	2	3	3	4	5	5	6	7	7

Figure 2 - Severity-of-ill-effect scores for adult salmonids.

Adult Salmonids
Average severity-of-ill-effect scores

Concentration (mg/l)	1	3	7	1	2	6	2	7	4	11	30
	Hours			Days			Weeks		Months		
162755	11	11	12	12	13	13	14	14	-	-	-
59874	10	10	11	11	12	12	13	13	14	14	-
22026	9	10	10	11	11	12	12	13	13	14	14
8103	8	9	9	10	10	11	11	12	12	13	13
2981	8	8	9	9	10	10	11	11	12	12	13
1097	7	7	8	8	9	9	10	10	11	11	12
403	6	7	7	8	8	9	9	10	10	11	11
148	5	6	6	7	7	8	8	9	9	10	10
55	5	5	6	6	7	7	8	8	9	9	9
20	4	4	5	5	6	6	7	7	8	8	9
7	3	4	4	5	5	6	6	7	7	7	8
3	2	3	3	4	4	5	5	6	6	7	7
1	2	2	3	3	4	4	5	5	5	6	6

Figure 3 - Severity-of-ill-effect scores for juvenile salmonids.

Juvenile Salmonids
Average severity-of-ill-effect scores

Concentration (mg/l)	Hours			Days			Weeks		Months		
	1	3	7	1	2	6	2	7	4	11	30
162755	9	10	11	11	12	13	14	14	-	-	-
59874	9	9	10	11	11	12	13	14	14	-	-
22026	8	9	9	10	11	11	12	13	13	14	-
8103	7	8	9	9	10	11	11	12	13	13	14
2981	6	7	8	9	9	10	11	11	12	13	13
1097	6	6	7	8	9	9	10	11	11	12	13
403	5	6	6	7	8	9	9	10	11	11	12
148	4	5	6	6	7	8	9	9	10	11	11
55	4	4	5	6	6	7	8	8	9	10	11
20	3	4	4	5	6	6	7	8	8	9	10
7	2	3	4	4	5	6	6	7	8	8	9
3	1	2	3	4	4	5	6	6	7	8	8
1	1	1	2	3	4	4	5	6	6	7	8

Figure 4 - Severity-of-ill-effect scores for eggs and alevins of salmonids.

Eggs and Alevins of Salmonids
Average severity-of-ill-effect scores

Concentration (mg/l)	Hours			Days			Weeks		Months		
	1	3	7	1	2	6	2	7	4	11	30
162755	7	9	10	11	12	13	14	-	-	-	-
59874	7	8	9	10	12	13	14	-	-	-	-
22026	7	8	9	10	11	12	13	-	-	-	-
8103	7	8	9	10	11	12	13	14	-	-	-
2981	6	7	8	10	11	12	13	14	-	-	-
1097	6	7	8	9	10	11	12	14	-	-	-
403	6	7	8	9	10	11	12	13	14	-	-
148	5	6	7	9	10	11	12	13	14	-	-
55	5	6	7	8	9	10	12	13	14	-	-
20	5	6	7	8	9	10	11	12	13	-	-
7	4	5	7	8	9	10	11	12	13	14	-
3	4	5	6	7	8	10	11	12	13	14	-
1	4	5	6	7	8	9	10	11	13	14	-

Table 4 - ESA Effect calls for different bull trout life stages in relation to the duration of effect and severity-of-ill-effect.

Life Stage	SEV	ESA Effect Call
Egg/alevin	1 to 4	not applicable - alevins are still in gravel and are not feeding.
	5 to 14	LAA - any stress to egg/alevin reduces survival
Juvenile	1 to 4	NLAA
	5 to 14	LAA
Subadult and Adult	1 to 5	NLAA
	6 to 14	LAA

Table 5 - Water quality monitoring data received by the Western Washington Fish and Wildlife Office showing distance downstream where data were recorded and the maximum magnitude of turbidity observed.

Project	Distance downstream from project that data were recorded	Distance downstream that State water quality standards are met, or the maximum turbidity levels observed.
Debris jam removal (SR - 20)	Not provided	Met standard
Rock placed in stream (Hoh River emergency bank protection)	100 feet - 200 feet	Met standard
Bridge construction (SR - 90) Stated removal of coffer dams and diversion resulted in increased turbidity	Not provided	Maximum daily magnitude measured: 25 NTUs over standard
River scour protection (SR 12) Contract no. C-6186	300 feet and 600 feet	Maximum daily magnitude measured: 9.3 NTUs over standard
Bridge construction	200 feet	Maximum daily magnitude measured: 169 NTUs
Culvert replacement project not described (SR 241) Contract # 6270 - Sulfur Cr.	100 feet and 200 feet	Maximum daily magnitude measured: over 30 NTUs
Bank stabilization (Saxon Cr.)	300 feet	Maximum daily magnitude measured: 35.2 NTUs over standard
Culvert replacement – (Stossel Cr Way.)	Not provided	Maximum daily magnitude measured: 24 NTUs over background
Culvert replacement – (Stevens Creek)	178 feet and 576 feet	Maximum daily magnitude measured: 185 NTUs over background
Culvert replacement – (Sunbeam Creek)	72 feet and 147 feet	Maximum daily magnitude measured: 454 NTUs over background
Culvert replacement – (Unnamed Waddell Creek Tributary)	62 feet	Maximum daily magnitude measured: 600 NTUs over background.

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Appendix D

Calculation of extent of river miles anticipated to be adversely affected as a result of habitat alteration and stranding/capturing/handling of bull trout.

Management or Recovery Unit	FMO or Core Area	Maximum number of Restoration Activities resulting in a may affect, likely to adversely affect	Total Project Area (574 ft) 75% of total projects over 8 years	Total Project Area (2,640 ft) 25% of total projects over 8 years	Extent of Project Area subject to stranding, capture, handling, or sediment effects (ft)	Extent of Project Area subject to stranding, capture, handling, or sediment effects (miles)	Extent of anticipated downstream increase turbidity (Max number of projects x 600 ft)	Extent of anticipated downstream increase turbidity (miles)	Extent of anticipated effects due to habitat alteration, stranding, capturing, or handling (River Miles)
Olympic Peninsula	Hood Canal and independent tributaries FMO up to the National Forest boundary	Likely to Adversely Affect not anticipated to occur							0
	Strait of Juan de Fuca and independent tributaries FMO up to the National Park boundary	Likely to Adversely Affect not anticipated to occur							0
	Pacific Ocean and independent coastal tributaries FMO (areas of National Park are not included)	Likely to Adversely Affect not anticipated to occur							0

Management or Recovery Unit	FMO or Core Area	Maximum number of Restoration Activities resulting in a may affect, likely to adversely affect	Total Project Area (574 ft) 75% of total projects over 8 years	Total Project Area (2,640 ft) 25% of total projects over 8 years	Extent of Project Area subject to stranding, capture, handling, or sediment effects (ft)	Extent of Project Area subject to stranding, capture, handling, or sediment effects (miles)	Extent of anticipated downstream increase turbidity (Max number of projects x 600 ft)	Extent of anticipated downstream increase turbidity (miles)	Extent of anticipated effects due to habitat alteration, stranding, capturing, or handling (River Miles)
Olympic Peninsula cont.	Lower Chehalis River/Grays Harbor and independent tributaries FMO	Likely to Adversely Affect not anticipated to occur							0
	Skokomish River Core Area, including North and South Forks from the mouth up to the National Forest or National Park boundaries	4 No more than 2 in any 1 year	1,722	2,640	4,362	0.83	2,400 No more than 1,200 ft in any 1 year	0.45	1.28
	Dungeness River Core Areaup to the National Forest boundary	6 No more than 3 in any 1 year No more than 2 within the local population in any 1 year*	2,583	3,960	6,543	1.24	3,600 No more than 1,800 ft in any 1 year No more than 1,200 ft within a local population in any 1 year	0.68	1.92

Management or Recovery Unit	FMO or Core Area	Maximum number of Restoration Activities resulting in a may affect, likely to adversely affect	Total Project Area (574 ft) 75% of total projects over 8 years	Total Project Area (2,640 ft) 25% of total projects over 8 years	Extent of Project Area subject to stranding, capture, handling, or sediment effects (ft)	Extent of Project Area subject to stranding, capture, handling, or sediment effects (miles)	Extent of anticipated downstream increase turbidity (Max number of projects x 600 ft)	Extent of anticipated downstream increase turbidity (miles)	Extent of anticipated effects due to habitat alteration, stranding, capturing, or handling (River Miles)
Olympic Peninsula cont.	Elwha River Core Area up to the National Forest or National Park boundary	2 No more than 1 in any 1 year	574	2,640	3,214	0.61	1,200 No more than 600 ft in any 1 year	0.23	0.84
	Hoh River Core Area up to the National Forest or National Park boundaries	2 No more than 1 in any 1 year	861	1,320	2,181	0.41	1,200 No more than 600 ft in any 1 year	0.23	0.64
	Queets River Core Area up to the National Park boundary	2 No more than 1 in any 1 year	861	1,320	2,181	0.41	1,200 No more than 600 ft in any 1 year	0.23	0.64
	Quinault River Core Area up to the National Forest or National Park boundary	10 No more than 5 in any 1 year	4,305	6,600	10,905	2.07	6,000 No more than 3,000 ft in any 1 year	1.14	3.20
Puget Sound	Samish River FMO	Likely to Adversely Affect not anticipated to occur							0.00

Management or Recovery Unit	FMO or Core Area	Maximum number of Restoration Activities resulting in a may affect, likely to adversely affect	Total Project Area (574 ft) 75% of total projects over 8 years	Total Project Area (2,640 ft) 25% of total projects over 8 years	Extent of Project Area subject to stranding, capture, handling, or sediment effects (ft)	Extent of Project Area subject to stranding, capture, handling, or sediment effects (miles)	Extent of anticipated downstream increase turbidity (Max number of projects x 600 ft)	Extent of anticipated downstream increase turbidity (miles)	Extent of anticipated effects due to habitat alteration, stranding, capturing, or handling (River Miles)
Puget Sound con.t	Lake Washington FMO including the following: Lower Cedar River; Sammamish River; Lakes Washington, Sammamish and Union; and Ship Canal	Likely to Adversely Affect not anticipated to occur							0.00
	Lower Green River FMO	Likely to Adversely Affect not anticipated to occur							0.00
	Lower Nisqually River FMO	Likely to Adversely Affect not anticipated to occur							0.00
	Marine Areas of Puget Sound FMO	Likely to Adversely Affect not anticipated to occur							0.00
	Chilliwack River Core Area up to the National Forest boundary	2 No more than 1 in any 1 year	861	1,320	2,181	0.41	1,200 No more than 600 ft in any 1 year	0.23	0.64

Management or Recovery Unit	FMO or Core Area	Maximum number of Restoration Activities resulting in a may affect, likely to adversely affect	Total Project Area (574 ft) 75% of total projects over 8 years	Total Project Area (2,640 ft) 25% of total projects over 8 years	Extent of Project Area subject to stranding, capture, handling, or sediment effects (ft)	Extent of Project Area subject to stranding, capture, handling, or sediment effects (miles)	Extent of anticipated downstream increase turbidity (Max number of projects x 600 ft)	Extent of anticipated downstream increase turbidity (miles)	Extent of anticipated effects due to habitat alteration, stranding, capturing, or handling (River Miles)
Puget Sound cont.	Nooksack River Core Area up to the National Forest boundary	20 No more than 5 in any 1 year No more than 2 within a local population in any 1 year*	8,610	13,200	21,810	4.13	12,000 No more than 3,000 ft in any 1 year No more than 1,200 ft within a local population in any 1 year	2.27	6.40
	Lower Skagit River Core Area up to the National Forest or National Park boundary	10 No more than 5 in any 1 year No more than 2 within a local population in any 1 year*	4,305	6,600	10,905	2.07	6,000 No more than 3,000 ft in any 1 year No more than 1,200 ft within a local population in any 1 year	1.14	3.2

Management or Recovery Unit	FMO or Core Area	Maximum number of Restoration Activities resulting in a may affect, likely to adversely affect	Total Project Area (574 ft) 75% of total projects over 8 years	Total Project Area (2,640 ft) 25% of total projects over 8 years	Extent of Project Area subject to stranding, capture, handling, or sediment effects (ft)	Extent of Project Area subject to stranding, capture, handling, or sediment effects (miles)	Extent of anticipated downstream increase turbidity (Max number of projects x 600 ft)	Extent of anticipated downstream increase turbidity (miles)	Extent of anticipated effects due to habitat alteration, stranding, capturing, or handling (River Miles)
Puget Sound cont.	Stillaguamish River Core Area up to the National Forest boundary	20 No more than 5 in any 1 year No more than 2 within a local population in any 1 year*	8,610	13,200	21,810	4.13	12,000 No more than 3,000 ft in any 1 year No more than 1,200 ft within a local population in any 1 year	2.27	6.40
	Snohomish/ Skykomish Rivers Core Area up to the National Forest boundary	10 No more than 5 in any 1 year No more than 2 within a local population in any 1 year*	4,305	6,600	10,905	2.07	6,000 No more than 3,000 ft within a local population in any 1 year No more than 1,200 ft within a local population in any 1 year	1.14	3.2

Management or Recovery Unit	FMO or Core Area	Maximum number of Restoration Activities resulting in a may affect, likely to adversely affect	Total Project Area (574 ft) 75% of total projects over 8 years	Total Project Area (2,640 ft) 25% of total projects over 8 years	Extent of Project Area subject to stranding, capture, handling, or sediment effects (ft)	Extent of Project Area subject to stranding, capture, handling, or sediment effects (miles)	Extent of anticipated downstream increase turbidity (Max number of projects x 600 ft)	Extent of anticipated downstream increase turbidity (miles)	Extent of anticipated effects due to habitat alteration, stranding, capturing, or handling (River Miles)
Puget Sound cont.	Puyallup River Core Area up to the National Forest or National Park boundary	20 No more than 5 in any 1 year No more than 2 within a local population in any 1 year*	8,610	13,200	21,810	4.13	12,000 No more than 3,000 ft within a local population in any 1 year No more than 1,200 ft within a local population in any 1 year	1.14	5.27
TOTALS						**22.50**		12.27	**34.76**

* May be exceeded if approved by CTA and L&R staff identified as bull trout species leads.

APPENDIX E

Crosswalk between Bull Trout Matrix and Critical Habitat Primary Constituent Elements

The Matrix of Pathway Indicators (Matrix) for bull trout is used to evaluate and document baseline conditions and to aid in determining whether a project is likely to adversely affect or result in the incidental take of bull trout.

The Matrix analysis incorporates 4 biological indicators and 19 physical habitat indicators. The majority of the Matrix analysis consists of specific consideration of the 19 habitat indicators. Analysis of these indicators should provide a thorough analysis of the existing baseline condition and potential impacts to bull trout habitat. While assessing potential effects to bull trout as a species, biologists can concurrently provide an analysis of effects to the primary constituent elements (PCEs) for bull trout critical habitat. Table 1 shows the relationship between the primary constituent elements (PCE) for bull trout critical habitat and the Matrix habitat indicators. The following information provides the rationale for how the PCEs for bull trout critical habitat can be thoroughly addressed by using the Matrix.

1. Water temperatures that support bull trout use. Bull trout have been documented in streams with temperatures from 32 to 72 °F (0 to 22 °C) but are found more frequently in temperatures ranging from 36 to 59 °F (2 to 15 °C). These temperature ranges may vary depending on bull trout life-history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence. Stream reaches with temperatures that preclude bull trout use are specifically excluded from designation.

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

2. Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.

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

3. ***Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. This should include a minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter.***

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

4. ***A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, currently operate under a biological opinion that addresses bull trout, or a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation: This rule finds that reservoirs currently operating under a biological opinion that addresses bull trout provides management for PCEs as currently operated.***

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

5. ***Springs, seeps, groundwater sources, and subsurface water to contribute to water quality and quantity as a cold water source.***

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

6. Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.

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

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

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

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

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

Table 1. Relationship of Matrix habitat indicators to the Primary Constituent Elements of bull trout critical habitat.

Indicator	**PCE 1 - Temperature**	**PCE 2 - Complex Stream Channel**	**PCE 3 - Substrate**	**PCE 4 - Natural Hydrograph**	**PCE 5 - Springs, seeps, groundwater**	**PCE 6 - Migratory corridors**	**PCE 7 - Abundant food base**	**PCE 8 - Permanent water**
Water Quality								
Temperature	x					x	x	x
Sediment			x			x	x	x
Chemical Contaminants and Nutrients					x	x	x	x
Habitat Access								
Physical Barriers						x		
Habitat Elements								
Substrate Embeddedness			x		x		x	
Large Woody Debris		x	x					
Pool Frequency and Quality		x	x				x	
Large Pools	x	x						
Off-Channel Habitat		x						
Refugia	x	x				x		
Channel Conditions and Dynamics								
Wetted Width/Maximum Depth Ratio	x	x				x		
Streambank Condition	x	x	x		x			
Floodplain Connectivity	x	x		x	x		x	x
Flow/Hydrology								
Changes in Peak/Base Flows	x			x	x	x		x
Drainage Network Increase				x	x			x
Watershed Conditions								
Road Density and Location	x			x	x			
Disturbance History		x		x				x
Riparian Conservation Areas	x	x		x	x		x	
Disturbance Regime		x		x				x

Table 2. Relationship of Matrix habitat indicators to the Primary Constituent Elements of bull trout critical habitat specific to PBA

Indicator	PCE 1 - Temperature	PCE 2 - Complex Stream Channel	PCE 3 - Substrate	PCE 4 - Natural Hydrograph	PCE 5 - Springs, seeps, groundwater	PCE 6 - Migratory corridors	PCE 7 - Abundant food base	PCE 8 - Permanent water
Water Quality								
Temperature	x					x	x	x
Sediment			x			x	x	x
Chemical Contaminants and Nutrients					x	x	x	x
Habitat Access								
Physical Barriers						x		
Habitat Elements								
Substrate Embeddedness			x		x		x	
Large Woody Debris		x	x					
Pool Frequency and Quality		x	x				x	
Large Pools	x	x						
Off-Channel Habitat		x			x			
Refugia	x	x				x		
Channel Conditions and Dynamics								
Wetted Width/Maximum Depth Ratio	x	x				x		
Streambank Condition	x	x	x		x			
Floodplain Connectivity	x	x		x	x		x	x
Flow/Hydrology								
Changes in Peak/Base Flows	x			x	x	x		x
Drainage Network Increase				x	x			x
Watershed Conditions								
Road Density and Location				x	x			
Disturbance History		x		x				x
Riparian Conservation Areas	x	x		x	x		x	
Disturbance Regime		x		x				x
RAs with short-term degrade from vegetation removal	1, 2, 4, 6, 7, 8, 9, 10, 11, 13	1, 2, 4, 8, 9, 11	1, 2, 4, 8, 9, 11	1, 2, 4, 6, 7, 8, 9, 10, 11, 13	1, 2, 4, 8, 9, 11	1, 2, 4, 8, 9, 11	1, 2, 4, 8, 9, 11	1, 2, 4, 8, 9, 11
RAs with short-term degrade from sediment mobilization		1, 2, 4, 6, 7, 10, 11, 13	1, 2, 4, 6, 7, 10, 11, 13		1, 2, 4, 6, 7, 10, 11, 13	1, 2, 4, 6, 7, 10, 11, 13	1, 2, 4, 6, 7, 10, 11, 13	1, 2, 4, 6, 7, 10, 11, 13
RAs that will Restore Indicators	2, 4, 6, 7, 8, 9, 10, 11	1, 2, 3, 6, 8, 9, 10, 11	1, 2, 3, 4, 6, 7, 8, 9, 10, 11	2, 3, 4, 6, 7, 8, 9, 10, 11	1, 2, 3, 4, 6, 7, 8, 9, 10, 11	2, 3, 4, 6, 7, 8, 9, 10, 11, 13	1, 2, 3, 4, 6, 7, 8, 9, 10, 11	2, 3, 4, 6, 7, 8, 9, 10, 11