Biological and Conference Opinion
on the
Effects to the Bull Trout (*Salvelinus confluentus*)
and
Bull Trout Proposed Critical Habitat
from
Continued Implementation
of
Forest Service Land and Resource Management Plans
and
Bureau of Land Management Resource Management Plans
as amended by the
1994 Northwest Forest Plan Record of Decision
as amended by the
October 24, 2003, Supplemental Environmental Impact Statement
regarding
Aquatic Conservation Strategy Clarification Amendments
to the
1994 Northwest Forest Plan Record of Decision

(Log no. 1-7-04-F-0106)

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Prepared by the U.S. Fish and Wildlife Service
Pacific Regional Office
Oregon Fish and Wildlife Office
Western Washington Fish and Wildlife Office

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United States Department of the Interior

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Dear Ms. Brong and Ms. Goodman:

This document transmits the Fish and Wildlife Service's (Service) plan-level biological and conference opinion (BO) based on our review of the Forest Service's (FS) and Bureau of Land Management's (BLM) proposal for continued implementation of Land and Resource Management Plans and Resource Management Plans (collectively referred to as RMPs), respectively, as amended by the 1994 Northwest Forest Plan (NWFP) Record of Decision (ROD) and further amended by the October 24, 2003, Final Supplemental Environmental Impact Statement (FSEIS) for Clarification of Language in the NWFP ROD.

This BO addresses the effects of the proposed action to the threatened Coastal-Puget Sound, Columbia River, and Klamath River Distinct Population Segments (DPSs) of the bull trout (*Salvelinus confluentus*) and its proposed critical habitat. This document was prepared in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act)(16 U.S.C. 1531 et seq.). The FS's and BLM's October 17, 2003, Biological Assessment (BA) and request for formal consultation was received on October 22, 2003. This BO supersedes the Service's May 31, 2000, bull trout BO for the NWFP.

In response to the FS's and BLM's request, this document includes an advisory conference opinion on the effects of the proposed action to bull trout proposed critical habitat. It is the Service's intent to confirm the conference opinion as a biological opinion issued through formal consultation, if the critical habitat is designated and the FS and BLM formally request the Service to do so. No further section 7 consultation on the proposed action will be necessary, unless the reinitiation criteria at 50 CFR 402.16 apply.

This BO is based on the following documents and other sources of information listed in the "Literature Cited" section below:

- BLM and FS October 17, 2003, BA (USDA & USDI 2003a);
- FSEIS for Clarification of Language in the ROD (USDA & USDI 2003b);
- Forest Ecosystem Management Assessment Team report (FEMAT) (USDA 1993);
- Final Supplemental EIS on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Spotted Owl (USDA & USDI 1994a)(1994 FSEIS);
- NWFP ROD for Amendments to FS and BLM Planning Documents Within the Range of the Spotted Owl (USDA & USDI 1994b);
- Biological Opinion for Alternative 9 of the FSEIS (1994 BO)(USDI 1994);
- An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Columbia Basins (USDA 1997a);
- Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis (USDA 1995);
- The Federal Riparian Reserve Module of the WA Guide (USDA 1997b), dated February, 1997;
- Interagency letter of agreement, dated January 27, 1998 (describing the approach to be used for bull trout conferencing/consultation);
- Interagency Memorandum of Agreement (MOA), dated May 31, 1995, describing the consultation streamlining process and subsequent updates;
- Final listing rule for the Columbia River and Klamath River bull trout DPSs, published on June 10, 1998 (USDI 1998b);
- Proposed listing rule for the Coastal-Puget Sound, Jarbridge River, and St. Mary-Belly River bull trout DPSs, published on June 10, 1998 (USDI 1998a);
- Final listing rule for bull trout in the coterminous United States, published on November 1, 1999 (USDI 1999);
- Proposed critical habitat designation for the Columbia River and Klamath River bull trout DPSs (67 FR 71236)(USDI 2002);
- Draft Bull Trout Recovery Plan (Service 2002a); and
- Biological Opinion for continued implementation of FS and BLM RMPs as amended by the NWFP ROD (Service 2000).

A complete administrative record of this consultation is on file at the Service's Pacific Regional Office in Portland, Oregon.

CONSULTATION HISTORY

On July 31, 1997, the FS and BLM requested formal consultation on the continued implementation of RMPs, as amended by the 1994 NWFP ROD relative to effects on the threatened Coastal-Puget Sound, Columbia River, and Klamath DPSs of the bull trout. On April 6, 1999, the FS amended the above request.

On May 31, 2000, the Service issued a non-jeopardy Biological Opinion in response to the July 31, 1997, request from the FS and BLM. At the time, there were no anticipated effects to critical habitat because none was proposed or designated for the bull trout.

On June 30, 2003, the FS and BLM requested reinitiation of formal consultation on the action addressed in the Service's May 31, 2000, opinion as a result of the 2003 FSEIS. The agencies also requested formal conferencing on the effects of their proposed action on bull trout proposed critical habitat.

On October 17, 2003, the FS and BLM again requested reinitiation of formal consultation and conferencing on the action addressed in the Service's May 31, 2000, opinion as a result of the 2003 FSEIS, and provided a revised BA.

DESCRIPTION OF THE PROPOSED ACTION

The FS and BLM have requested reinitiation of formal consultation on the continued implementation of 30 RMPs governing 19 National Forests, 9 BLM Districts or Resource Areas, the Columbia River Gorge National Scenic Area (CRGNSA), and the King Range National Conservation Area (KRNCA) within the range of the northern spotted owl (*Strix occidentalis caurina*) as amended by the 1994 NWFP ROD and the 2003 FSEIS. The BA addressed only the aspects of these RMPs that have been amended by the 1994 ROD and the 2003 FSEIS. The FS and BLM have also included as part of the proposed action the implementation of RMPs for the Mendicino National Forest (NF), Wenatchee NF, and the Coquille Forest. Although these three areas are outside of the NWFP boundary, they are managed in accordance with the NWFP.

The proposed action consists of the RMPs as amended by the 1994 NWFP ROD and the 2003 FSEIS.

RMPs

The RMPs generically authorize various categories or types of Federal actions or projects, which respond to the needs for forest habitat, goods and services. While all of the FS and BLM administrative units implement many of the same land-use practices, the levels of activities and outputs will vary depending on local conditions. Even though RMPs set important parameters for the authorization of specific projects, with some exceptions, RMPs do not provide the final authorization for project implementation. Final authorization of projects depends on the analysis of site-specific effects and consistency with appropriate management direction (RMPs, ROD, regulations, etc).

RMPs establish broad management direction in two general areas. First, RMP management direction is established through goals, objectives, desired future conditions, and/or standards and guidelines (S&Gs). S&Gs provide the sideboards for reaching the broad goals, objectives, and desired future conditions established in the RMPs. Second, RMPs establish goals and objectives regarding where, when, and how goods and services will be produced. As described in the BA, management actions which are typically conducted on FS and BLM lands include forest management, recreation, grazing, mining, watershed restoration, fish and wildlife habitat management, fire/fuels management, land exchanges and acquisitions, and a variety of special uses.

A complete description of all of the types of projects covered under the RMPs is included in the BLM and FS October 17, 2003, BA and is hereby incorporated by reference.

RMPs as Amended per the 1994 NWFP ROD

The ROD (USDA & USDI 1994b) formally amended the existing FS and BLM RMPs by the addition of new land allocations (ROD, page 6-7), and S&Gs (ROD, Attachment A, as well as in its entirety). These amending land allocations and S&Gs generally override those in existing plans, except for any provisions of the existing plans more stringent in their protection (see ROD, pages 11-12). The ROD also amended the FS Regional Guides for those portions of the Pacific Northwest Region (Region 6) and the Pacific Southwest Region (Region 5) within the range of the northern spotted owl (ROD, page 12).

A description of the Aquatic Conservation Strategy (ACS) component of the NWFP is presented in the BA and further discussed below in the "Effects of the Action" section.

RMPs as Amended per the 2003 FSEIS

The Secretaries of Agriculture and the Interior are amending the ACS portions of the RMPs except for the Columbia River Gorge National Scenic Area (CRGNSA) within the NWFP area. The CRGNSA Plan will be indirectly affected by the proposed ACS amendment since only the NWFP RMPs within the CRGNSA would be amended (see BA section 5.11 for details regarding CRGNSA). As described in the BA, the proposed ACS amendment would provide that:

- The proper scales for Federal land managers to evaluate progress toward achievement of the ACS objectives are the watershed and broader scales. No single project should be expected to achieve all ACS objectives.

- No management activities can be expected to maintain the existing condition at all scales and all times; disturbance from management activities must be considered in the context of the condition of the fifth-field watershed as a whole.

- Decision-makers are required to document how the agency used relevant information from applicable WA to provide context for project planning.

- To comply with Riparian Reserve S&Gs that reference ACS objectives, the decision maker must document that analysis has been completed, including a description of the existing condition, a description of the range of natural variability of the important physical and biological components of a given 5th field watershed, and how the project or management action maintains the existing condition or restores it toward that range of natural variability.

The Appendix to the BA describes the process whereby the FS and BLM assess and mitigate the effects of land management activities at a variety of scales. In addition to project-level NEPA analysis, analysis to obtain permits, and monitoring and inventory, this Appendix also includes a detailed discussion of the process that the FS and BLM propose to apply during project-level section 7 consultations under the Act, including a multi-scale analytical process and consultation streamlining procedures. The Appendix to the BA and the consultation streamlining procedures provide a framework for conducting ESA consultations on individual projects pursuant to the proposed action.

Action Area

The Action Area for this consultation is defined as being inclusive of FS and BLM administrative units within the NWFP area (Figure 1) and downstream reaches of streams that flow out of the NWFP area. The Action Area also includes the Mendicino NF, Wenatchee NF, and the Coquille Forest. Although these three areas are outside of the NWFP boundary, they are managed in accordance with the NWFP. FS and BLM administrative units addressed in this document are listed in Table 1. The distribution of bull trout DPSs and proposed critical habitat is also listed by administrative unit in Table 1.

Figure 1. Northwest Forest Plan Area.

FS and BLM Administrative Units

This document addresses the 12 (out of 30) FS and BLM RMPs in the NWFP area that are within the range of the bull trout. The 12 RMPs consist of 9 National Forests (NFs), 2 BLM Districts or Resource Areas, and the CRGNSA Plan. The 12 RMPs or Plans are as follows:

Bureau of Land Management:

District	**Resource Area**
Eugene	Klamath Falls

Forest Service:

National Forest	**National Forest**	**National Scenic Area**
Deschutes	Wenatchee	Columbia River Gorge
Gifford Pinchot	Willamette	
Mt. Baker-Snoqualmie	Winema	
Mt. Hood	Olympic	
Okanogan		

Distribution of Bull Trout DPSs and Proposed Critical Habitat by Administrative Unit

Table 1. The distribution of bull trout DPSs and proposed critical habitat by FS and BLM administrative unit in the NWFP area. CRBT = Columbia River DPS; CPSBT = Coastal-Puget Sound DPS; KRBT = Klamath River DPS.

Administrative Unit	Listed Species	Proposed Critical Habitat
Columbia River Gorge NSA	CRBT	CRBT
Deschutes	CRBT	CRBT
Gifford Pinchot	CRBT, CPSBT	CRBT
Mount Baker Snoqualmie	CPSBT	
Mount Hood	CRBT	CRBT
Okanogan	CRBT	CRBT
Olympic	CPSBT	
Wenatchee	CRBT	CRBT
Willamette	CRBT	CRBT
Winema	KRBT	KRBT
Eugene	CRBT	CRBT
Klamath Falls	KRBT	

STATUS OF THE SPECIES

Coastal-Puget Sound Distinct Population Segment

Bull trout and “native char” in the Coastal-Puget Sound distinct population segment (DPS), despite their relative widespread distribution, have declined in abundance and distribution within many individual river basins. Bull trout and “native char” currently occur as 35 isolated subpopulations, which indicates the level of habitat fragmentation and geographic isolation. Eight subpopulations are isolated by dams or other diversion structures, with at least 17 dams proposed in streams inhabited by the bull trout or “native char” subpopulations. The bull trout and “native char” continue to be threatened by the effects of habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, harvest, and introduced non-native species. The Coastal-Puget Sound DPS was listed as threatened on November 1, 1999 (64 FR 58910). See Appendix 1 for more information on the range-wide condition, threats, and conservation needs of this DPS.

Columbia River Distinct Population Segment

The bull trout in the Columbia River basin, despite its relatively widespread distribution, has declined in both its overall range and numbers. Numerous extirpations of local subpopulations have been reported, with bull trout eliminated from areas ranging in size from relatively small tributaries of currently occupied, though fragmented habitat, to large river systems comprising a substantial portion of the species’ previous range. Bull trout in the Columbia River DPS are currently limited to 141 isolated subpopulations, which indicates habitat fragmentation and geographic isolation. Many remaining bull trout occur as isolated subpopulations in headwater lakes or tributaries with migratory life histories lost or restricted. Remaining important strongholds tend to be found within large areas of contiguous habitats in the Snake River basin of central Idaho, upper Clark Fork and Flathead rivers in Montana, and the Blue Mountains in Washington and Oregon. The decline of the bull trout is due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices and the introduction of non-native species. Most bull trout subpopulations are affected by one or more threats.

Recent activities to address threats and reverse the long-term decline of the bull trout are being initiated at Federal, State, and local levels (e.g., restrictive angling regulations, adoption of various land management rules, and development of conservation strategies and plans).

The Columbia River DPS was listed as threatened on June 10, 1998 (63 FR 31647). See Appendix 1 for more information on the range-wide condition, threats, and conservation needs of this DPS.

Klamath River Distinct Population Segment

Bull trout within this DPS are currently limited to seven geographically isolated subpopulations that occupy only a fraction of the historical habitat. Bull trout distribution and numbers have declined due to habitat degradation, isolation, loss of migratory corridors, poor water quality, and the introduction of non-native species. Six of the seven subpopulations are small in population size. Remaining Klamath River bull trout subpopulations are threatened by the effects of past, present, and future land and water management practices.

Conservation actions are being initiated at Federal, State, and local levels to begin to reverse the long-term declining trend for the bull trout in the Klamath River basin. Progress has already been made toward improving habitat conditions for the bull trout. These conservation actions include efforts of the Klamath Basin Working Group to eradicate brook trout in Long, Sun, and Threemile creeks, reduce livestock grazing along bull trout-occupied streams, and monitoring of watershed conditions and bull trout status. Bull trout conservation in the Klamath River basin has also benefited from habitat restoration activities of the Upper Klasmath Basin Working Group which began in 1994.

The Klamath River DPS was listed as threatened on June 10, 1998 (63 FR 31647). See Appendix 1 for more information on the range-wide condition, threats, and conservation needs of this DPS.

<u>Conservation Needs of the Coastal-Puget Sound, Columbia River, and Klamath River DPSs</u>

Conservation needs reflect those biological and physical requirements of a species for its long-term survival and recovery. Based on the best available scientific information (Rieman and McIntyre 1993, MBTSG 1998, Hard 1995, Healey and Prince 1995, Rieman and Allendorf 2001), the conservation needs of the bull trout are:

1. Maintain and restore multiple, interconnected populations in diverse habitats across the range of each DPS.

2. Preserve the diversity of life-history strategies (e.g., resident and migratory forms, emigration age, spawning frequency, local habitat adaptations).

3. Maintain genetic and phenotypic diversity across the range of each DPS.

4. Protect populations from catastrophic fires across the range of each DPS.

STATUS OF PROPOSED CRITICAL HABITAT

Critical habitat for the Columbia River and the Klamath River DPSs of the bull trout was proposed on November 29, 2002 (67 FR 71236)(USDI 2002). For the Klamath River DPS, the proposed critical habitat designation includes about 476 kilometers (km) (296 miles (mi)) of streams and 13,735 hectares (ha) (33,939 acres (ac)) of lakes and marshes in Oregon. For the Columbia River DPS, the proposed critical habitat designation totals about 29,251 km (18,175 mi) of streams and 201,850 ha (498,782 ac) of lakes and reservoirs, which includes: about 14,416 km (8,958 mi) of streams and 83,219 ha (205,639 ac) of lakes and reservoirs in the State of Idaho; 5,341 km (3,319 mi) of streams and 88,051 ha (217,577 ac) of lakes and reservoirs in the State of Montana; 5,460 km (3,391 mi) of streams and 18,077 ha (44,670 ac) of lakes and reservoirs in the State of Oregon; and 4,034 km (2,507 mi) of streams and 12,503 ha (30,897 ac) of lakes and reservoirs in the State of Washington. For a complete description of bull trout proposed critical habitat, see the proposed rule cited above which is herein incorporated by reference.

A brief summary of the primary constituent elements of bull trout proposed critical habitat is presented below. In accordance with section 3(5)(A)(i) of the Act and regulations at 50 CFR 424.12, in determining which areas to propose as critical habitat, the Service is required to base our proposal on the best scientific data available, and to consider those physical and biological features that are essential to the conservation of the species and that may require special management considerations or protection. These physical and biological features include, but are not limited to: space for individual and population growth, and for normal behavior; food, water, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, or rearing of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

The primary constituent elements of bull trout proposed critical habitat are derived from studies of bull trout habitat requirements, life-history characteristics, and population biology, as described above. These primary constituent elements are: (1) permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited; (2) water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will 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; (3) 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; (4) 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. A minimal amount of fine substrate less than 0.63 cm (0.25 in) in diameter and minimal substrate embeddedness are characteristic of these conditions; (5) a natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations; (6) springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity; (7) migratory corridors with minimal physical, biological, or chemical barriers between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows; (8) an abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish; and (9) few or no predatory, interbreeding, or competitive non-native species present.

ENVIRONMENTAL BASELINE

Klamath River Distinct Population Segment

Bull trout within the Upper Klamath Lake portion of the DPS fall within the NWFP area. The Service identified two bull trout subpopulations in tributaries of Upper Klamath Lake: Threemile Creek and Sun Creek. As recently as the 1970s, bull trout occurred in Cherry and Sevenmile creeks, but now are likely extirpated in both (Light *et al.* 1996).

In 1996, the Threemile Creek subpopulation was estimated to be approximately 50 fish (L. Dunsmoor, Klamath Tribe, and S. West, USFS, *in lit.* 1996) in a 1.4 km (0.9 mi.) reach (Buchanan *et al.* 1997). Within this reach, bull trout are sympatric with brook trout for 0.3 km (0.2 mi.) (Buchanan *et al.* 1997). No young-of-the-year bull trout or brook trout were collected in Threemile Creek during 1996 (L. Dunsmoor, Klamath Tribe, and S. West, USFS, *in lit*. 1996). Although the reach occupied by bull trout is entirely within the Winema National Forest, the lower creek is privately owned and channelized and diverted for agricultural purposes (Light *et al.* 1996), resulting in degraded habitat downstream.

The Sun Creek subpopulation was estimated to be 133 fish (105 spawners) in 1989 (OCAFS 1993) in a 6.2 km (3.9 mi) reach of Sun Creek, which is entirely within Crater Lake National Park (Buktenica 1997). From 1992 through 1994, annual estimates of bull trout abundance ranged from 120 to 360 fish (Buktenica 1997). Bull trout are sympatric with brook trout throughout the entire reach (Buchanan *et al.* 1997). Lower Sun Creek is privately owned and channelized and diverted for agricultural purposes (Light *et al.* 1996).

A discussion of bull trout status within the Klamath River basin can be found in Chapter 2 of the Draft Bull Trout Recovery Plan (Service 2002a) which is herein incorporated by reference.

Columbia River DPS

The Columbia River bull trout distribution within the NWFP area is contained only in portions of the lower and mid-Columbia analysis areas. Current known bull trout distribution within the NWFP area includes portions of ten river basins in Oregon and Washington: the Willamette, Hood, and Deschutes River basins in Oregon; and the Lewis, Klickitat, White Salmon, Yakima, Wenatchee, Entiat, and Methow River basins in Washington. A total of 28 bull trout subpopulations occur within these basins in Oregon and Washington.

<u>Lewis River</u>. Two subpopulations of bull trout occur in the Lewis River watershed, both within the North Fork: at Yale Reservoir and at Swift Reservoir. As of 1997, only

migratory (adfluvial) bull trout have been identified (WDFW 1997). The North Fork Lewis River is segregated by three dams (Merwin, Yale, and Swift), which do not allow upstream passage. Limited downstream passage over these dams is assumed to contribute adult bull trout observed in the most downstream reservoir (Merwin). Because no known spawning sites are accessible to bull trout in Merwin Reservoir, the fish are not considered a subpopulation. Bull trout currently occupy 22.1 km (11.9 mi) of the mainstem North Fork Lewis River including identified spawning tributaries (Gifford Pinchot National Forest (GPNF) 1995). Although Platts *et al.* (1995) concluded that insufficient information existed to determine the status and trends of bull trout in Swift and Yale reservoirs, WDFW (1997) considers bull trout to be depressed due to "chronically low abundance.” Spawning ground surveys conducted since 1988 for the Yale Reservoir subpopulation indicate an annual escapement in Cougar Creek of 22 fish (range 7 to 37).

The Swift Reservoir subpopulation spawns in Pine and Rush creeks (WDFW 1997). Radio telemetry studies conducted on bull trout in Swift Reservoir indicate that migrating adults use both Rush and Pine creeks with no evidence of reproductive isolation. Bull trout distribution is limited to the lower 1.6 km (1.0 mi) of Rush Creek due to impassable falls, and the expansion of bull trout range within other tributaries in the upper watershed is thought to be limited by unsuitable temperature regimes (Faler and Bair 1996). From 1994 through 1996, 101, 246, and 282 adult bull trout were estimated to migrate annually into Rush and Pine creeks (GPNF 1995, WDFW 1997). Unlike the Yale Reservoir subpopulation, bull trout in Swift Reservoir have a larger spawning area and connectivity between spawning grounds (Pine and Rush creeks), which would buffer this subpopulation against stochastic events. For example, after the 1980 eruption of Mt. St. Helens when habitat throughout the Pine Creek drainage was severely altered (Faler and Bair 1996), migratory (adfluvial) bull trout from Swift Reservoir subsequently recolonized Pine Creek.

A discussion of bull trout status within the Lewis River can be found in Chapter 20 of the Draft Bull Trout Recovery Plan (Service 2002a).

<u>Willamette River</u>. Historically, bull trout are considered to have been distributed throughout the Willamette River in streams draining the west side of the Cascade Mountain Range. Presently, bull trout occur in the McKenzie River and the Middle Fork of the Willamette River where they were recently introduced.

The McKenzie River population consists of three, isolated subpopulations: (1) lower McKenzie River (McKenzie River and tributaries from the mouth upstream to Trailbridge Dam); (2) McKenzie River (McKenzie River and tributaries above Trailbridge Dam); and (3) South Fork McKenzie River (upstream of Cougar Reservoir in the South Fork McKenzie River). Mature bull trout in the entire McKenzie River system are suspected to number below 300 individuals, and only migratory fish are assumed to be present. Bull trout in the lower McKenzie River subpopulation spawn in two tributaries, Anderson and Olallie creeks, and use the mainstem McKenzie seasonally from Trailbridge Dam downstream to below Leaburg Dam (Buchanan *et al.* 1997). Redd counts within index areas on Anderson Creek were 7 to 30 from 1989 through 1996 and indicated an overall increasing trend (total counts of 30 to 82 from 1994 through 1996).

Bull trout in the McKenzie River subpopulation spawn in the McKenzie River above Trail Bridge Dam and possibly in Sweetwater Creek. Seven redds were observed in 1996 in the McKenzie River. Bull trout distribution extends from Trail Bridge Dam to a natural barrier, Tamolitch Falls (Buchanan *et al.* 1997). The South Fork McKenzie River subpopulation is isolated by Cougar Dam, which does not have passage facilities. Spawning has been documented from a single tributary, the Roaring River (Buchanan *et al.* 1997). Redd counts in the Roaring River are extremely low with only one redd observed in 1994, two in 1995, and zero in 1996 (Buchanan *et al.* 1997).

A discussion of bull trout status within the Willamette River basin can be found in Chapter 5 of the Draft Bull Trout Recovery Plan (Service 2002a).

<u>Hood River</u>. Two subpopulations of the bull trout occur in the Hood River basin within the Middle Fork Hood River drainage: 1) Lawrence Lake (upstream of Clear Branch Dam) and 2) Middle Fork Hood River (downstream of Clear Branch Dam and including tributaries). Historically, bull trout distribution included primarily the mainstem, Middle Fork and tributaries, and a short reach of the West Fork; and bull trout likely used the Columbia River for juvenile rearing and adult foraging (Buchanan *et al.* 1997). Punchbowl Falls is suspected to be a natural barrier to fish migrations in the West Fork Hood River during low flows; only one bull trout has been captured at this location (Pribyl *et al.* 1995, Buchanan *et al.* 1997). Resident and migratory fish are present in both subpopulations, and total numbers of mature fish are believed to be below 300 individuals basin-wide (Buchanan *et al.* 1997).

Snorkel surveys of the Lawrence Lake subpopulation detected 50 to 301 total bull trout annually from 1992 through 1996, including juveniles (Buchanan *et al.* 1997). Although upstream passage is now provided by a trap at Clear Branch Dam, the Service considers this subpopulation isolated until information is available on trap effectiveness. The Service considers the subpopulation at risk of stochastic extirpation due to its inability to be refounded, single life-history form, limited spawning area, and low numbers.

Bull trout in the Middle Fork Hood River subpopulation are believed to spawn in Compass Creek and the Middle Fork Hood River (Buchanan *et al.* 1997). Nineteen fish greater than 200 mm (7.9 in.) in fork length were collected during surveys of Compass Creek in 1995 (Buchanan *et al.* 1997).

A discussion of bull trout status within the Hood River basin can be found in Chapter 6 of the Draft Bull Trout Recovery Plan (Service 2002a).

<u>Klickitat River</u>. One subpopulation of bull trout occurs in the Klickitat River. In 1990, electrofishing surveys in the basin collected a total of 23 bull trout ranging in size from 76 to 25 mm (3 to 10 in.) in length (D. Lind, Yakima Indian Nation, <u>in lit</u>. 1995, WDFW 1997). In 1994, spot daytime snorkel surveys identified the presence of juvenile bull

trout in three Klickitat River tributaries. However, abundance information for bull trout in the surveyed tributaries was not available (D. Lind, Yakima Indian Nation, in lit. 1995). During the 1994 surveys, brook trout were found to be sympatric with bull trout in four stream reaches.

A discussion of bull trout status within the Klickitat River basin can be found in Chapter 20 of the Draft Bull Trout Recovery Plan (Service 2002a).

Deschutes River. Three subpopulations of the bull trout occur in the Deschutes River basin: (1) Odell Lake on the upper Deschutes River basin; (2) Metolius River-Lake Billy Chinook complex; and (3) the lower Deschutes River. Only the Odell Lake and Metolius River subpopulations occur in the NWFP area. Historically bull trout were distributed throughout the Deschutes River basin from the headwaters and headwater lakes to the Columbia River (Newton and Pribyl 1994, Buchanan *et al.* 1997), allowing access to the Columbia River for juvenile rearing and adult foraging. The subpopulations are isolated by Pelton and Round Butte dams on the Deschutes River, Opal Springs Dam on the Crooked River, and a lava flow that isolates Odell Lake. Bull trout are thought to be extirpated in up to seven reaches or tributaries within the Deschutes River basin (Buchanan *et al.* 1997).

The Odell Lake subpopulation is presently limited to Odell Lake, which contains the last extant native lake migratory (adfluvial) bull trout in Oregon (Ratliff and Howell 1992, Buchanan *et al.* 1997). There are no current estimates for the number of bull trout in Odell Lake, although they were considered abundant in the 1940s (T. Fies, ODFW, *in lit.* 1993). Buchanan *et al.* (1997) documented one 460 mm (18.1 in.) female and five juveniles in Trapper Creek in 1995, and 12 bull trout caught and released in 1996. Also in 1996, 23 juvenile bull trout were observed during snorkel surveys in Trapper Creek. A detailed description of the environmental baseline conditions for the Odell Lake area can be found in Chapter 8 of the Draft Bull Trout Recovery Plan (Service 2002a).

The Metolius River-Lake Billy Chinook subpopulation includes migratory bull trout that use the Metolius River and Lake Billy Chinook as seasonal foraging habitat and as a migration corridor (Buchanan *et al.* 1997). Bull trout spawn in Jack, Canyon, Roaring, Candle, and Jefferson creeks and in the Whitewater River. The subpopulation has exhibited a positive trend in spawning numbers, based on numbers of redds observed, from 27 in 1987 to 330 in 1994 (Ratliff *et al.* 1996). Estimated population numbers for adult fish system-wide increased from 818 in 1993 to 1,895 in 1994 (Buchanan *et al.* 1997).

A discussion of bull trout status within the Deschutes River basin can be found in Chapter 7 of the Draft Bull Trout Recovery Plan (Service 2002a).

White Salmon River. One bull trout subpopulation possibly occurs in the White Salmon River. Migration is blocked by Condit Dam, which is located 5.3 km (3.3 mi) upstream from the confluence with the Columbia River. The historic distribution of bull trout in the basin is unknown; and due to few verified observations, the current status of bull trout within the basin is unknown. Only two bull trout have been observed above Condit Dam since 1986 (WDFW 1997). A discussion of bull trout status within the White Salmon River basin can be found in Chapter 20 of the Draft Bull Trout Recovery Plan (Service 2002a).

Yakima River. Bull trout are now isolated in eight subpopulations in the Yakima River basin: (1) Ahtanum Creek; (2) Naches River; (3) Rimrock Lake; (4) Bumping Lake; (5) North Fork Teanaway River; (6) Cle Elum Lake; (7) Kachess Lake; and (8) Keechelus Lake. The subpopulations are isolated by dams (five subpopulations) and other human caused habitat changes (three subpopulations) (E. Anderson, WDFW, *in lit.* 1997, WDFW 1997). Historically, bull trout in the Yakima River basin likely occurred throughout the forested portions of the drainage with a distribution and abundance greater than today (E. Anderson, WDFW, in lit. 1995). Few bull trout now occur in the upper Yakima River (i.e., generally upstream of Ellensburg, Washington). Most are believed to be migrants originating from Keechelus Lake, Kachess Lake, and Cle Elum Lake (WDFW 1997). No identified spawning sites are accessible to fish in the upper Yakima River, so it is unlikely bull trout reproduce in this area (E. Anderson, WDFW, *in lit.* 1995, 1997, E. Anderson, WDFW, pers. comm. 1997, WDFW 1997). Additionally, bull trout were last recorded in 1953 at upper Status Creek, a tributary to the lower Yakima River, and are likely extirpated there (D. Lind, Yakima Indian Nation, *in. lit.* 1997). The Service found no evidence that a subpopulation of bull trout remains in the mainstem Yakima River. In the 1970s, bull trout were present in two Naches River tributaries, Nile and Orr creeks but they are now likely extirpated (S. Hoefer, USFS, *in lit.* 1997). Bull trout are also thought to be extirpated in Cowiche and Oak creeks (WDFW 1997).

The Ahtanum Creek bull trout subpopulation is now seasonally isolated from the Yakima River by irrigation diversion dams and associated dewatering and thermal barriers (E. Anderson, WDFW, in lit. 1997). The subpopulation is composed of resident bull trout. Surveys conducted in the North Fork Ahtanum Creek from 1993 through 1996 found an average of 8.5 redds (range: 5 to 14) (WDFW 1997). Plum Creek Timber Company documented bull trout in the South Fork Ahtanum Creek (J. Kraft, Plum Creek Timber Company, in lit. 1997).

The Naches River subpopulation inhabits several tributaries in the Naches River basin (e.g., Tieton, American, Littles Naches, and Bumping Rivers and Rattlesnake, Dog, Crow, and Kettle Creeks). The subpopulation is composed of resident and migratory (fluvial) fish. Dams and irrigation diversion dams are causing dewatering, direct mortality, and seasonal thermal barriers (E. Anderson, WDFW, in lit. 1997). Although 2 and 4 redds were observed in 1990 and 1994, respectively, in Rattlesnake Creek, 26 were observed in 1995 and 38 in 1996 (WDFW 1997). Twenty-five redds were found in the American River in 1996 (WDFW 1997). Sixty-three redds were observed in two widely separated spawning areas in Rattlesnake and Union creeks during 1996 (E. Anderson, WDFW, in lit. 1997).

The Rimrock Lake subpopulation became isolated by Tieton Dam in 1925 (WDFW 1997). The subpopulation is composed primarily of migratory (adfluvial) fish. Based on redd counts, bull trout have steadily increased since 1984 (E. Anderson, WDFW, in lit. 1995). For two spawning tributaries of Rimrock Lake where surveys were performed, Indian Creek averaged 123 redds (range: 25 to 201 for1988 through 1996).

The Bumping Lake subpopulation became isolated by a dam in 1910 (WDFW 1997). The subpopulation is composed of migratory (adfluvial) fish. Since 1991, redd counts have been variable, ranging from 12 to 101, with an average of 61 (E. Anderson, WDFW, in lit. 1995, 1997). Spawning occurs only in Deep Creek.

The North Fork Teanaway River subpopulation of resident bull trout is seasonally isolated from the Yakima River by irrigation diversions and dewatering (WDFW 1997). Few bull trout have been documented in recent years and their status is considered critically low. During seven years of surveys, some involving multiple techniques, only 28 bull trout and two redds have been observed (WDFW 1997).

The Cle Elum Lake subpopulation became isolated by Cle Elum Dam in 1905 (WDFW 1997). The subpopulation is composed primarily of migratory (adfluvial) fish, with few bull trout in recent harvest records. Researchers have captured or observed about 20 individuals in this subpopulation since 1990 (S. Craig, University of Washington, pers. comm. 1997, WDFW 1997).

The Kachess Lake subpopulation became isolated by Kachess Lake Dam in 1905 (WDFW 1997). Spawning has been confirmed only in Box Canyon Creek. The number of redds observed annually from 1984 through 1996 averaged 4.5 (range: 0 to 11) (E. Anderson, WDFW, in lit. 1995, 1997).

The Keechelus Lake subpopulation is composed of migratory (adfluvial) fish and became isolated by a dam in 1914 (WDFW 1997). Spawning is likely confined to Gold Creek, and redd counts from 1984 through 1996 averaged 14 (range: 2-51) (E. Anderson, WDFW, in lit. 1997, WDFW 1997). Historically, spawning may have occurred in Rocky Run Creek.

In summary, bull trout are believed to have historically occurred throughout the Yakima River basin but fish have been essentially eliminated from the mainstream Yakima River and tributaries such as Nile, Orr, and upper Satus creeks (E. Anderson, WDFW, in lit. 1995, 1997).

A discussion of bull trout status within the Yakima River basin can be found in Chapter 21 of the Draft Bull Trout Recovery Plan (Service 2002a).

Wenatchee River. Three bull trout subpopulations occur within the Wenatchee River basin: (1) Lake Wenatchee; (2) Icicle Creek; and (3) Ingalls Creek. The Chelan County Public Utility District observed 15 bull trout ascending Tumwater Dam with a video recorder in 1995. Although migratory (fluvial) and possibly resident bull trout are present, the Service believes that the majority of bull trout upstream of Tumwater are migratory (adfluvial) and use Lake Wenatchee.

The Lake Wenatchee subpopulation has the highest abundance of fish among the three subpopulations in the Wenatchee River basin (Brown 1992, K. Williams, WDFW, in lit. 1996, A. Murdoch, WDFW, in lit. 1997). The subpopulation is composed of migratory (adfluvial) fish. From anecdotal accounts, the Little Wenatchee River and tributaries to Lake Wenatchee once supported a popular bull trout fishery on adult fish (WDFW 1997). The last recorded bull trout spawning in the Little Wenatchee River basin occurred in 1984 (WDFW 1997). Bull trout are likely extirpated from the Little Wenatchee River (WDFW, in. lit. 1995) and the Napecqua River, a tributary to Lake Wenatchee (WDFW 1997). Four distinct spawning stream reaches remain and this subpopulation (K. MacDonald, FS, in lit. 1996).

The Icicle Creek subpopulation is composed of resident bull trout isolated above the Leavenworth National Fish Hatchery dam. A total of 11 bull trout were observed in surveys in 1994 and 1995 (Ringel 1997). Migratory bull trout are occasionally observed below the dam and are believed to originate from the subpopulation upstream (K. MacDonald, FS, in lit. 1996).

The Ingalls Creek subpopulation is composed primarily of resident. Eight bull trout were observed during snorkel surveys of Ingalls Creek in 1995 (Ringle 1997).

In summary, the Little Wenatchee River and its tributaries may no longer support migratory (adfluvial) bull trout. The mainstem Wenatchee River now supports few (0 to 15, annually) adults that ascend Tumwater Dam (Brown 1992, A. Murdoch, WDFW, in. lit. 1997). Migratory bull trout in Lake Wenatchee are likely stable and at a moderate risk of extinction (Mongillo 1993).

A discussion of bull trout status within the Wenatchee River can be found in Chapter 22 of the Draft Bull Trout Recovery Plan (Service 2002a).

Entiat River. One subpopulation of the bull trout occurs in the Entiat River, isolated from other bull trout by mainstem Columbia River dams. Most spawning is believed to be confined to a 12.3 km (7.7 mi) reach of the Mad River, a tributary of the Entiat River. Redd counts from 1989 through 1996 ranged from 10 to 23 (mean 18) (K. Williams, WDFW, in lit. 1996). Around 1935, bull trout were the second most abundant of five species of “trout” sampled in the Entiat River (U.S. Bureau of Fisheries, in lit. 1934, 1935, 1936).

A discussion of bull trout status within the Entiat River can be found in Chapter 22 of the Draft Bull Trout Recovery Plan (Service 2002a).

Methow River. Four bull trout subpopulations occur in the Methow River basin: (1) Methow River; (2) Lost River; (3) Goat Creek; and (4) upper Early winters (K. Williams, WDFW, in lit. 1996). Bull trout are isolated by a waterfall (Early Winters Creek), subsurface flows (upper Lost River), and a seasonally impassable delta (Goat Creek). Based on high water temperature limitations, recruitment of bull trout likely occurs in no more than five percent of stream habitat within the Methow River basin prior to development beginning in the late 19th century (WDFW 1997). Presently, potential spawning and rearing habitats have been reduced to about 1.4 percent of total stream area, 11.7 hectares (29 acres) within the Methow River basin, an approximate 60 percent loss of spawning and rearing habitats (Mullan *et al.* 1992, WDFW 1997).

The Methow River subpopulation is composed primarily of migratory (fluvial) fish. There appears to be sufficient connectivity to allow bull trout access to spawn in various reaches of seven tributaries (Gold, Wolf, and lower Early Winters Creeks and Twisp, West Fork Methow, lower Lost, and Chewack Rivers) (WDFW 1997). Migratory and resident bull trout are generally in low abundance (K. Williams, WDFW, in lit. 1996, J. Molesworth, Okanagan National Forest, in lit. 1997). The number of redds observed at 21 transects in the seven streams was 0 to 27, with an overall mean of 9.4 per stream (K. Williams, WDFW, in lit. 1996). The Lost River subpopulation is isolated in the upper portion of the watershed, which is considered to be a “stronghold” for bull trout (K. Williams, WDFW, in lit. 1996). The subpopulation is composed primarily of resident bull trout, which in 1993, was estimated at over 1,000 resident and migratory fish (K. Williams, WDFW, in lit. 1996).

The Goat Creek subpopulation consists of low numbers of resident bull trout, which are believed to be genetically distinct (Proebstel *et al.* in press, WDFW 1997). The subpopulation is isolated upstream by a culvert 10.9 km (6.8 mi) from the confluence and a seasonal (July through October) barrier in dry years caused by caused by low flows across an alluvial fan at the confluence with the Methow River.

Upper Early Winters Creek subpopulation is isolated above a waterfall 12.6 km (7.9 mi) from the confluence with the Methow River. The subpopulation is composed of resident bull trout (J. Molesworth, Okanagan National Forest, in lit. 1997). Low numbers of bull trout (2 to 7 fish/100 m^2 (0.2 to 0.7 fish/100 ft^2)) were observed in 1986 and 1989.

A discussion of bull trout status within the Methow River basin can be found in Chapter 22 of the Draft Bull Trout Recovery Plan (Service 2002a).

Coastal-Puget Sound Distinct Population Segment

Puget Sound Management Area. Sixteen bull trout subpopulations occur in the area delineated as the Puget Sound Management Area (PSMA): Chilliwack River-Selesia Creek; Lower Nooksack River; Upper Middle Fork Nooksack River; Canyon Creek; Lower Skagit River; Gorge Reservoir; Diablo Reservoir; Ross Reservoir; Stillaguamish River; Snohomish River-Skykomish River; Chester Morse Reservoir; Sammamish River-Issaquah Creek; Green River; Lower Puyallup; Upper Puyallup River; and Nisqually River (Chan 2003). The Service considered habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, harvest, and introduced non-native species as the greatest threats to the bull trout in the PSMA.

Bull trout are distributed throughout most of the large rivers and associated tributary systems within the PSMA (WDFW 1998). With the probable exception of the Nisqually

River, where only a few observations have been reported in the recent past, bull trout continue to be present in nearly all major watersheds where they likely occurred historically in this management area. Generally, bull trout distribution has contracted and abundance has declined in the southern part of the management area. Bull trout in this management area exhibit anadromous, adfluvial, fluvial, and resident life history patterns. Anadromous bull trout populations have been documented throughout the current distribution within the management area, and it is believed that fluvial forms are present in most populations as well.

Anadromous and fluvial life history forms typically have widely distributed foraging, migration, and overwintering habitat. In freshwater, important forage include loose salmon eggs, salmon fry and smolts, sculpins, whitefish and other small fish. Foraging juvenile and subadult bull trout can migrate throughout a watershed looking for these feeding opportunities. Freshwater foraging habitat may be found anywhere in the watershed downstream of spawning areas (spawning groups) and accessible to anadromous salmonids. Bull trout also use non-natal watersheds to forage, migrate, and potentially overwinter. In marine waters, the principle forage is surf smelt and other small schooling fish (*e.g.*, sandlance, herring). Although foraging bull trout may tend to concentrate in forage fish spawning areas, they can be found throughout accessible estuarine and nearshore habitats. The maintenance of these forage species and marine foraging areas is key to maintaining the anadromous life form.

There are two naturally occurring adfluvial bull trout populations within the management area; one is associated with Chester Morse Lake in the upper Cedar River drainage, and the other is associated with Chilliwack Lake in the upper Chilliwack River drainage. Prior to enhancement of Baker Lake in the Skagit River system, it was unknown to what degree the adfluvial life history was naturally expressed by bull trout in the Baker River watershed. As a result of dam construction, adfluvial populations now exist in Gorge, Diablo, and Ross Lakes in the Upper Skagit River drainage (Chan 2003).

Bull trout and Dolly Varden occur together only within the area of the Coastal Puget Sound DPS and in British Columbia, Canada. Although these two species of native char were previously considered a single species, the bull trout and the Dolly Varden are now formally recognized as two separate species (Bond 1992; Cavender 1978; Robins *et al.* 1980). Currently, genetic analyses can distinguish between the two species (Baxter *et al.* 1997; Crane *et al.* 1994; Leary & Allendorf 1997). In the PSMA, Dolly Varden have been confirmed only in the Upper Skagit and Nooksack watersheds (McPhail 1995; Spruell 2002). Hybridization has been documented between the two species (Baxter *et al.* 1997) indicating they can coexist together, however, current evidence suggest that Dolly Varden tend to be distributed as isolated tributary populations above natural anadromous barriers, while bull trout are distributed below these barriers (Spruell 2002; WDFW 1998). Dolly Varden may also be present in the Lower Skagit watershed, but this has not been confirmed. In all other watersheds within the PSMA, only bull trout have been identified genetically. Based on this information, all native char observed in accessible anadromous reaches are believed to be bull trout (Chan 2003).

There are currently no data to confidently estimate bull trout abundance for the entire watershed. However, a few watersheds have been monitored through redd counts and adult counts at a level where estimates can be made at the spawning group or watershed level. It is important to note that current data on distribution and abundance in the PSMA is limited and has been collected by a variety of methods (Chan 2003). Sources of data include historical reports, incidental bull trout counts obtained during other fish surveys, smolt and adult trap counts, creel survey data, redd count data, and adult counts. It is likely that spawner distribution and abundance is underestimated, and that some spawning and rearing areas have not been located and thus have been omitted.

Chilliwack River-Selesia Creek Watershed

The Chilliwack watershed is delineated around those portions of the Chilliwack River and its, major tributaries (Silesia Creek, Tomyhoi Creek, and Sumas River) contained within the United States. However, a significant portion of the Chilliwack River drainage lies within Canada and is functionally part of this watershed. It is a transboundary system that flows from the United States northwest into British Columbia where it discharges into the lower Fraser River. Those reaches of the Chilliwack River and Silesia Creek (spelled Slesse in Canada) within the United States are contained within North Cascades National Park and the Mount Baker Wilderness, respectively. The short section of the Chilliwack River extending from the United States-Canadian border to, and including, Chilliwack Lake, comprise Chilliwack Lake Provincial Park in British Columbia. Although Chilliwack Lake is now entirely within the Chilliwack Lake Provincial Park, two of its major tributaries, Paleface and Depot Creeks, are extensively outside of the provincial park boundary with the exception of their lower reaches. The headwater reaches of Depot Creek do fall within North Cascades National Park in the United States. Silesia Creek and Tomyhoi Creek (spelled Tamihi in Canada) and one of its tributaries, Damfino Creek, initiate from the Mount Baker Wilderness in the United States, eventually entering the Chilliwack River downstream of Chilliwack Lake. The Chilliwack River flows west, eventually becoming the Vedder River, where it is then joined by the Sumas River (at Vedder Canal) before discharging into the Fraser River.

An extensive survey effort for bull trout has not yet occurred within the upper Chilliwack River system, making it difficult to estimate spawner abundance for this watershed (Glesne 2002). However, limited survey efforts have helped to determine distribution and the identification of current spawning groups. A total of three spawning groups (Upper Chilliwack River, which includes Easy, Brush, and Indian Creeks; Little Chilliwack River; and Selesia Creek) have currently been identified in this watershed, with two additional spawning groups, Paleface Creek and Depot Creek, identified within British Columbia. Accessible habitat occurs upstream as far as the United States-Canada border (Whelen 1996), while topographic maps indicate approximately 3.2 kilometers (2 miles) of additional accessible habitat upstream of this point.

In the upper Chilliwack River, rearing bull trout (juveniles) have been observed in the mainstem Chilliwack River from Chilliwack Lake upstream to approximately Easy Creek (Glesne 2002). Limited spawning has also been documented in the mainstem of

Chilliwack River above Chilliwack Lake, and suitable spawning habitat in the mainstem is believed to span from approximately 3.2 kilometers (2 miles) above Chilliwack Lake upstream to an area just above Easy Creek (Glesne 2002). Accessible habitat on the mainstem Chilliwack River ends approximately 3.2 kilometers (2 miles) upstream from Easy Creek, near the confluence with Copper Creek. Although bull trout have not been observed within Bear Creek and Indian Creek during recent limited survey efforts, habitat in the lower reaches of these streams is clearly accessible and likely provides some spawning and rearing habitat. It is unknown what proportion of the Silesia Creek group spawns within Washington, and since no population surveys have been conducted at this time, no estimates of abundance are currently available for this system (Chan 2003).

Migratory bull trout in this system spend all or part of their subadult and adult lives either in the mainstem of the Chilliwack River, Chilliwack Lake, and Fraser River. If anadromous forms exist in this population, they would also use nearshore waters of the Strait of Georgia. All these areas provide foraging, migration, and overwintering habitat, however, Chilliwack Lake appears to be very important to the majority of spawning groups in this system.

Nooksack Watershed

The Nooksack River is the northern most major river system draining directly to Puget Sound in the contiguous United States. The North and Middle Forks of the Nooksack River are glacially influenced, while the South Fork is fed primarily by snowmelt. Known spawning occurs in all three forks of the Nooksack River and in tributaries to them, while post dispersal rearing and subadult and adult foraging is believed to occur throughout the anadromous reaches. Overwintering likely occurs primarily in the lower mainstem reaches of the three forks and in the Nooksack River. The anadromous life history form is known to be present (Lummi 2003; Maudlin M *et al.* 2002), and resident and fluvial life history forms are also believed to occur within this watershed. Outmigrants have been caught in the lower mainstem from early April through mid-July. The anadromous life history form uses estuarine and nearshore marine areas in and near Bellingham Bay (Ballinger 2000) and likely use areas further north and south of these areas similar to other anadromous populations.

The Nooksack watershed contains populations of both bull trout and Dolly Varden, however, there is currently an incomplete understanding about the level of interaction between the two species and degree of overlap in their distribution. Limited genetic analysis and observational data suggest Dolly Varden in this watershed inhabit stream reaches above anadromous barriers. Similar to the Chilliwack River basin, comprehensive spawn surveys have not been conducted within the Nooksack watershed, although limited survey data were very recently collected by Washington Department of Fish and Wildlife and FS staff in a small number of streams. Data are not yet sufficient to estimate spawner abundances for the watershed, but this and past observational data have helped define current spawning groups. A total of ten spawning groups (Upper North Fork Nooksack River, Glacier Creek, Middle North Fork Nooksack River, Canyon Creek, Lower North Fork Nooksack River, Upper Middle Fork Nooksack River, Lower

Middle Fork Nooksack River, Upper South Fork Nooksack River, Wanlick Creek, and Lower South Fork Nooksack River) have currently been identified in this watershed. While tributaries with spawning and rearing are described, other unsurveyed adjacent and accessible tributaries are probably utilized (Chan 2003).

Lower Skagit Watershed

The Lower Skagit watershed includes the entire Skagit basin downstream of Seattle City Lights Diablo Dam. This encompasses all of the mainstem Skagit River downstream of Diablo Dam (including Gorge Lake), Cascade River, Sauk River, Suiattle River, White Chuck River, and Baker River (including the lake systems above Shannon and Baker Dams). Limited genetic work indicates that the native char within the lower Skagit River drainage are all bull trout while meristic and morphological data have suggested that some may be Dolly Varden (WDFW 1998). Bull trout can be found throughout these waters and their tributaries expressing various life histories and behaviors. In addition to these freshwater areas, many bull trout make extensive use of the lower estuary and near shore marine areas (*e.g.*, Skagit Bay, Port Susan) for extended rearing and subadult and adult foraging. In the lower Skagit watershed, the key spawning and early rearing habitat is found in the upper portion of much of the basin (Chan 2003). Typically this habitat is found between the 305 to 914 meter (1,000 to 3,000 feet) elevation range and often 129 kilometers (80 miles) or more upstream from the mouth of the river. Fortunately, much of this essential spawning and rearing habitat is found on federally protected lands in North Cascade National Park, North Cascade Recreation Area, Glacier Peak Wilderness and the Henry M. Jackson Wilderness Area.

The Lower Skagit watershed supports all four life forms of bull trout: resident, fluvial, adfluvial, and anadromous. Rearing and foraging individuals may be found in nearly all anadromous reaches of the basin as well as several isolated areas above the typical anadromous zone. Bull trout are currently known to spawn and rear in at least 19 streams or stream complexes (*i.e.*, spawning groups). The resident life history form is found in a number of these areas as well as a number of additional small tributaries. These resident life history forms often coexist with migratory life history forms within the same spawning groups (Kraemer 2003b). Adfluvial fish are found only in the Baker Lake spawning group. Historically, the Baker River system likely supported both fluvial and anadromous bull trout. Two hydroelectric dams, Lower and Upper Baker Dams have greatly limited fish movement in the Baker River system (WDFW 1998).

It is thought that the Lower Skagit watershed supports a spawning population of migratory char that numbers in the thousands, likely making it the largest population in Washington (Kraemer 2001). The resident form may be nearly as abundant. It is believed that the diverse and connected habitats found in this watershed have allowed for the continued expression of the diverse life forms and behaviors that would have been typically found in robust coastal bull trout populations. Connectivity among most spawning groups and foraging areas is good to excellent, though some habitat diversity has been lost in the mainstem Skagit River due to channel simplification, culverts, and diking and leveeing of the mainstem and estuary areas. For much of the basin, the migration corridors connecting the spawning and early rearing areas to downstream foraging and overwintering areas remain intact (Chan 2003).

The fluvial population within the Lower Skagit watershed typically forages and overwinters in the larger pools of the upper portion of the mainstem Skagit River and to a lesser degree the Sauk River (Kraemer 2003b; WDFW 1998). Expression of this fluvial life history appears to be highly dependent upon availability of forage. The abundance of pacific salmon (especially pink and chum salmon) appears to be key in supporting this life history form. In the fall of the year, fluvial bull trout gain considerable weight by feeding on the abundance of loose eggs from the large numbers of spawning salmon. In the spring, they forage heavily on the emerging fry and outmigrating smolts. Whitefish, scuplins and other fishes are important forage species for bull trout that are available throughout the year. The sockeye salmon and kokanee population within the Baker Lake complex supplies the forage base for the adfluvial population.

A significant portion of the migratory fish in the basin exhibit an anadromous life history and use the estuarine and nearshore marine areas in Skagit Bay and Port Susan with juvenile fish as small as 135 millimeters (5.3 inches) (Kraemer 1994; Yates 2001). The anadromous fish are typically found in nearshore marine waters from the early spring through the late fall. The maintenance of marine nearshore and estuary habitat is crucial to supporting this life history form. While the anadromous fish are in the river, either as post-spawn adults or over-wintering subadults, they rely on much the same forage base as the fluvial fish (Kraemer 1994).

Upper Skagit Watershed

The Upper Skagit watershed includes the Skagit basin upstream of Diablo Dam, including Diablo Lake, Ross Lake, and functionally includes the upper Skagit River within British Columbia, Canada. Much of the bull trout habitat in the upper Skagit River watershed is undisturbed, since a large portion of this watershed is located within North Cascades National Park, Pasayten Wilderness, and Skagit Valley Provincial Park. The Upper Skagit watershed supports populations of both bull trout and Dolly Varden (McPhail 1995). Adfluvial, fluvial, and resident life history forms of bull trout are present in the upper Skagit drainage. Adfluvial bull trout are present in Ross Lake, while fluvial forms of bull trout are found in the upper Skagit River within British Columbia. Fluvial forms may also be present in Ruby Creek, a large tributary to Ross Lake. Resident bull trout are also found in several British Columbia tributaries to the upper Skagit River including Nepopekum and Snass Creeks, and the Klesilkwa, Sumallo, and Skaist Rivers. Dolly Varden have been found in headwater tributaries of the Skagit River in British Columbia including Nepopekum Creek (McPhail 1995), and are likely present in tributaries of the Skagit in the United States as well. Populations of Dolly Varden in the upper Skagit River drainage appear to be spatially segregated from bull trout, with Dolly Varden typically found above those areas possessing resident and fluvial bull trout (Chan 2003).

The population status of bull trout and Dolly Varden in the upper Skagit River drainage is currently unknown. Bull trout are known to spawn and rear in at least eight streams (*i.e.*, spawning groups) in the United States; these are Ruby Creek (including Canyon and Granite Creeks), Panther, Lightning, Big Beaver, Little Beaver, Silver, Pierce, and Thunder Creeks (Connor 2003a; WDFW 1998). Recent spawning surveys indicate the majority of bull trout in the Upper Skagit River watershed spawn in the mainstem Skagit River and in a number of its tributaries within British Columbia. Bull trout spawn and rear in at least seven streams in the Skagit River drainage north of the United States-Canada border, including the mainstem Skagit, upper (East Fork) Skagit, Klesilkwa, Skaist, Sumallo Rivers and, Nepopekum Creek and Snass Creek (McPhail 1995). However, no spawning index areas have been established in this drainage within either Washington or British Columbia, so only rough estimates of abundance are available for a few spawning groups. Adfluvial bull trout have been observed staging and migrating into many of these tributaries of Ross Lake to spawn, including Ruby Creek, Lightning Creek, Big Beaver Creek, Little Beaver Creek, and Silver Creek. The largest runs of adfluvial fish south of the United States-Canada border are in Lightning Creek and Ruby Creek (Connor 2003b; Hopkins 2002). Up to several dozen fish at a time can be observed staging at the mouths of these tributaries from mid-September through mid-November. Relatively large numbers of adfluvial bull trout (> 100) can be observed holding in the upper Skagit River just north of the border by the end of September.

Stillaguamish Watershed

The Stillaguamish watershed comprises the Stillaguamish River basin, including both the North and South Forks. Major tributaries to the North Fork include the Boulder River, Deer Creek and its tributary Higgins Creek. Canyon Creek constitutes the only major tributary to the South Fork, which also receives water from several minor tributaries including Palmer, Perry, and Beaver Creeks. Spawning habitat is believed to be somewhat limited, where in most cases only the extreme upper reaches of these waters appear to provide adequate spawning conditions. This is believed to have been the case historically due to the lack of accessible high elevation stream habitat and instability of soils found in the basin, but has been further reduced from the effects of land management activities. In some cases, access to these reaches is blocked by natural barriers. Rearing and foraging habitat does exist downstream of these areas. This watershed is believed to support primarily anadromous and fluvial life history forms. No exclusively resident populations have been identified in this watershed, but the South Fork population does have a strong resident component, which coexists with migratory forms (Chan 2003).

The paucity and spatial isolation of available spawning habitat suggest that only four spawning groups likely exist in the Stillaguamish watershed. Upper Deer Creek (including Higgins Creek); the North Fork Stillaguamish River (including a major tributary, the Boulder River, and potentially Squire Creek); the South Fork Stillaguamish River (including its upper minor tributaries); and Canyon Creek (major tributary to the South Fork Stillaguamish River), comprise the four assumed distinct spawning groups for this watershed. These spawning groups are somewhat isolated from one another, therefore maintaining connectivity between each of these within the watershed will be critical.

Primary foraging, migration, and overwintering areas in this river basin include the mainstem areas of the North and South Forks, and the Stillaguamish River to the estuary. Like anadromous populations in the Lower Skagit and Snohomish-Skykomish watersheds, anadromous forms in the Stillaguamish watershed are believed to use nearshore marine areas in Skagit Bay, Port Susan, and Possession Sound (Chan 2003).

Snohomish-Skykomish Watershed

The Snohomish-Skykomish watershed includes the Snohomish, Skykomish and Snoqualmie Rivers and all their tributaries. Bull trout can be found throughout these waters, generally downstream of anadromous barriers. They are not known to be present above Snoqulmie Falls, above Spada Lake on the Sultan River, above the upper forks of the Tolt River, above Deer Falls on the North Fork Skykomish River, or above Alpine Falls on the Tye River (Kraemer 1999). Fluvial, resident and anadromous life histories are all found within the basin. There are no lake systems within the basin that support typical adfluvial populations, however, anadromous and fluvial forms occasionally forage in a number of lowland lakes having connectivity to the mainstem rivers. A large portion of the migratory segment of these populations is anadromous, and these forms make extensive use of the lower estuary and nearshore marine areas for extended rearing.

Rearing char can be found throughout the anadromous portions of the Snohomish, Skykomish, North Skykomish and South Fork Skykomish with occasional use in the other portions of the anadromous reaches of the basin. A population containing only resident forms is found in Troublesome Creek on the North Fork Skykomish River. This resident population is above an upstream migration barrier at river mile 0.5. Infrequent access to Troublesome Creek above the barrier by summer steelhead has been documented at least once in the last 15 years (Kraemer 2003a). It is possible that migratory bull trout may occasionally migrate to the upper basin under the same conditions that allow steelhead access above this barrier. The known spawning and early rearing areas of the Skykomish River basin are all found at an elevation of 305 to 457 meters (1000 to 1500 feet). Because of the topography of the basin, the amount of key spawning and early rearing habitat available is more limited than in some basins. Spawning and early rearing of the char is found in the upper North Fork Skykomish River drainage. The major areas of production include the North Fork Skykomish River between Bear Creek Falls and Deer Falls, Goblin Creek, Troublesome Creek, and Salmon Creek. In addition, in the last several decades a migratory bull trout population has become established in the East Fork Foss the Beckler River on the South Fork Skykomish River.

The mainstem corridors on the Snohomish, North Fork Skykomish, South Fork Skykomish, and Snoqualmie Rivers, and many of their accessible tributaries provide important foraging, migration, and overwintering habitat for subadult and adult bull trout in this system. The anadromous component of this core population appears to be much more abundant than the fluvial component. Fluvial fish are generally confined to a few large pools found in the middle portion of the mainstem Skykomish River. In contrast, anadromous bull trout can be found throughout the anadromous reaches of the Snohomish-Skykomish River system. Juvenile and subadult life stages forage throughout the mainstream, but occasionally may be found using tributary streams. Subadults typically overwinter in the mainstem reaches of the Snohomish River. Recent tagging information indicates that subadults observed in the mainstem reaches may include fish from populations outside of the Snohomish watershed (Goetz 2002). The anadromous subadult and adult life stages spend much of the growing season (late winter to fall) in the estuary and nearshore marine waters of Possession Sound and Port Susan.

Chester Morse Watershed

The Chester Morse Lake watershed is located within the Cedar River Municipal Watershed in the upper reaches of the Cedar River drainage, upstream of a natural migration barrier at Lower Cedar Falls (river mile 34.4). The municipal watershed serves as the major source of water for the City of Seattle and surrounding communities, and has had restricted public access since 1908 to maintain high water quality. The Chester Morse Lake watershed has a drainage area of 214 square kilometers (83 square miles). The Cedar River watershed upstream of the Masonry Dam supports the only known self-sustaining population of bull trout in the Lake Washington basin. Identification of char in this watershed to date has been based on morphometric and meristic measurements that strongly indicate that they are bull trout (Seattle 2000).

The presence of bull trout in the Chester Morse Lake watershed has been documented in Chester Morse Lake and Masonry Pool, and in some tributaries to Chester Morse Lake, including the Cedar and Rex Rivers (Seattle 2000). Within the Chester Morse Lake watershed, in addition to Chester Morse Lake and the Masonry Pool, the presence of bull trout has been confirmed in a total of 36.6 kilometers (22.7 miles) of streams.

The level of emigration of bull trout occurring from Chester Morse Lake to the lower Cedar River is unknown. The only means for bull trout to leave the reservoir complex and pass to the lower Cedar River is during use of the emergency spill gates and/or the smaller spillway near the south end of the Masonry Dam. It is possible, however, and in fact probable, that bull trout do successfully pass through the spill gates when water is released and thereby gain access to the canyon reach and the lower Cedar River, but no accurate estimate of numbers of fish passing the dam can be determined.

The only sexually mature bull trout that have been observed to date in the Cedar and Rex rivers are spawning adults that have migrated upstream from Chester Morse Lake. Consequently, spawning groups of bull trout in this watershed appear to be primarily, if not completely, composed of adfluvial life history forms. There remains, however, the possibility that resident and/or fluvial life history forms may be present in some upper reaches of the North and/or South Fork of the Cedar River downstream of natural passage barriers (Chan 2003).

Based upon the spatial distribution of spawners observed in the Chester Morse Lake watershed in the Cedar River Municipal Watershed, the Cedar and Rex Rivers have been currently identified as the primary spawning groups for this watershed (Chan 2003). Small spawning groups are presumed to be present in Boulder Creek, a major tributary to the Rex River, and Rack Creek and possibly Shotgun Creek based upon the relatively limited amount of spawning and rearing activity observed in these lake tributaries, and their degree of spatial separation from other spawning groups.

This watershed appears to have one of the most extended spawning periods within the PSMA, and potentially within the entire range of the species. The spawning period of bull trout in the upper Cedar River watershed extends from mid-September through December, with some fish observed spawning as late as mid-January (Paige 2003). Spawning is typically observed from mid-October through mid-November, but peaked the first week of November in 2001 and 2002 (Paige 2003). Spawning typically commences following the first major storms in the fall, and appears to be initiated by rapidly declining water temperatures and significant increases in streamflow.

Chester Morse Lake and Masonry Pool provide the foraging, migration, and over-wintering habitat within the Chester Morse Lake watershed for subadult and adult adfluvial bull trout in the Chester Morse Lake watershed. Reservoir levels vary both between and within seasons, although the most substantial differences are exhibited between major seasons (*e.g.*, spring refill and fall drawdown). Seasonally fluctuating reservoir levels alter the surface area of the lake, exposing or inundating varying degrees of the littoral zone, especially in low gradient delta areas. Therefore, the type and relative amount of habitat available to bull trout changes constantly and the type and availability of food resources varies accordingly and is dependant upon the integrated effects of all prevailing environmental conditions. Bull trout in Chester Morse Lake and Masonry Pool forage on a wide variety of food items, including invertebrates, salamanders, sculpin, juvenile rainbow trout, and pygmy whitefish. The most important food item to the largest bull trout in this lake system is pygmy whitefish. Chester Morse Lake possesses the largest population of pygmy whitefish in western Washington (Seattle 2000).

Puyallup Watershed

The Puyallup watershed contains the southern most population of bull trout in the PSMA. This watershed is critical to maintaining the overall distribution of migratory bull trout, since it is the only anadromous bull trout population in south Puget Sound. The Puyallup watershed consists of several major watersheds draining the north and west sides of Mount Rainier. This glacial source significantly influences both water and substrate conditions in the mainstem reaches of this drainage. The watershed includes the Puyallup River, the Mowich River, Carbon River and their tributaries, and the White River including the Clearwater River, Greenwater River, West Fork White River, and Huckleberry Creek. Both anadromous and fluvial/resident bull trout spawning groups have been identified in the White River and Puyallup River systems, which converge in the lower basin at river mile 10.4 of the Puyallup River. Limited information is available regarding the distribution and abundance of bull trout in this watershed. Observations of bull trout have generally been incidental to other fish survey work. Glacial turbidity creates limited opportunities and sites to survey for bull trout in this system. Based on limited information, six spawning groups have currently been identified for this watershed. These are the upper Puyallup and Mowich Rivers, Carbon River, upper White River, West Fork White River, Greenwater River, and Clearwater River.

Spawning occurs in the upper reaches of this basin where higher elevations produce the cool temperatures required by bull trout. Based on current survey data, bull trout spawning in the Puyallup watershed appears to occur earlier (September) than what has typically been observed within other Puget Sound watersheds (Marks 2002). Rearing is believed to occur throughout the rivers listed above; however, sampling indicates that a majority of the rearing is confined to the upper reaches of the basin. The Puyallup Tribal fisheries in the lower Puyallup River and the U.S. Army Corps of Engineer's Buckley trap commonly intercept large migratory bull trout indicating that an anadromous life history is present in this system (Hunter 2000). Primary foraging, migration, and overwintering habitat for migratory bull trout within the watershed is believed to be the mainstem reaches of the White, Carbon, and Puyallup Rivers. The anadromous life history form also uses Commencement Bay and likely other marine nearshore habitats along Puget Sound (Chan 2003).

Many of the headwater reaches of the basin are within either Mount Rainier National Park or designated wilderness areas (Clearwater Wilderness, Norse Peak Wilderness) providing pristine habitat conditions. However, a majority of the basin has been significantly altered via a variety of anthropogenic factors including extensive timber harvest and associated road construction; conversion of landscape to residential, commercial, and agricultural use; substantial channelization of lower mainstem reaches; and total commercial development of the estuarine habitat. Non-native species (i.e., Brook Trout) are believed to be an adverse influence on bull trout numbers in the Puyallup, Nooksack, and Upper Skagit Systems. These factors have undoubtedly reduced the overall productivity of bull trout and salmon populations in the basin (Chan 2003).

<u>Olympic Peninsula Management Area.</u> Eighteen bull trout subpopulations occur in nine river basins within the Olympic Peninsula Management Area (OPMA). Due to the lack of sufficient genetic analysis for most subpopulations, bull trout and Dolly Varden were not identified as distinct subpopulations at the time of listing. The term "native char" described populations that could include both Dolly Varden and bull trout. Ten native char subpopulations were identified for the coastal analysis area as occurring in five river basins (number of subpopulations): Chehalis River-Grays Harbor (1), Coastal Plains-Quinault River (5), Queets River (1), Hoh River-Goodman Creek (2), and Quillayute River (1). Although little historical and current information about bull trout in these river basins was known at the time of listing, habitat degradation in the past has adversely affected other salmonids (Spalding 2003).

For the Strait of Juan de Fuca analysis area five native char subpopulations were identified as occurring in three river basins (number of subpopulations): Elwha River (2), Angeles Basin (1), and Dungeness River (2). Two subpopulations in the Dungeness occurred primarily in the Olympic National Park and Buckhorn Wilderness. In both the Elwha and Dungeness Rivers non-native brook trout have been planted in streams within the park. Much of the Dungeness River basin outside the Olympic National Park has been degraded by past forestry and agricultural practices. The two Elwha River subpopulations have been isolated by dams. The lower Elwha subpopulation was considered depressed because less than 500 spawners likely occur. Although native char were thought to be widely distributed in some basins within the analysis area, such as the Dungeness and Gray Wolf Rivers, fish abundance was thought to be generally reduced in number (Mongillo 1993). The lower Dungeness-Gray Wolf subpopulation was considered depressed because abundance had declined.

For the Hood Canal analysis area three native char subpopulations were identified as occurring in the Skokomish River. Surveys in the South Fork Skokomish River and tributaries indicated low numbers of bull trout and the subpopulation was considered depressed. Past forest and agricultural practices and hydropower development were considered to have severely degraded the South Fork-lower North Fork subpopulation. In the North Fork Skokomish River, bull trout are isolated above Cushman Reservoir restricting the Cushman subpopulation to an adfluvial life form (Spalding 2003).

Bull trout are distributed throughout most of the large rivers and associated tributary systems within the OPMA (WDFW 1998). Bull trout in this watershed exhibit anadromous, adfluvial, fluvial, and possibly resident life history patterns. There are two naturally occurring adfluvial bull trout populations within the watershed; one is associated with Lake Cushman in the upper North Fork Skokomish drainage, and the other is associated with Lake Quinault in the Quinault River drainage.

Watersheds supporting anadromous and fluvial life history forms typically have widely distributed foraging, migration, and overwintering habitat. In freshwater, important forage include loose macro-invertebrates, salmon eggs, salmon fry and smolts, sculpins, whitefish and other small fish. Macro-invertebrates are a major food item for bull trout fry before they shift to a piscivorous diet. Larger juvenile and subadult bull trout can migrate throughout a watershed looking for feeding opportunities. Freshwater foraging habitat may be found anywhere within the watershed that is accessible to anadromous salmonids. Subadult and adult bull trout forage in marine waters as well as in freshwater. In marine waters, the principle forage includes surf smelt and other small schooling fish (*e.g.*, sandlance, herring). Although foraging bull trout may tend to concentrate in forage fish spawning areas, they can be found throughout accessible estuarine and nearshore habitats. The maintenance of these forage species and marine foraging areas is key to maintaining the anadromous life form (Spalding 2003).

The Olympic National Park forms a hub of pristine habitat for bull trout in this watershed. However, the Olympic Peninsula probably presents a more significant challenge for assessing the abundance of bull trout than other areas throughout its range due to the high number of turbid, glacial rivers, high rain fall and resulting high flows, and access problems due to steep terrain combined with the extensive roadless wilderness areas. While the Olympic National Park provides great benefits to all fish by protecting large watersheds, it also hinders access needed to conduct monitoring, especially of spawning trends and population abundance.

There are no data to confidently estimate current bull trout abundance for the watershed (Spalding 2003). It is important to note that current data on distribution and abundance in the OPMA is limited and has been collected by a variety of methods. Sources of data include historical reports, incidental bull trout counts obtained during other fish surveys, smolt and adult trap counts, creel survey data, redd count data, personal observations by biologists, and adult counts. Spawner distribution and number of spawning group are likely underestimated. Many spawning and rearing areas have not been located and thus have likely been omitted. Washington Department of Ecology analyzed all spawning data for bull trout west of the Cascades to determine elevation above which spawning would most likely occur (WDOE 2002). All spawning sites except one occurred above 150 meters (500 feet) in elevation.

Coastal rivers, estuaries, and nearshore marine waters provide a necessary contribution to the forage base and connectivity of anadromous bull trout. These waters have been designated as foraging, migration and overwintering habitat (Spalding 2003).

Skokomish River Watershed

The Skokomish River watershed is believed to be at high risk of genetic inbreeding depression, and potential extirpation base on low numbers of fish and fragmentation. Historic accounts indicate the presence of bull trout in the original Lake Cushman prior to its impoundment (Harza 1990). Although specific data is lacking on whether bull trout were able to ascend the series of cascades (known as Little and Big Falls) prior to the construction of Cushman Dams 1 and 2, historical records indicate that chinook salmon and steelhead migrated upstream past the two dams to reach their spawning habitat (Mayhall 1926; Pollock 1929; Stetson 1925). Since the falls downstream of the Cushman Dams are described as being a series of cascades, it is likely that bull trout were also able to pass these turbulent areas.

The North Fork Skokomish River includes bull trout that inhabit Lake Cushman (a reservoir) in Olympic National Forest and the river upstream from the reservoir in Olympic National Park. A series of cascades above Lake Cushman (termed Staircase Rapids) may prevent upstream passage of some fish species. Washington Department of Fish and Wildlife (WDFW 1998) maintains that Staircase Rapids is a barrier to upstream migration of bull trout. However, Olympic National Park biologists observed adult bull trout estimated up to 63.5 centimeters (25 inches) length upstream of Staircase Rapids. Olympic National Park believes the origin of these large fish to be from Lake Cushman (Spalding 2003).

Available spawning in the North Fork Skokomish River above Lake Cushman appears to be limited. Spawning has been observed from river kilometer 45.2 (river mile 28) to a point upstream near the confluence of Four Stream (Brenkman 1998), although most spawning occurs downstream from Staircase Rapids. Adult adfluvial bull trout typically enter the North Fork Skokomish River in October although some fish enter as early as May. Increased river discharge and decreased water temperature appear to influence timing of migration (Brenkman *et al.* 2001).

Observations of young-of-the-year and juvenile bull trout are limited despite extensive day snorkel surveys throughout 5.6 kilometers (3.5 miles) of river (Brenkman 1998). Low numbers of young-of-the-year and juvenile bull trout were found in the river and Elk and Slate Creeks during the summer months. The lower portion of Slate Creek often goes dry during summer months. Elk and Slate Creeks likely do not support multiple year classes of juvenile bull trout on an annual basis, based on extreme low or no flow conditions during summer months (Spalding 2003).

The South Fork Skokomish River is a fourth order stream (Strahler 1957) originating 44 kilometer (27 miles) above the mainstem Skokomish River and approximately 1,005 meters (3297 feet) above sea level within Olympic National Park. A series of 5 to 10 meter (15 to 30 feet) waterfalls at river kilometer 38 (river mile 24) prevents upstream migration of bull trout in the South Fork. The two major tributaries of the South Fork are Vance Creek, which contains seven kilometers (4 miles) of anadromous accessible stream, and Brown Creek, which contains nine kilometers (6 miles) of anadromous accessible stream. Anadromous habitat in the remaining tributaries is relatively short, ranging from 0.4 kilometers (0.2 miles) to 2 kilometers (1 mile). The area above river mile 19 has remained relatively pristine. The reach between river mile 19 and the anadromous barrier (river mile 24) contains the majority of juvenile and subadult (< 400 mm; <16 inches) bull trout within the system (Ogg 2002).

The South Fork Skokomish River includes bull trout in the river up to a natural barrier at river mile 23.48. Total number of bull trout in the South Fork Skokomish River spawning group complex is estimated to be less than 50 fish. Adfluvial, fluvial and possibly anadromous and resident bull trout inhabit this watershed. Although bull trout occur throughout the mainstem South Fork and in a majority of tributaries, the highest densities are found above river mile 18.3. Juvenile bull trout have been observed as low as river mile 0.2 in the South Fork Skokomish River and in every tributary above that. Low numbers of multiple age classes of bull trout have been observed in the anadromous reaches of Brown, LeBar, and Pine Creeks. Higher numbers have been detected in Church Creek (USFS 2003).

Quinault Watershed

It is likely that the basin supports all life history types of bull trout including adfluvial, fluvial, anadromous, and, potentially, resident forms. Bull trout and Dolly Varden are sympatric within the watershed. Some separation in local is due to bull trout utilization of the larger river reaches whereas Dolly Varden are found more in the upper tributary reaches. The North Fork Quinault River and associated tributaries were identified as a spawning group and the upper mainstem Quinault River (East Fork) and associated tributaries were identified as a separate spawning group (Spalding 2003). Both spawning groups are above 150 meters (500 feet) elevation and therefore within elevations where bull trout spawning is most likely to occur (WDOE 2002). More than two spawning groups likely exist although data are insufficient to define additional spawning groups at this time. The status of Quinault River bull trout and actual spawning sites are unknown.

In the North Fork Quinault River spawning group, multiple age classes of native char occur upstream to at least river kilometer 16 (RM 10) (ONP 2001). In the upper mainstem Quinault River (East Fork) spawning group multiple age classes of native char have been found above and below a potential anadromous barrier located just upstream of the confluence of Graves Creek, and up to river mile 66 (ONP 2001; WDFW 1998).

Although both bull trout and Dolly Varden may occur in Lake Quinault, the extent and distribution of native char is unknown for most of the tributaries that drain directly into the lake. Below the lake bull trout have been identified in Cook Creek (Zajac 2002). Bull trout presence and distribution in lower river tributaries is unknown largely due to lack of survey effort, but the migratory life forms likely occur in the mainstem and anadromous reaches of the tributaries.

Queets River Watershed

At the time of listing bull trout in the Coastal-Puget Sound DPS, the Service determined that the status for bull trout in the Queets River subpopulations was unknown due to lack of monitoring data that could be rigorously compared. The Quinault Indian Nation has a long-term data set of bull trout captured during night seining surveys, however, data collected since 1991 have not been analyzed. Several anglers interviewed by Washington Department of Wildlife in 1992 stated that native char abundance in 1992 appeared much lower than in the 10 years prior (WDW 1992). To date, there have been no studies designed to determine trends or abundance of bull trout in the Queets Basin. In their most recent bull trout status review, Washington Department of Fish and Wildlife (WDFW 1998) considered the status of Queets River bull trout to be healthy. Spawning has been documented at RM 44.5 to 47.8 in the Queets. Bull trout also occur within Matheney Cr., Clearwater, Sams, and Salmon Rivers.

In the Queets River, bull trout have been caught in the anadromous zone. Migration to marine waters by Queets River bull trout was verified in 2000 using otolith strontium from fish that had also been genetically identified as bull trout (Leary & Allendorf 1997; Volk 2000). In addition, the otolith core strontium/calcium values for the Queets River bull trout in the Volk study suggest that the fish were spawned by anadromous females (Spalding 2003).

Hoh River Watershed

There is no information related to trends or abundance of Hoh River bull trout and the status of Hoh River bull trout is unknown. Bull trout were historically an important food source for early settlers on the Hoh (Powell 1999). Mongillo (Mongillo 1993) described the Hoh as historically containing the largest population of bull trout on the Washington coast, although interviews with anglers and Washington Department of Fish and Wildlife employees suggested that bull trout numbers declined in the period from 1982 to 1992, when the interviews were completed. Bull trout have been found throughout the main stem Hoh River (RM 3 to 48) and South Fork Hoh River (RM 0.2 to 14)(Brenkman 1999).

In 1998, bull trout were documented spawning in the upper Hoh River basin from October 19 to November 18, although it is likely that additional spawning areas were not located (Brenkman 1999). No bull trout spawning was observed in the lower portions of numerous tributaries to the Hoh River during weekly walking surveys from October to December 1998. In 1998, a total of 34 redds were observed from river mile 43 to 48 in the Hoh River, from river mile 10 to 14 in the South Fork Hoh River, in lower “OGS” Creek, and in lower Cougar Creek (Brenkman 1999). The presence of co-occurring fall spawning bull trout, coho salmon and chinook salmon make it difficult to distinguish which species actually constructed an identified redd. Redds are only identified as bull trout redds if they are occupied by bull trout at the time of the survey. In 1998, no bull trout spawning was observed in the lower portions of Canyon, Jackson, Mount Tom, Snider, Taft, Tower, Twin, and Willoughby Creeks despite weekly surveys from October 13 to December 2, 1998 (Brenkman 1999). Historically, bull trout were documented in Owl, Nolan, and Winfield Creeks.

In the South Fork Hoh River the Olympic National Park has conducted annual “all species” snorkel surveys since 1991 (Spalding 2003). The surveys are conducted in the fall although the exact time and extent of the surveys have varied from year to year, making comparison of year to year data difficult. However, in 2002, from river mile 13 to the mouth, 236 bull trout over 30 centimeters (12 inches) were observed. This is the highest number counted to date (Brenkman 2003b). Using data provided in a summary of the all species found during snorkel surveys, a range of bull trout densities for the survey area can be made. Densities range from a low of one fish per mile in 2001 to a high of 18 fish per mile in 2002.

Elwha River Watershed

The Elwha River watershed includes the entire mainstem river, all tributaries, Lake Mills, Lake Aldwell, and the estuary of the river. There is no information on the extent of life history forms present in the basin although it is likely that anadromous, fluvial, adfluvial, and resident morphs exist. Bull trout have been caught in Lake Mills, Lake Aldwell, in the river between the reservoirs, below Elwha Dam, and in the river up to river mile 44 (Brenkman 2001). Genetic analysis of fin clips confirms that native char in the Elwha are bull trout (n=58) (Young 2001).

The two Elwha River dams and their associated reservoirs have been identified as the causal mechanism for elevated stream temperatures in both the middle and lower rivers. In the lower river the elevated temperature regime is likely contributing to increased disease and mortality episodes for salmonids (McHenry 2002a), and one to two bull trout mortalities have been observed annually in this section (McHenry 2002b). Bull trout tend to occur in moderately low numbers between the two dams; however juvenile and adult bull trout have been captured in the middle Elwha (Chan 2001; Hiss & Wunderlich 1994).

In the upper Elwha River, above Glines Canyon Dam, multiple age classes of bull trout have been observed throughout the basin, including in Boulder, Cat, Prescott, Stony, Hayes, Godkin, Buckinghorse, and Delabarre Creeks (Brenkman 2001; Reisenbichler 1999). This entire spawning group is above 150 meters (500 feet) elevation and therefore within elevations where bull trout spawning is most likely to occur (WDOE 2002). Although spawning has not been detected in the Elwha River watershed, there has been little survey effort, access to most of the watershed is very difficult, and multiple age classes of bull trout have been observed above the Glines Canyon dam. It is likely that more than one spawning group exists in the Elwha River watershed, and future surveys may indicate departures from this current single spawning group. There is no information related to trends or abundance of Elwha River bull trout and the status of Elwha River bull trout is unknown (Spalding 2003).

Bull trout have been observed each year in the lower Elwha River and the Washington Department of Fish and Wildlife chinook rearing channel (WDFW 1998). It is unknown whether these bull trout in the Elwha River below Elwha dam migrated from other watersheds *(i.e.* the Dungeness), are from parents that spawned in this lower river, or originated from the more suitable, pristine habitat within the Olympic National Park, above the two dams.

The Elwha River Ecosystem and Fisheries Restoration Act of 1992 (P.L. 102-495) authorizes the removal of the Elwha and Glines Canyon Dams in order to fully restore the Elwha River ecosystem and native anadromous fisheries. With dam removal and fisheries restoration, connectivity for the upper, middle and lower sections of the Elwha River should also be restored, and the watershed will no longer be fragmented by artificial barriers. The Elwha River below Glines Canyon dam will likely provide important foraging, migration and overwintering habitat for bull trout in the Elwha watershed (Spalding 2003).

Dungeness River Watershed

Bull trout have been observed in the Gray Wolf River up to river mile 5.1 and throughout the Dungeness River up to an impassable barrier at river mile 24 (Peters 1997). Resident Dolly Varden (n=50) have been identified using genetic analysis in the Upper Dungeness River above river mile 24 (Young 2001) and bull trout (n=25) have been identified in the Dungeness River below the barrier at river mile 24 (Spruell 2002). It is unknown if native char are present above the anadromous blocks in the Gray Wolf River at the confluence with Cameron and Grand Creeks.

The watershed includes spawning, rearing, foraging, migration and over wintering habitat. Multiple age classes of char have been observed in the Dungeness mainstem and it is likely that the watershed supports fluvial and anadromous forms of bull trout (Chan 2001; Peters 1997). Population abundance has not been monitored in the mainstem and few surveys have been conducted in the tributaries (Spalding 2003).

The Dungeness River above the confluence with and including Canyon Creek, and associated tributaries including Silver and Canyon Creeks, has been identified as a spawning group. Although spawning has not been detected in this spawning group, there has been little survey effort, multiple age classes have been documented (Chan 2001; Peters 1997), and there is suitable spawning and rearing habitat within the mainstem and tributaries to support a spawning group.

Bull trout redds were recently documented in the Gray Wolf River between river mile 2 and 4 (Cooper 2002). The Gray Wolf River has also been identified as a spawning group based on the documentation of redds and the availability of suitable habitat (Spalding 2003). Both spawning groups are above 150 meters (500 feet) elevation and therefore within elevations where bull trout spawning is most likely to occur on the westside of the Cascades in Washington (WDOE 2002).

Pacific Ocean and Coastal Streams Foraging, Migration and Overwintering Habitat

The Coastal-Puget Sound DPS is unique across the range of the bull trout within the coterminous United States due to the presence of the anadromous life history morph. These anadromous bull trout are able to move into saltwater as well as freshwater rivers and lakes to take advantage of productive foraging opportunities.

Not all coastal rivers are occupied by the bull trout and others may be occupied only seasonally. However, it is likely that many of these rivers provide a necessary contribution to the forage base for bull trout occupying these rivers or adjacent nearshore marine waters, estuaries and rivers. It is currently unclear to what degree this foraging behavior actually influences population structuring within the Olympic Peninsula (Spalding 2003).

The Pacific Ocean forms the western boundary of the OPMA. Bull trout have recently been documented in the coastal drainages of Cedar Creek, Kalaloch Creek, Goodman Creek, Steamboat Creek, Raft River, Moclips River, Copalis River, and Joe Creek (Brenkman 2003a; Freymond 2001, 2003; Mongillo 1993; Potter 2000; WDFW 1998). Based on current or historic habitat conditions, and the experience and professional judgment, rivers and streams outside of the Queets, Hoh, and Quinault systems, with documented use by bull trout located between Goodman Creek and Greys Harbor are not believed to support spawning populations, but are believed to provide important foraging and overwintering opportunities for bull trout (OPRUT 2002).

Lower Chehalis River/Grays Harbor Foraging, Migration and Overwintering Habitat

The Chehalis River system is a large basin, which drains portions of the Olympics, the Cascades, the Black Hills, and the Willapa Hills before entering the Pacific Ocean. It forms much of the southern boundary of the OPMA (Spalding 2003). The drainage is almost entirely on State, Forest Service, or private lands. The mouth of the Chehalis River is located at Greys Harbor. Bull trout are believed to be either historically or currently distributed in tributaries west of and including the Satsop River in the Chehalis system (Mongillo 1993). Historically bull trout have been caught by steelhead anglers along the lower Wynoochee (Deschamps 1997), and in the West Fork Satsop River and Canyon River (J. Webster, *in litt.* 2001). Bull trout have also recently been caught in smaller systems that enter into Grays Harbor, such as Wishkah and Humptulips rivers (Dachtler 2001; Ereth 2002; WDFW 1998). Bull trout had been reported in Greys Harbor surveys from 1966 through 1981 targeting other salmonids. In beach seine surveys conducted in 2001-2002, which targeted bull trout, bull trout were again detected in Greys Harbor. It is not currently understood how bull trout in these rivers and the harbor interact or relate to one another. Grays Harbor, the Chehalis River up to and including the Satsop River, and portions of the Wishkah and Humptulips Rivers that are utilized by salmon and steelhead have been identified as either current or suspected bull trout foraging, migration and overwintering habitat important for bull trout recovery in the Olympic Peninsula (Spalding 2003). The Satsop River has also been identified as a research need to determine the feasibility of re-establishing bull trout in the West Fork. No records of bull trout use in the Hoquiam River exist; only historic anecdotal accounts exist for bull trout use in the lower Wynoochee River. Bull trout use of the Hoquiam and Wynoochee rivers has been identified as research needs (Spalding 2003).

Restoration Accomplishments in the NWFP area within the Range of the Bull Trout

In addition to the environmental baseline established above, restoration is another component of the effects of past and ongoing human and natural factors leading to the current status of the bull trout, its habitat, and ecosystem within the action area. Restoration is also one of the primary components of the NWFP ACS. Restoration accomplishments by the FS and BLM administrative units are summarized for various time periods in the following table derived from the BA.

Administrative Unit	*Instream Structures (mi.)*	*Instream Passage (mi.)*	*Riparian (ac.)*	*Riparian (mi.)*	*Upland (ac.)*	*Decommis-sioned Roads (mi)*	*Road Improved (mi.)*	*Wetland Fresh (ac.)*
Columbia River Gorge NSA	3	0	375	0	0	6	3	137
Deschutes	26.3	0.7	513	30.5	529	104.3	15.4	207
Gifford Pinchot	178.3	1.1	1508	21.7	11	285.8	193.3	0
Mount Baker Snoqualmie	8.4	0.5	13	0	1	54.4	137.6	0
Mount Hood	50.3	24.1	176	13.3	309	42.4	16.1	4
Okanogan	0.6	0.2	15	1.3	47	24.2	19.2	0
Olympic	0.8	4.3	82	9.9	368	46.7	33.9	0
Wenatchee	8.3	27	337	63.6	4	91.9	92.2	18
Willamette	18	0	613	38.7	1784	43.4	65.1	7
Winema	0.3	0	0	0	1	150.1	0.2	0
Klamath Falls	0	0	273	1.5	738	0.3	1.4	3
Eugene	7.7	8.2	11	3.1	0	5.3	0.9	0
Totals	302	66.1	3916	183.6	3792	854.8	578.3	376

Status of Bull Trout Proposed Critical Habitat within the Action Area

Appendix 2 displays the extent of bull trout proposed critical habitat within the NWFP area. The current condition of each proposed critical habitat unit (relative to the function of primary constituent elements) has not yet been specifically evaluated. However, the Draft Bull Trout Recovery Plan (Service 2002a) generally evaluates habitat conditions within specific river basins that are proposed for designation as critical habitat. These analyses are incorporated by reference.

Conservation Needs of the Bull Trout within the Action Area

Conservation needs reflect those biological and physical requirements of a species for its long-term survival and recovery. Based on the best available scientific information (Rieman and McIntyre 1993, MBTSG 1998, Hard 1995, Healey and Prince 1995, Rieman and Allendorf 2001), the conservation needs of the bull trout within the NWFP area are:

1. Maintain and restore multiple, interconnected populations in diverse habitats.

2. Preserve the diversity of life-history strategies (e.g., resident and migratory forms, emigration age, spawning frequency, local habitat adaptations).

3. Maintain genetic and phenotypic diversity.

4. Protect populations from catastrophic fires.

EFFECTS OF THE ACTION

Overview

The scope of analysis herein is restricted to evaluating the effects on the bull trout and its proposed critical habitat of establishing management direction, standards and guidelines, and other governing criteria under which specific activities will be planned under the RMPs amended by the 1994 ROD and the 2003 FSEIS, as described in the BA. On that basis, and in recognition of the fact that the proposed action does not authorize specific, ground-disturbing activities, the effects analysis discussed below addresses the range of potential effects of the proposed action on the bull trout and its proposed critical habitat.

The primary focus of this analysis of the proposed action is the four components of the ACS (riparian reserves, key watersheds, watershed analysis and watershed restoration). In addition, the analysis considers the ACS objectives, and the various NWFP standards and guidelines for each land allocation. The analysis examines each of these features separately and then in combination.

Effects of ACS-Related Components

The ACS was developed to restore and maintain the ecological health of watersheds and the aquatic ecosystems contained within them on public lands. The four main components of the ACS (Riparian Reserves, Key Watersheds, Watershed Analysis, and Watershed Restoration) are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems. LSRs also provide some protection to aquatic habitats because the S&Gs for LSRs generally increase protection for all stream types found within them.

The ACS Objectives

This section discusses the ACS objectives and their value to the conservation of the bull trout and its proposed critical habitat; later sections of this Opinion will present the analysis of how these objectives are intended to be achieved. The BA describes the achievement of the Objectives as follows: “the four components of the ACS, in combination with the application of relevant S&Gs in Sections C and D (and other relevant standards in Resource Management Plans) are intended to achieve the Aquatic Conservation Strategy Objectives.”

The ROD (1994) established, and the proposed action does not change, the nine ACS objectives which serve as long-term landscape management objectives directed at the watershed scale. According to the proposed action, FS and BLM-administered lands will be managed to maintain and restore various ecosystem processes and functions. These aquatic ecosystem features operate at a variety of spatial and temporal scales, and reflect the dynamic nature of the environment (USDA & USDI 2003b). The ACS objectives range from maintaining and restoring the distribution, diversity, and complexity of

watershed and landscape-scale features to maintaining and restoring habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species, including listed species such as the bull trout.
The ACS Objectives address important biological and physical features of the aquatic ecosystem that are important to the conservation of the bull trout and its proposed critical habitat within the NWFP area. In fact, the BA concludes that the ACS Objectives address all of the physical and biological features that were determined to be essential to the conservation of the bull trout. Those features are discussed in the Service's proposed critical habitat designation, which describes the primary constituent elements (PCEs) of bull trout critical habitat, and are reiterated in the "Status of Proposed Critical Habitat" section above. See Table 19 in the BA for a comparison of the PCEs to the ACS Objectives.

The FSEIS clarifies both the scale for determining achievement of the Objectives and the project documentation requirements with regard to standards that refer to the ACS Objectives. The FSEIS states "[t]he proper scales for Federal land managers to evaluate progress toward achievement of the ACS Objectives are the (5th field) watershed and broader scales." The effects associated with both these topics are described under the "Effect of Land Allocations and S&Gs" section below.

ACS Components

<u>Riparian Reserves</u>

Riparian Reserves are a management tool designed to protect the vegetation along streams to provide: stable streambanks to retain appropriate width/depth ratios; shade for instream temperature regulation; large wood and small organic matter to stabilize the channel or supply the base of the food chain; and a buffer against large inputs of nutrients, pollutants or sediments that are not captured through other management measures (Spence *et al.* 1996). Although riparian buffers alone are insufficient to ensure healthy aquatic habitat, they have been generally accepted as a way to minimize the adverse effects of timber management on aquatic communities (FEMAT 1993; Murphy 1995; Spence *et al.* 1996; Thomas *et al.* 1993).

In the ACS, the function of the Riparian Reserves is to provide a buffer between management activities and the aquatic system. Riparian Reserves assist in meeting some of the ACS Objectives. "Riparian Reserves are portions of watersheds where riparian-dependent resources receive primary emphasis and where special S&Gs apply" (USDA & USDI 1994b, page B-12). The Service expects that this primary emphasis will be met through the application of the Riparian Reserve S&Gs. Riparian Reserve S&Gs are second in priority of all land allocations under the NWFP, second only to Congressionally Reserved Areas. The S&Gs for Riparian Reserves are added to those for the land allocations overlain by reserves (USDA & USDI 1994b, page C-1).
Riparian Reserves overlay all historic or current bull trout habitat and other stream and riparian areas on Federal lands with the NWFP area. The interim Riparian Reserve widths were based upon ecologic and geomorphic factors. According to the 1994 ROD,

they were designed to provide a high level of fish and riparian protection until watershed and site-specific analysis could be completed. "WA and appropriate NEPA compliance is required to change Riparian Reserve boundaries in all watersheds." (USDA & USDI 1994b, page C-31). Although Riparian Reserve boundaries can be modified, according to the BA, there has been little change to Riparian Reserve boundaries since 1994.

The widths of the Riparian Reserves generally equal the published recommendations available in the literature. The FEMAT report (FEMAT 1993) summarized these recommendations, and the Riparian Reserve widths are based upon the FEMAT report. Most of these recommendations assume a functioning, healthy riparian habitat with a high degree of vegetative cover and complexity to provide water temperature regulation, large woody debris recruitment, bank stability, filtering of overland sediment flow, and regulation of chemicals and nutrients. Management activities within the riparian zone have the potential to reduce the ability of the riparian area to provide for these aquatic habitat features. How much of the Riparian Reserves within the NWFP area are providing healthy riparian habitat is not known. However, according to the 1994 FEIS report (on pages 3&4-59, 61), not all of the Riparian Reserves are providing these habitat features within the Action Area.

The proposed action, as described in the BA, allows for management activities within Riparian Reserves. Timber management S&Gs allow activities such as salvage, stand thinning, and fuel wood-cutting within Riparian Reserves. Roads are discouraged, but may be constructed after WA has been completed. Grazing, recreation, mining and other management activities are also allowed within Riparian Reserves, in compliance with applicable S&Gs. Restoration activities are also permitted, in order to secure those elements necessary to maintain aquatic habitats. These management activities have the potential to adversely affect the ability of riparian areas to provide necessary habitat features (e.g., sediment filtering, water temperature regulation, and large woody debris recruitment) for the bull trout and its proposed critical habitat. Restoration activities may also result in short-term adverse effects, but are expected to provide long-term benefits to the bull trout and its proposed critical habitat as habitat features develop and mature. Activities within Riparian Reserves are managed through the S&Gs; a more thorough review of site-scale effects related to S&Gs is provided in "Land Allocations and S&Gs," below.

Bull trout have very specific habitat needs and are extremely sensitive to disturbance (see "Life History Attributes" in Appendix 1). To the degree that Riparian Reserves are managed to provide primary emphasis to riparian-dependent species, and to the extent that past management actions have not compromised the ability of the Riparian Reserves to provide for essential aquatic habitat features, Riparian Reserves are beneficial to the bull trout and its proposed critical habitat.

<u>Key Watersheds</u>

According to the ROD (USDA & USDI 1994b), refugia are a cornerstone of most species conservation strategies. They are designated areas that either provide, or are expected to provide, high quality habitat. This is particularly important to species, such as the bull trout, that are strongly associated with upstream sources of cool, high quality water, such as seeps, springs, and natural upwellings. Clear, cool water is needed for all bull trout life stages, especially during the spawning and rearing phases. Thus, a system of Key Watersheds that serve as refugia is crucial for maintaining and recovering habitat for the bull trout. Key Watersheds with high quality conditions will serve as anchors for the potential recovery of depressed stocks. Those of lower quality habitat have a high potential for restoration and will become future sources of high quality habitat with the implementation of a comprehensive restoration program (USDA & USDI 1994b).

The ROD did not identify Key Watersheds as a "land allocation." Rather, Key Watersheds overlay land allocations and are intended to provide additional protections within them. The proposed action does not change the numbers or distribution of Key Watersheds in the NWFP area, and the role of Key Watersheds is not changed (USDA & USDI 2003a). The benefits of Key Watersheds accrue largely from being composed of relatively functional habitat areas and their overlap with major portions of relatively protective land allocations. The Service's GIS analysis of Key Watersheds (Appendix 3) shows that Key Watersheds overlap between 37 percent and 65 percent of bull trout habitat on Federal lands within the NWFP, depending on the DPS. Further analysis of the land allocations that overlap with Key Watersheds is provided in "Land Allocations and S&Gs," below.

The proposed action includes S&Gs that preclude certain actions or emphasize certain beneficial activities in Key Watersheds. Key Watersheds will receive the highest priority for watershed restoration. No new roads will be built in inventoried roadless areas within Key Watersheds. Outside of roadless areas, existing roads should be reduced or, at a minimum, there should be no net increase in the amount of roads in Key Watersheds. That is, for each mile of new road constructed, at least one mile of road should be decommissioned, with priority given to roads that pose the greatest risks to riparian and aquatic ecosystems.

Most management activities, including salvage and timber harvest, can occur within Key Watersheds, but only after WA (although minor activities, such as those categorically excluded under NEPA, can occur prior to WA). According to the BA, since the signing of the ROD in 1994, most management units within the NWFP area had completed WA for their Key Watersheds. Therefore, management activities, including salvage and timber harvest, can now occur in these areas. Adverse effects to the bull trout and its proposed critical habitat may occur as a result of implementing these types of management activities within Key Watersheds. According to the BA (Page 68), management actions within Key Watersheds will be consistent with maintaining present or restoring future refugial conditions, which is beneficial to the bull trout and its proposed critical habitat. Therefore, the Service concludes that although short- term adverse effects may occur from implementing management actions, overall management within Key Watersheds will result in long-term beneficial effects to the bull trout and its critical habitat.

Watershed Analysis

Watershed analysis is one of the principle analyses that are to be used in making decisions on implementation of the ACS (USDA & USDI 1994b). WA focuses on collecting and compiling information within a watershed that is essential for making sound management decisions (REO 1999; USDA & USDI 1994b).

The WA process is issue-driven (USDA 1995). It identifies and describes ecological processes of greatest concern, establishes how well or poorly those processes are functioning, and determine the conditions under which management activities, including restoration, should and should not take place. WA is required in Key Watersheds, remaining unroaded portions of RARE II roadless areas in non-Key Watersheds, and in Riparian Reserves prior to implementation of resource management activities. It is recommended in all other watersheds. The proposed action does not change these requirements. According to the BA, a large portion of the lands within the NWFP area have been assessed using WA.

The BA (page 71) also states that WA results and recommendations are intended to focus on the goal of maintaining and restoring entire aquatic ecosystems. The proposed action clarifies that WAs are not decision-making documents and WA recommendations are discretionary. Decisions regarding WA recommendations are part of the NEPA decision-making process. Provided that WAs identify the bull trout and its critical habitat as a key issue, where appropriate, and information from the WA regarding the physical and biological features that provide for the maintenance or creation, over time, of properly functioning aquatic conditions for the bull trout and its proposed critical habitat is used in subsequent decision making processes, WA should be generally beneficial to the bull trout and its proposed critical habitat.

Watershed Restoration

According to the ROD, page B-30 to 31, watershed restoration will be an integral part of a program to aid recovery of fish habitat, riparian habitat, and water quality. Watershed restoration relies on WA and planning to identify restoration activities with the greatest likelihood of success. Watershed restoration is occurring in many watersheds and overall represents a positive benefit to the recovery of the bull trout. According to the BA, page 71, fish habitat has been restored directly or indirectly by: (1) reducing sediment and improving flow regimes by decommissioning roads, erosion control, and upgrading sizes of culverts; (2) improving instream fish habitat complexity; (3) improving fish passage at road crossings; and (4) restoring riparian vegetation functions by planting, seeding and thinning riparian areas.

Short-term adverse effects such as increased turbidity, sediment deposition, or water temperature may accrue from restoration activities such as culvert removal and replacement, road obliteration, and other restoration activities occurring within the active stream channel or riparian reserves. However, these actions, when properly analyzed and implemented, should provide a long-term benefit for the bull trout and its proposed critical habitat because they will help to restore functioning, healthy habitat in degraded areas.

Effects of Management Activities and Projects

A variety of projects and activities are directed by the RMPs and conditioned by the ACS and S&Gs. These include timber, roads, grazing, minerals, recreation, fire/fuels, lands management, riparian management, watershed and habitat restoration, fish and wildlife management, research, special forest products and American Indian uses. A summary of effects to the bull trout that may occur from these activities was included in the "Reasons for Decline" section in Appendix 1 of this document. The discussion that follows considers the potential effects outlined in Appendix 1 in the context of the NWFP requirements.

Effects of Land Allocations and S&Gs

The NWFP land allocations all have special management direction regarding how lands are to be managed, including actions that are prohibited and descriptions of conditions that should occur. These directions are called the S&Gs – the rules and limits governing actions, and the principles specifying the environmental conditions or levels to be achieved and maintained. Numerous S&Gs are not directly applicable to aquatic resources, but rather address specific management direction for the conservation of non-vascular plants, amphibians, birds, etc. The analysis below only addresses the S&Gs that are directly applicable to aquatic resources. The analysis is structured to evaluate S&Gs as they appear in the 1994 ROD by specific land allocation.

Typically, RMP S&Gs provide direction to achieve or maintain specific habitat conditions when implementing projects (e.g., RF-4, New culverts…shall be constructed … to accommodate at least the 100 year flood). However, the authors of the NWFP state that explicit standards for habitat elements associated with the aquatic environment would be insufficient for protecting even the target species (See ROD page B-9). Thus, the ACS S&Gs of the NWFP rely on a process whereby WA and other local analysis guides management decisions that would best meet the ACS Objectives given local watershed capabilities and conditions. Approximately, 70% of the ACS S&G's require meeting or not preventing the attainment of the ACS Objectives. The proposed action clarifies that this determination is to be made at the 5th-field watershed scale or greater over the long-term. An example of how these S&G's would be applied is provided in the BA, page 72-73:

> "GM-1 reads: "Adjust grazing practices to eliminate impacts that retard or prevent attainment of Aquatic Conservation Strategy Objectives. If adjusting practices is not effective, eliminate grazing." Under the proposed action, one is directed to use relevant information from the applicable WA to provide context for project planning. Other sources would be used to supplement WA information if needed. Relevant information for important physical and biological components of a given 5th field watershed in this case (for grazing

> allotments which include riparian areas) may include the baseline conditions and trends for riparian vegetation, bank stability, proportion of fine sediment in streambeds, water temperature, and width-to-depth ratio at the scale of the watershed, as well as RNV [range of natural variability] for those watershed processes/habitat elements. Information on the distribution of fish species and locations of particularly important habitat areas is also relevant. This information, along with monitoring results, would provide a context for determining whether or not grazing practices should be adjusted or eliminated. If the action, at the site scale, impacted the conditions at the watershed or larger scales, so they were not operating within or moving toward the range of natural variability, or key indicators (i.e. width-to-depth ratio) could not be maintained at the watershed scale with implementation of the action, it would be modified or eliminated."

The above discussion indicates that the action agencies will modify or eliminate activities if adverse effects, as described above, are anticipated at the watershed or broader scale. Effects analyses for actions also consider more than just the response of the bull trout and its critical habitat relative to achievement of the goals and the objectives at the 5th field watershed over the long-term. This is because analyses at this broad scale may not detect effects to local areas that are important to the conservation of the bull trout[1,2,3].

Actions implemented under the proposed action could result in adverse effects to the bull trout and its proposed critical habitat at scales smaller than the 5th field watershed. Consequently, the BA describes an analytical process designed to evaluate potential localized and short-term impacts to listed bull trout and proposed critical habitat. As described in the BA, resource values would be identified and potential impacts will be addressed during project design and the NEPA process, as well as during project-level ESA consultation. Through these analytical processes the physical and biological features that provide for the maintenance or creation, over time, of properly functioning freshwater aquatic habitat for the bull trout and its proposed critical habitat will be addressed, and this information will be used in the course of designing and implementing specific management activities.

At the DPS level, the distribution of the bull trout on Federal lands within the NWFP area overlays Matrix lands, LSRs, Congressionally-Reserved Areas, Administratively

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[1] With regard to the masking of finer-scale effects at larger scales, Ziemer (1998) noted that, "…attempts to detect the effect of land use by observing the response of large watershed have often been unsuccessful because large watersheds tend to represent a homogenization of land disturbances, with each large watershed having relatively similar management histories."

[2] Reaches that support particular life stages, especially spawning and overwintering areas, are not randomly located throughout 5th field watersheds, so specific local areas may be critical to bull trout subpopulation survival and reproduction (Baxter & Hauer 2000).

[3] Minshall (Minshall 1994) noted that a single or few small-scale effects may be undetectable or relatively restricted but, when taken together, may result in severe degradation of stream-riparian conditions. According to Firth and Fisher (1992; cited in Minshall 1994), some disturbances occur gradually and, hence, are often are not recognized as problems until the situation becomes extremely difficult or impossible to reverse. They noted that these disturbances include some types of logging and mining, livestock grazing, and fire suppression.

Withdrawn Areas, Managed Late Successional Areas, Adaptive Management Areas, and Riparian Reserves (for a description of the land allocations and their acreages, see ROD, pages B-6-7).

The S&G effects sections begin with an analysis of the management intent or the purpose(s) of the land allocations and the ACS-related components. These sections are followed by an assessment of the types of projects and land management activities allowed within each land allocation as guided by the protective measures (i.e., S&Gs) described in the proposed action. With the exception of the Coastal-Puget Sound DPS, data from proposed critical habitat maps were used to characterize the extent (in stream miles) of bull trout spawning and rearing, and foraging, migrating, and overwintering (FMO) habitat on Federal land use allocations and non-Federal lands within the NWFP area. Geographic Information System (GIS) analysis was used to determine the distribution of stream miles within each land allocation category and the results are displayed by DPS (Appendix 3). For the Coastal-Puget Sound DPS, data on habitat currently supporting bull trout populations were used for the above GIS analysis.

In the analysis of S&Gs below, the potential for adverse effects to the bull trout or its proposed critical habitat was categorized as low, moderate, or high. The ranking also considered the total amount of bull trout habitat within the NWFP area potentially affected within each land allocation.

Late Successional Reserves

LSRs, in combination with other land allocations and S&Gs, are intended to “maintain a functional, interactive, late successional and old growth forest ecosystem. They are designed to serve as habitat for late successional and old-growth related species including the northern spotted owl” (ROD, page 6). LSRs, in many cases, were designed to incorporate Key Watersheds (ROD, page C-9). In the long-term, LSRs and their associated S&Gs will likely prove beneficial to the bull trout and its proposed critical habitat by providing large blocks of late seral forest with high water quality and habitat complexity. However, these beneficial effects are limited by the amount of potential bull trout habitat within LRSs as exemplified in the chart below. About 26%, 38%, and 34% of bull trout habitat within the NWFP area lies within the LSR land allocation relative to the Klamath, Columbia River, and Costal Puget Sound DPSs, respectively.

Table 2 displays bull trout habitat amounts located within the LSR land allocation. For the complete GIS analysis, see Appendix 3.

Table 2. LSR Land Allocation.

	Klamath River DPS	Columbia River DPS	Costal-Puget Sound DPS
Spawning Habitat (mi)	10.9 mi	238.5 mi	303.1 mi
FMO Habitat (mi)	0 mi	84.3 mi	67.9 mi
Total Habitat (mi)	11 mi	335 mi	371 mi
Total Habitat as a % of DPS habitat within the NWFP area (excluding private lands)	26 %	38 %	34 %
Total Habitat within LSRs in Key Watersheds	6 mi	246 mi	250 mi
% of Total Habitat within LSRs in Key Watersheds	57%	73%	67%

In the short- and intermediate-term, some activities in LSRs may have adverse effects to the bull trout and its proposed critical habitat as discussed below.

Silviculture

LSR silvicultural S&Gs allow or encourage large scale "risk reduction" measures and promote late seral forest conditions. This may result in aggressive silvicultural treatments that may include Riparian Reserve treatments in order to safeguard late successional habitats and promote or accelerate development of late seral forest conditions. Silvicultural practices and associated activities, such as road construction affect stream habitats by altering recruitment of large woody debris (LWD), erosion and sedimentation rates, runoff patterns, the magnitude of peak and base flows, water temperature, and annual water yield (Cacek 1989; Furniss *et al.* 1991; Spence *et al.* 1996; Spencer & Schelske 1998; Swanson *et al.* 1998; Wissmar *et al.* 1994). General effects of silvicultural treatments on the bull trout are further discussed in Appendix 1, "Reason for Decline."

The hierarchy of S&Gs in the ROD (page C-1) indicates that S&Gs for Congressionally Reserved Areas, Key Watersheds, and Riparian Reserves overlay and are added to those of LSRs. This overlay establishes additional requirements that must be met in LSRs, beyond those specifically described in the LSR S&Gs. These additional requirements help to minimize some of the potential adverse effects to the bull trout and its proposed critical habitat associated with some potential LSR management activities.

Although risk reduction or prevention measures may help reduce the longer-term risks of catastrophic fire and loss of habitat conditions necessary to support the bull trout within population strongholds, some of these treatments may have a moderate to high potential for adversely affecting the bull trout and its proposed critical habitat in the short-term.

Salvage

Salvage within LSRs is not considered a silvicultural treatment (ROD, page C-13). Salvage S&Gs in LSRs allow significant reductions in standing dead and down wood, which may reduce current and future potential for LWD recruitment to bull trout streams. LWD is a significant pool-forming element in Pacific Northwest streams. Large, deep pools are needed by the bull trout for rearing and to provide depth cover and thermal refugia (see Appendix 1 for further information on this topic). Salvage may also increase fine sediment production in watersheds containing the bull trout or its proposed critical habitat. Although the S&Gs generally allow salvage to occur where necessary to avoid future risk (e.g., fire) or promote stand regeneration, deviations from these salvage guidelines are allowed to provide access to salvage sites and feasible logging operations, and to promote safety of salvage operations (ROD, page C-15). Salvage logging, particularly in Riparian Reserves, and in unroaded or relatively undisturbed areas within LSRs generally have a high potential for adversely effecting the bull trout and its proposed critical habitat because of potential loss of LWD and shade, and potential increases in fine sediment production associated both with the salvage operations themselves and with roads used to provide access to salvage sites.

Roads

Road construction in LSRs for silvicultural, salvage and other activities generally is not recommended unless potential benefits exceed the costs of habitat impairment. Road S&Gs do not prohibit new road construction in LSRs. If new roads are necessary to implement an action that is otherwise in accordance with the S&Gs, they will be kept to a minimum, be routed through non-late-successional habitat where possible, and be designed to minimize adverse impacts. Alternatives to roads are to be considered (ROD, page C-16).

There are numerous pathways by which roads negatively impact the bull trout and its habitat. Effects of roads on the bull trout and its critical habitat are further discussed in the "Reasons for Decline" section of Appendix 1 of this document. Analyses done for the ICBEMP (Lee *et al.* 1997) demonstrated that bull trout are strongly associated with roadless areas (i.e., inventoried RARE II areas of 5,000 acres and greater and other non-inventoried areas that are generally smaller in size). Across their range, current bull trout populations are generally associated with wilderness, low-road density "reserved" land allocations, and remaining unroaded portions of otherwise managed watersheds. Known and predicted bull trout "strongholds" identified in Lee *et al.* (Lee *et al.* 1997) are associated with road densities of approximately 0.1 to 0.7 miles/square mile. The species is generally absent or only present in low or very low abundance at road densities exceeding 1.0 or 1.7 miles/square mile.

Current road densities reported in LSR Assessments that the Service has reviewed for the Wenatchee NF are generally in the 2 to 5 miles/square mile range, therefore, road densities in these LSRs are in excess of road densities reported to be associated with bull trout strongholds, and species presence (Lee *et al.* 1997). The objectives for LSRs mean that existing roads will be needed, and new road segments may need to be built, to facilitate thinning, silviculture, and risk reduction projects. Therefore, road densities in excess of those that are consistent with supporting strong bull trout population may be maintained. In addition, any roads built or located near bull trout streams, or that cross streams or unstable landslide prone areas, may adversely affect the bull trout and its proposed critical habitat in LSRs. Overall, road activities consistent with S&Gs in LSRs have a high potential for adversely affecting the bull trout and its proposed critical habitat, given the sensitivity of bull trout to direct, indirect, and cumulative effects of roads.

Mining

The S&Gs for mining (ROD, page C-17) state that "the impacts of ongoing and proposed mining actions will be assessed, and mineral activity permits will include appropriate stipulations (e.g., seasonal or other restrictions) related to all phases of mineral activity. The guiding principle will be to design mitigation measures that minimize detrimental effects to late-successional habitat."

In general, the S&Gs do not discuss avoidance or curtailment of mining activities in LSRs, but rather apply through the standard permitting process, minimization and mitigation measures that are not focused directly on aquatic species protection, but on late-successional conditions. Mining activities, especially those that occur in riparian areas or in-stream, often degrade streambanks, modify channel bed configurations, and can add significant amounts of fine sediment and toxic pollutants to streams. Mining activities consistent with S&Gs in LSRs have a high potential for adverse effects to the bull trout and its proposed critical habitat.

Development

New developments that can occur in LSRs, according to the S&Gs, include the following: powerlines, pipelines, reservoirs, recreation sites ("when adverse effects can be minimized and mitigated"). Existing developments that can remain in LSRs, according to the S&Gs include campgrounds, recreation residences, ski areas, utility corridors, and electronic sites, ("when these are consistent with other S&Gs"). The proposed action also states that "Development of new facilities that may adversely affect LSRs should not be permitted" (ROD, page C-17).

Because this category includes such a broad range of land management activities it is difficult to provide an accurate description of the probable effects. Each of the developments, depending on their placement, can result in disruption of flow and sediment regimes, decreases in water quality and quantity, or loss of connectivity. However, it would appear that just two categories of new developments, reservoirs and recreation sites (especially if these are located on or adjacent to bull trout streams), have a relatively high potential to cause adverse effects to bull trout or its proposed critical habitat. Most other types of new developments have a moderate potential for adverse effects to the bull trout and its proposed critical habitat because of the requirements to minimize adverse effects to late-successional habitats. Existing developments are included in the environmental baseline, but few if any have been analyzed and some may contribute to long-term adverse effects to the bull trout and its proposed critical habitat.

Range Management

The ROD (page C-19) states, "Range-related management that does not adversely affect late-successional habitat will be developed in coordination with wildlife and fisheries biologists. Adjust or eliminate grazing practices that retard or prevent attainment of reserve objectives. Evaluate effects of existing and proposed livestock management and handling facilities in reserves to determine if reserve objectives are met. Where objectives cannot be met, relocate livestock management and/or handling facilities."

Although this S&G does not directly address effects to aquatic resources, it is the Service's understanding that there is not a great deal of grazing activity within LSRs in west-side forests within the area occupied by the three listed bull trout DPSs in the action area. Most grazing activity is limited to the Wenatchee NF in Washington and a few other locations. Therefore, we consider implementation of activities associated with these S&Gs to have, overall, a low potential for adverse effects to the bull trout and its proposed critical habitat for the reasons discussed under "Reasons for Decline" in Appexdix 1.

Rights of Way, Contracted Rights, Easements, and Special Use Permits

The S&Gs for Rights of Way state "Access to non-federal lands through Late-Successional Reserves will be considered and existing right-of-way agreements, contracted rights, easements, and special use permits in Late-Successional Reserves will be recognized as valid uses. New access proposals may require mitigation measures to reduce adverse effects on Late Successional Reserves. Review all special use permits and when objectives of Late-Successional Reserves are not being met, reduce impacts through either modification of existing permits or education" (ROD, page C-19).

The wording of the above S&Gs suggests that the action agencies generally do not deny new applications for rights of way, or access, but only review new permits/proposals or old permits when they expire and modify them to minimize or reduce, not eliminate, adverse effects to late successional habitat. As stated previously, this requirement applies to generalized late-successional habitats and may not be interpreted as applying to bull trout and their specific habitat needs. Overall, activities conducted under the S&Gs for Rights of Way have a moderate to high potential for adverse effects to the bull trout and its proposed critical habitat due to the extreme sensitivity of the bull trout and its habitat to the multiple adverse effects of roads, and to the lack of specific language in these S&Gs that would control the extent of rights of way, new road construction to access non-federal lands, or existing road use.

Recreational Uses

The S&Gs state “Dispersed recreational uses, including hunting and fishing, generally are consistent with the objectives of Late-Successional Reserves. Use adjustment measures such as education, use limitations, traffic control devices, or increased maintenance when dispersed and developed recreation practices retard or prevent attainment of Late-Successional Reserve Objectives” (ROD, page C-18).

Bull trout are particularly susceptible to exploitation by fishing or poaching, (MBTSG 1998). Bull trout are also sensitive to the multiple adverse effects of roads. Dispersed recreation and increased human access in LSRs may adversely affect the bull trout and its proposed critical habitat, particularly if use is frequent or if recreation sites are located in or near key bull trout staging, spawning, and rearing areas. Such effects include, but are not limited to, direct capture or kill, firewood gathering at campgrounds which may contribute to reductions in shade or LWD recruitment to streams, localized compaction of soils, trailing and bank trampling, alteration of drainage patterns, e.g., disruption of springs or seeps, and increased surface erosion from road surfaces used to provide access for recreation opportunities. Mitigation for the above types of adverse effects may not be generally covered under the phrase “when dispersed and developed recreation practices retard or prevent attainment of Late-Successional Reserve Objectives.” Overall, however, dispersed recreation is not necessarily inconsistent with the maintenance of high quality bull trout habitats, therefore, the potential for adverse effects of these S&Gs on the bull trout and its proposed critical habitat is generally low to moderate.

Land Exchanges

S&Gs relating to land exchanges (ROD, page C-17) generally do not provide enough information to evaluate their potential for adversely affecting the bull trout or its proposed critical habitat. Individual land exchanges would need to be evaluated specifically to determine the potential for such adverse effects.

Research

S&Gs for research (ROD, page C-18) generally allow research activities that are “consistent with LSR objectives” and there is an explicit requirement to assess whether current, ongoing, research does not constitute “a significant risk to Aquatic Conservation objectives”. Because the S&G for research activities in LSRs does not provide site level guidance for project development, we are unable to evaluate the potential for research activities to adversely affect the bull trout and its proposed critical habitat.

LSRs S&Gs for Other Activities

LSR S&Gs for habitat improvement projects, special forest products, fuelwood gathering, American Indian uses, fire suppression and prevention generally require that projects be consistent with LSR objectives. The potential for adversely affecting the bull trout and its proposed critical habitat from implementing activities associated with these S&Gs is low for the following reasons. Special forest products involve hand-gathering of forest plants (e.g., salal, huckleberry, or fungi) are non-ground disturbing activities that produce insignificant soil disturbance and minimal vegetative cover. This results in isolated and minor exposure of the soil. Fuelwood gathering effects are the same as for silviculture or salvage, but on a much smaller scale, given the small size of most gathering permits and low total amount of wood removed from the forest. American Indian uses involves removal of canoe trees is provided for under Usual and Accustom (U&As) guarantees under treaty rights. Individual tree removal is consulted on a case-by-case basis but not precluded. There is a regional process for addressing this single forest/U&A product. Fire suppression and prevention S&Gs specify that minimum impact suppression methods be employed and that resource specialists familiar with an area be consulted to minimize habitat damage.

Summary of LSR Effects

LSR silvicultural objectives focus on actively managing LSRs to achieve late successional habitat conditions over the long-term. Aggressive silviculture and risk reduction activities, salvage, and the potential for continued reliance on new road construction, road reconstruction, and maintenance of existing high road densities in order to provide management access to LSRs may result in short-term or long-term adverse effects to the bull trout and its proposed critical habitat. Implementing the LSR objectives and LSR S&Gs may also result in significant long-term benefits to the bull trout and its proposed critical habitat by maintaining a functional network of LSRs.
To minimize adverse effects to listed species, the proposed action provides for an analytical process designed to evaluate, within the context of WA, potential localized and short-term impacts to the bull trout and proposed critical habitat. As described in the BA, resource values will be identified and potential impacts will be addressed during project design and the NEPA process, as well as during project-level ESA consultation. Through these analytical processes the physical and biological features that provide for the maintenance or creation, over time, of properly functioning freshwater aquatic habitat for the bull trout and its proposed critical habitat will be addressed, and this information will be used in the course of designing and implementing specific management activities.

Matrix Lands

According to the ROD, Matrix is defined as lands outside of the six categories of designated areas where, "most timber harvest and other silvicultural activities would be conducted” (ROD page 7). “Most timber harvest and other silvicultural activities would be conducted in that portion of the Matrix with suitable forest lands, according to the standards and guidelines. Most scheduled timber harvest (that contributes to the probable sale quantity [PSQ] not taking place in Adaptive Management Areas) takes place in the Matrix. The Matrix includes non-forested areas and forested areas that are technically unsuitable for timber production and therefore do not contribute to PSQ” (ROD, page C-39).

Table 3 displays bull trout habitat amounts located within the Matrix land allocation. For the complete GIS analysis, see Appendix 3.

Table 3. Matrix Land Allocation.

	Klamath River DPS	Columbia River DPS	Costal Puget Sound DPS
Spawning Habitat (mi)	3.4 mi	120.3 mi	80.9 mi
FMO Habitat (mi)	1.2 mi	78.2 mi	0.2 mi
Total Habitat (mi)	5 mi	199 mi	81 mi
Total Habitat as a % of DPS Habitat within the NWFP Area (excluding private lands)	11 %	22%	7 %
Total Habitat within Matrix in Key Watersheds	4 mi	96 mi	65 mi
% of Total Habitat within Matrix in Key Watersheds	93%	48%	80%

About 11%, 22%, and 7% of bull trout habitat within the NWFP area lies within the Matrix land allocation in the Klamath, Columbia River, and Costal Puget Sound DPSs, respectively. The proportion of the Matrix lands within each DPS that are overlain by Key Watersheds ranges from 93% in the Klamath DPS to 48% in Columbia River DPS. According to the BA (page 75), an estimated 39% of the area within the Matrix land allocation is also overlain by Riparian Reserves. The Key Watershed designation and Riparian Reserve land allocation within Matrix areas provide management direction that should reduce the potential for adverse effects to the bull trout and its proposed critical habitat resulting from management activities within the Matrix land allocation, which has timber production as its primary management emphasis. Compliance with the S&Gs associated with the Matrix land allocation should further reduce the potential for adverse affects to the bull trout and its proposed critical habitat from management activities within Matrix areas.

S&Gs specific to the Matrix land allocation are provided for a variety of categories or issues ranging from down wood to protection buffers for specific species. Of the S&Gs for Matrix lands, standards for coarse woody debris, bat protection and protection buffers for specific species are likely neutral in terms of their effects on the bull trout and its proposed critical habitat. Although not harmful, they do not identify any protective measures that can be identified as beneficial to bull trout, particularly given the scale of this analysis, and the intent of this land allocation.

S&Gs for green tree retention, connectivity/diversity blocks, and retention of old-growth fragments may provide a low level of protection for the bull trout and its proposed critical habitat given the intent of this allocation. The overall goal of these S&Gs is to limit the potential for converting entire landscapes within Matrix to a homogeneous condition of managed, even-aged forest with maximum structural conditions dictated by the prevailing rotation schedule. For example, on USFS-managed lands outside the Oregon Coast Range and Olympic Peninsula Provinces, green trees are to be retained on at least 15 percent of the area associated with each cutting unit (ROD, page C-41). S&Gs for retention of old-growth fragments (ROD, page C-44) are applied in 5^{th} field watersheds and indicate that where Federal forest lands are comprised of 15 percent or less late successional forest all remaining late-successional stands should be protected. In particular, preserving old growth fragments in 5^{th} field watersheds where 15 percent or less remain could add protection for the bull trout and its proposed critical habitat where these fragments occur outside of Riparian Reserves. Since remaining old-growth fragments likely represented small uninventoried roadless areas, preservation of these areas may provide key benefits where these areas overlap the bull trout's distribution.

One additional S&G specific to Matrix lands concerns modifying site treatment practices, the use of fire and pesticides, and harvest methods to minimize soil and litter disturbance (ROD, page C-44). Implementing this S&G while "reducing the intensity and frequency of site treatments" does not preclude ground-disturbing activities. Where Riparian Reserves are functional and contain mature trees, this S&G should further limit the potential for adverse hydrologic impacts and sediment contributions to surface waters; where Riparian Reserves are currently not functioning, and comprised primarily of trees in younger age classes, benefits may not be immediately realized.

The Matrix land allocation focuses on providing for timber harvest and other silvicultural activities. It is the allocation where a majority of the timber volume will be derived; this means that Matrix lands will be the subject of the highest level of management activity among the NWFP land allocations, presently and in the future. Riparian Reserve and Key Watershed S&Gs do, however, apply to Matrix lands. As Riparian Reserves mature through time, direct impacts to aquatic habitats from forest management should diminish, but will remain high relative to the other land allocations because of the focus on timber harvest and other silvicultural activities.

Impacts from other land management activities are less clear. Outside of Riparian Reserves and Key Watersheds, there are no general S&Gs addressing road systems, grazing, mining, or development within the Matrix allocation, although certain Riparian Reserve S&Gs address activities outside of Riparian Reserves (e.g., RF-3, RF-5, RF-7, GM-1, and RM-2). The potential for adverse effects to the bull trout and its proposed critical habitat from these activities is expected to be high, where Matrix lands are not overlain by more protective land designations such as Riparian Reserves or contained within delineated Key Watersheds.

According to the BA (Page 68) management actions within Key Watersheds will be consistent with maintaining present or restoring future refugial conditions. A high percentage of bull trout habitats within the Matrix land use allocation are overlain by Key Watershed (see table above). On that basis, the potential for adverse effects to the bull trout and its proposed critical habitat from timber management and other silvicultural activities within Matrix outside of Riparian Reserves and Key Watersheds is expected to be high. The bull trout is particularly sensitive to hydrologic effects and stream channel changes because its eggs, alevins and fry incubate/rear in stream gravels for about 200 to 220 days per year. The bull trout has more specific habitat requirements than other salmonids. (MBTSG 1998; Rieman & McIntyre 1993).

There are no specific requirements in the Matrix S&Gs to limit or assess the adverse affects of upland timber management and roads to the bull trout and its proposed critical habitat. Current road densities in Matrix were not reported, but according to BA there are about 87,000 miles of road on Federal land with in the NWFP area, therefore, the road density over the entire NWFP area (37,488 mi^2) would be about 2.3 mi/mi^2. Given this large overall road network, road densities in many watersheds are likely to be in excess of road densities reported to be associated with bull trout strongholds, and species presence (Lee *et al.* 1997). The objectives for the Matrix mean that existing roads will be needed, and new road segments may need to be built, to facilitate timber harvest. Therefore, road densities in excess of those that are consistent with supporting strong bull trout population may be maintained. In addition, any roads built or located near bull trout streams, or that cross streams or unstable landslide prone areas, may adversely affect the bull trout and its proposed critical habitat in the Matrix. Overall, road activities consistent with S&Gs in Matrix have a high potential for adversely affecting the bull trout and its proposed critical habitat, given the sensitivity of bull trout to direct, indirect, and cumulative effects of roads.

The effects of upland timber management activities on the bull trout and its proposed critical habitat include: reduced pool quality, habitat complexity, channel stability, and bank stability caused by increased peak flows (MBTSG 1998); increased sediment delivery reduces substrate quality (MBTSG 1998); and alteration of natural streamflow regimes affects stream temperature as well as channel form and physical habitat conditions/available habitat. Alteration of upland material transfer processes (LWD, sediment, etc.) may influence stream channel processes, such as stream sediment load, bedload composition, nutrients available for invertebrates and fish, structural habitat components (LWD, boulders) and other physical and chemical stream conditions (Swanson *et al.* 1982). Increased sediment loads may increase rates of channel aggradation, which may reduce the connection between stream systems by blocking migratory corridors" (MBTSG 1998).

Adverse effects to the bull trout and its proposed critical habitat may result from upland activities due to:

- Peak flow increases from timber harvest and associated roads (Jones & Grant 1996; McDonald & Ritland 1989; Spence *et al.* 1996).
- Reduction in summer low flows, over time, from timber harvest (Harr 1982; Hicks *et al.* 1991) resulting in higher summer water temperatures (MBTSG 1998).
- Increases in fine sediment additions to streams from ground disturbing activities in uplands.

- Decreases in upland sources of LWD, which enters streams episodically during landslide events.
- Problems with the road network and landings associated with timber harvest (drainage, fish passage, wetland impacts, and loss of hydrologic connectivity of surface and groundwater).

The bull trout requires habitats that are relatively free from fine sediments, and it is more frequently associated with large substrate (boulder and cobble) and slow velocity areas with undercut banks than areas with fine sediment and turbulent, fast water (Watson & Hillman 1997). Excessive fine sediments, combined with increased peak flows or reduced late summer low flows, could be detrimental to bull trout survival.

Congressionally Reserved Areas

Congressionally Reserved Areas are "lands that have been reserved by act of Congress for specific land allocation purposes (ROD, page 6)." These lands include National Parks and Monuments, Wilderness Areas, Wild and Scenic Rivers, National Wildlife Refuges, Department of Defense lands, and other lands with congressional designations.

Table 4 displays bull trout habitat amounts located within the Congressionally Reserved land allocation. For the complete GIS analysis, see Appendix 3.

Table 4. Congressionally Reserved (CR) Land Allocation.

	Klamath River DPS	Columbia River DPS	Costal Puget Sound DPS
Spawning Habitat (mi)	25.3 mi	162.8 mi	536.4 mi
FMO Habitat (mi)	0.3 mi	28.4 mi	75.5 mi
Total Habitat (mi)	26 mi	191 mi	612 mi
Total Habitat as a % of DPS habitat within the NWFP area (excluding private lands)	62 %	21 %	56 %
Total Habitat within CR areas in Key Watersheds	5 mi	138 mi	93 mi
% of Total Habitat within CR areas in Key Watersheds	18%	72%	15%

The Klamath River and Coastal-Puget Sound DPSs have a substantial portion of their habitat within the NWFP area located within the more protective (see below) Congressionally Reserved Areas. A high percentage of Columbia River DPS bull trout habitat in Congressionally Reserved Areas lies within Key Watersheds.

Congressionally Reserved Areas include such areas as wilderness areas, National Parks and Monuments, and Wild and Scenic Rivers. In general, few land disturbing activities can occur within these areas, therefore the potential for adverse effects to the bull trout and its proposed critical habitat is low.

Administratively Withdrawn Areas

Administratively Withdrawn Areas are identified in current RMPs or draft plan preferred alternatives and include recreational and visual areas, back country and other areas not scheduled for timber harvest (ROD, Page 7). In some cases Administratively Withdrawn Areas are overlaid by Key Watersheds. In these cases, S&Gs for Key Watersheds as well as S&Gs for Administratively Withdrawn Areas apply. These areas have already been designated in existing plans. S&Gs of existing RMPs will apply only when they are more restrictive, or provide greater benefits to late-successional and old-growth forest related species than the S&Gs described in the ROD.

Table 5 displays bull trout habitat amounts located within the Administratively Withdrawn land allocation. For the complete GIS analysis, see Appendix 3.

Table 5. Administratively Withdrawn (AW) Land Allocation.

	Klamath River DPS	Columbia River DPS	Costal Puget Sound DPS
Spawning Habitat (mi)	0.1 mi	52.8 mi	9.4 mi
FMO Habitat (mi)	0.3 mi	43.8 mi	0.6 mi
Total Habitat (mi)	0.4 mi	97 mi	10 mi
Total Habitat as % of DPS habitat within the NWFP area (excluding private lands)	1 %	11 %	1 %
Total Habitat within AW Areas in Key Watersheds	0.2 mi	57 mi	3 mi
% of Total Habitat within AW Areas in Key Watersheds	47 %	59 %	34 %

In general, few land-disturbing activities can occur within these areas, therefore the potential for adverse effects to the bull trout and its proposed critical habitat is low. Additionally, relatively little bull trout habitat in the NWFP area actually occurs within AW areas (see table above).

Riparian Reserves

According to the ROD, page B-12: “Riparian Reserves are portions of watersheds where riparian-dependent resources receive primary emphasis and where special S&Gs apply”.

The proposed action modifies page C-31 of the ROD to read, "As a general rule, S&Gs for Riparian Reserves prohibit or regulate activities in Riparian Reserves that retard or prevent attainment of the ACS objectives at the 5th field watershed scale over the long term. Watershed analysis and appropriate NEPA compliance is required to change Riparian Reserve boundaries in all watersheds". Riparian Reserves have the second highest priority of all land allocations, second only to Congressionally Reserved Areas. The S&Gs for riparian areas are added to the S&Gs of other land allocations (ROD, page C-1).

The amount of bull trout habitat within the Riparian Reserve land allocation is equal to the total amount of bull trout habitat within the NWFP area; see Appendix 3 for the total miles of bull trout habitat within the NWFP area. This complete overlap occurs because the Riparian Reserves include the stream channels and wetlands that encompass the historic and current extent of bull trout habitat within the NWFP area.

Activity-based S&Gs within Riparian Reserves are evaluated below relative to how compliance with them influences the design of management actions that have the potential to adversely affect the bull trout or its proposed critical habitat.

Timber Management

The S&Gs for Riparian Reserves prohibit timber harvest, including fuelwood cutting, except for salvage and fuelwood cutting after catastrophic events, and in instances where the activity is required to attain ACS objectives (ROD, pages C-31, 32). Salvage can take place only when WA determines that present and future coarse woody debris needs are met, and other ACS objectives are not adversely affected (ROD, page C-32). The S&Gs for timber management in Riparian Reserves refer to attaining the ACS Objectives. For such S&Gs the proposed action states that:

> "To comply with Riparian Reserve Standards and Guidelines that reference ACS objectives, the decision maker must document that analysis has been completed, including a description of the existing condition, a description of the range of natural variability of the important physical and biological components of a given fifth-field watershed, and how the project or management action maintains the existing condition or restores it toward that range of natural variability."

Timber management activities in Riparian Reserves that maintain, or do not adversely affect 5th field watershed conditions in the long term, may result in conditions at scales smaller than the 5th field that have adverse effects to the bull trout and its proposed critical habitat. Reaches that support particular life stages of bull trout, especially spawning and overwintering areas, are not randomly located throughout 5th field watersheds, so specific local areas may be critical to bull trout subpopulation survival and reproduction (Baxter & Hauer 2000). [NOTE: This rationale applies to all Riparian Reserve standards that refer to the ACS objectives and that are analyzed below.] Compliance with this standard (TM-1) would require project modification only when effects are predicted at the 5th field or larger scales.

Given the sensitivity of the bull trout and PCEs to the effects of timber harvest, the potential for adverse effects to the bull trout and its proposed critical habitat at the project level for silvicultural activities (e.g., thinning), and salvage or fuelwood cutting activities in the Riparian Reserves is considered to be moderate and high, respectively. Silvicultural practices may have a lower potential for adverse effects if the activity occurs on a small scale, outside of the bank stability zone, in areas where LWD is not limited, and where stream temperatures for the bull trout are not impaired. Silvicultural practices designed to acquire desired riparian characteristics that are consistent with the ACS objectives (at the watershed scale and long term) may be beneficial to the bull trout and its proposed critical habitat. For a more thorough discussion of the effect of timber harvest on bull trout see "Reasons for Decline" section of Appendix 1 of this document.

Roads Management

Road design, operation, and maintenance for each existing or planned road within Riparian Reserves (see below) must meet ACS objectives (RF-1 through RF-7, ROD, page C-32). The S&Gs for road management within Riparian Reserves require Federal, state, and county agencies to cooperate to achieve consistency in road design, operation, and maintenance necessary to attain ACS Objectives (RF-1). Land managers are also required to make sure each existing or planned road meets the ACS objectives by complying with a series of standards (RF-2). Finally, land managers must meet the ACS objectives by prioritizing, reconstructing, and closing roads (RF-3). All of these Road Management S&Gs refer to the ACS objectives; therefore compliance with these standards would require project modification only when effects are predicted at the 5^{th} field watershed or larger scales.

S&Gs for Riparian Reserves also address the maintenance of fish passage at all road crossings (RF-6--ROD, page C-33), and also stipulate that new road crossings be constructed to accommodate a 100-year flood and that existing crossings be improved to meet this same criterion (RF-4--ROD, page C-33).

There are a large number of pathways by which roads negatively impact the bull trout and its proposed critical habitat. Impacts from roads can be even more acute when located in riparian areas. Obliteration of roads in riparian areas can also contribute a large pulse of additional sediment to aquatic systems. Road obliteration or full decommissioning, however, will reduce the potential for excess sediment delivery to streams from roads, over time, and would eliminate further impacts of road use. On that basis, road obliteration or full decommissioning is generally considered to have long-term beneficial effects to the bull trout and its proposed critical habitat.

Riparian Reserve S&Gs direct the development and implementation of a Road Management Plan or a Transportation Management Plan that will meet ACS Objectives (RF-7--ROD, page C-33). Because of the bull trout's sensitivity to the adverse effects caused by roads, such management plans, especially in sensitive areas such as Riparian Reserves, will likely be unsuccessful in maintaining healthy bull trout subpopulations unless net road densities are reduced, except in those areas that currently have very low road densities or in areas that are roadless.

The Riparian Reserve S&Gs do not prohibit the construction of new roads in Riparian Reserves. Because this land allocation encompasses sensitive zones for aquatic habitats and affects all bull trout subpopulations and proposed critical habitat within the NWFP area, road management impacts can be widespread. Any roads built or that exist near bull trout streams, especially those that cross streams or unstable landslide prone areas, have a high potential for adversely affecting the bull trout and its proposed critical habitat. Improperly designed, blocked, or poorly placed culverts can prevent upstream or downstream movement of adults or juveniles. This can be a serious adverse effect, as bull trout adults require access to upstream spawning and rearing habitat, and juveniles and subadults need access to feeding and overwintering areas. Bull trout are also adversely affected by poaching and introductions of non-native char (e.g., the brook trout, *Salvelinus fontinalis*, and the lake trout, *Salvelinus namaycush*) that occur via increased human access to remote areas.

The Road Management standards that refer to the ACS objectives (RM-1, -2, -3, -7) do not provide site level guidance for project level development. Given the sensitivity of the bull trout and PCEs to the effects of road management, the potential for adverse effects to the bull trout and its proposed critical habitat at the project level is high.

Grazing Management

Riparian Reserve S&Gs state that grazing practices will be adjusted to eliminate impacts that retard or prevent attainment of the ACS objectives (GM-1--ROD, page C-33); that new livestock management facilities will be located outside Riparian Reserves, and existing livestock facilities within Riparian Reserves that do not meet ACS objectives will be relocated or removed (GM-2--ROD, page C-33); and that livestock trailing, bedding, watering, loading, and other handling efforts will be limited to, "those areas and times that will ensure ACS objectives are met"(GM-3--ROD, page C-34).

All of the Grazing Management standards refer to the ACS objectives; therefore compliance with these standards would require project modification only when effects are predicted at the 5th field watershed or larger scales. Livestock management activities, especially those occurring within Riparian Reserves, would have a relatively high potential to adversely affect the bull trout and its proposed critical habitat. However, it is the Service's understanding that of the action area occupied by the three listed bull trout DPSs there is not a great deal of grazing activity within west-side forests. Most grazing activity is limited to the Wenatchee NF in Washington and a few other locations. Therefore, we consider implementation of activities associated with these S&Gs to have, overall, a moderate potential for adverse effects to the bull trout and its proposed critical habitat.

Recreation Management

Riparian Reserve S&Gs allow for new recreational facilities, but they "should be designed to not prevent meeting Aquatic Conservation Strategy objectives" and construction of these facilities should not prevent future attainment of these objectives" (RM-1--ROD, C-34). For existing recreation facilities within Riparian Reserves, evaluate and mitigate impact to ensure that these do not prevent, and to the extent practicable contribute to, attainment of Aquatic Conservation Strategy objectives"(RM-1--ROD, page C-34). Dispersed and developed recreation practices and occupancy must be eliminated when adjustment measures are not successful in attaining the ACS Objectives (RM-2). Wild and Scenic River and Wilderness Management Plans will address attainment of ACS Objectives (RM-3).

All of the Recreation Management S&Gs refer to the ACS objectives; therefore compliance with these standards would require project modification only when effects are predicted at the 5th field watershed or larger scales. Impacts from recreational facilities to riparian areas include removal of streambank vegetation, destabilization of streambanks, and alteration of instream habitat. In addition, recreational facilities can increase public access to bull trout-occupied areas. Bull trout are adversely affected by poaching and introductions of non-native char (brook trout and lake trout) that occur via increased human access to remote areas. Although biologists are very familiar with these impacts, the general public who utilize such facilities may not be aware of or understand such impacts. In general, recreational management consistent with the Riparian Reserve S&Gs have a moderate potential for adverse effects to the bull trout and its proposed critical habitat due to the potential for direct and indirect impacts, primarily from dispersed recreational activities (see Appendix 1).

Minerals Management

Riparian Reserve S&Gs allow for mining to take place within riparian areas. Mining operations require a reclamation plan, approved Plan of Operations, and reclamation bond for all minerals operations that include Riparian Reserves. The ROD states that "Such plans and bonds must address the costs of removing facilities, equipment, and materials; recontouring disturbed areas to near pre-mining topography; isolating and neutralizing or removing toxic or potentially toxic materials; salvage and replacement of topsoil; and seedbed preparation and revegetation to meet Aquatic Conservation Strategy objectives" (MM-1--ROD, page C-34). Support facilities and roads will be located outside Riparian Reserves, and "where no alternative to siting facilities in Riparian Reserves exists, locate them in a way compatible with ACS objectives"(MM-2--ROD, page C-34). In addition, mining roads will be "constructed and maintained to meet roads management standards and to minimize damage to resources in the Riparian Reserve. When a road is no longer required for mineral or land management activities, it will be closed, obliterated, and stabilized"(MM-2--ROD, page C-34). Sand and gravel mining and extraction within Riparian Reserves will occur only if ACS objectives can be met (MM-5--ROD, page C-35).

All of the Minerals Management standards that refer to the ACS objectives, therefore compliance with these standards would require project modification only when effects are predicted at the 5th field watershed or larger scales. Mining and associated road construction have the potential to adversely effect the bull trout and its proposed critical habitat at scales less than the 5th field by degrading bull trout PCEs by altering water quality, changing stream morphology and flow, and causing sediment to enter streams (Martin & Platts 1981; Spence *et al.* 1996). Most bull trout spend their entire lives in freshwater, so they are extremely sensitive to those activities which directly or indirectly degrade important instream habitat elements (i.e., the PCEs of proposed critical habitat (USDI 2002)). Given the sensitivity of the bull trout and the effects of minerals management to bull trout PCEs, the potential for adverse effects to the bull trout and its proposed critical habitat at the project level is moderate to high.

Fire/Fuel Management

Riparian Reserve S&Gs allow for fire and fuels management, but strategies must be designed to “meet Aquatic Conservation Strategy objectives, and to minimize disturbance of riparian ground cover and vegetation” (FM-1--ROD, page C-35). These S&Gs direct that centers for incident activities to be located outside Riparian Reserves, unless granted an exemption from the resource advisor (FM-2—ROD, page C-35). Delivery of chemical retardant to surface waters will be minimized except where granted an exemption when there are overriding safety issues (FM-3 - - ROD, page C-35). Prescribed burn projects and prescriptions that are designed “to contribute to attainment of ACS objectives” (FM-4--ROD, page C-36) are of particular concern within Riparian Reserves.

The Fire/Fuel Management S&Gs refer to the ACS objectives (FM-1, -4, -5), therefore compliance with these standards would require project modification only when effects are predicted at the 5th field watershed or larger scales. Management that is used to restore ecological structure, composition, and process is largely experimental and potentially risky (Rieman & Clayton 1997). Prescribed burns can remove coarse wood, reduce LWD recruitment, reduce canopy cover (leading to increased water temperatures), increase the likelihood of mass erosion on sites, and alter water yield and timing of peak and low flows. These kinds of impacts constitute significant adverse effects to the bull trout and its proposed critical habitat. Ground disturbing activities associated with the suppression of wildfire may result in an increase in sediment delivery to streams.

Chemical fire retardants that are commonly used for the suppression of wildfires may have significant effects on the bull trout and its proposed critical habitat. The effects of fire retardants on salmonids are discussed in Norris *et al.* (1991) and Spence *et al.* (1996). The construction and use of pump chances has the potential to delivery fine sediment and chemicals (oil and gasoline) into streams, and the use of unscreened pump equipment has a slight potential to kill fish. FM-2 and FM-3 provide specific direction to minimize the delivery of chemicals to surface waters and to locate centers for incident activities outside

Riparian Reserves except where exemptions are granted. These S&Gs provide site-level guidance and should reduce potential adverse impacts to the bull trout and its proposed critical habitat due to these activities.

Fire and fuels management consistent with the Riparian Reserve S&Gs, overall, would likely have a moderate potential for adverse effects to the bull trout and its proposed critical habitat, given the risky nature of the activity and the sensitivity of the bull trout and critical habitat PCEs to the resulting habitat changes.

<u>Lands (hydro/surface water development, right-of-ways, land acquisition/ exchange/ conservation easements)</u>

Riparian Reserve S&Gs for "Lands" include provisions for existing and proposed hydroelectric and other surface water development; right-of-ways, leases, permits, and easements for activities other than surface water developments; and land acquisition, exchange, and conservation easements. Some of these must meet or not hinder attainment of ACS objectives (LH -3, -4, -5- -ROD, C-36&37). Some of these S&Gs are specific to Tier 1 Key Watersheds (LH-2--ROD, C-36).

Surface water development projects can alter habitats; flow, sediment, and temperature regimes; migration corridors; and interspecific interactions, especially between the bull trout and introduced species. Impassible dams have caused declines of the bull trout primarily by preventing access to spawning and rearing areas, and precluding recolonization of areas where the bull trout has been extirpated (Rieman & McIntyre 1993). Maintaining and restoring connectivity between habitats and between subpopulations is an important factor in achieving the long-term conservation of the species. The requirement for projects within Tier-1 Key Watersheds, to maintain in-stream flows and habitat conditions that maintain or restore riparian resources, favorable channel conditions, and fish passage, would reduce adverse effects to the bull trout and its proposed critical habitat in these watersheds.

The Land Management S&Gs refer to the ACS objectives (LH-3, -4, -5); therefore compliance with these standards would require project modification only when effects are predicted at the 5^{th} field watershed or larger scales. Rights-of-way, leases, permits, and easement actions issued by the FS and BLM may vary in effects to the bull trout and its proposed critical habitat from completely benign to adverse, depending on the nature and location of the authorized activity (e.g., right-of-way permit for timber harvest that increases sedimentation into a bull trout-occupied stream). Land acquisition and conservation easements related to the Riparian Reserve S&G LH-5 (ROD, page C-37) are expected to be beneficial to the bull trout and its proposed critical habitat since they would be used to meet ACS objectives.

Overall, Land Management activities consistent with the Riparian Reserve S&Gs have a moderate to high potential for adverse effects to the bull trout and its proposed critical habitat due to the extreme sensitivity of bull trout to the multiple adverse effects of roads, ongoing and potential effects from hydroelectric developments, and ongoing and potential effects from diversions authorized by special use permits.

General Riparian Area Management

Riparian Reserve S&G RA-1 is a restoration action related to identification and attempting to secure in-stream flows. The other three S&Gs are designed to limit management impacts on the aquatic resources (RA-2,3,4--ROD, page C-37) and address removal of hazard trees, forest chemical use, and water drafting. The restoration activities guided by Riparian Reserve S&Gs RA-1&2 would be generally beneficial to the bull trout and its proposed critical habitat.

Riparian Reserve S&G RA-3 refers to the ACS objectives; therefore compliance with these standards would require project modification only when effects are predicted at the 5^{th} field watershed or larger scales. Forest chemicals can affect salmonids through several direct and indirect pathways. Chemicals that reach surface waters can be toxic to salmonids or may alter primary and secondary production. Indirect effects can include changes to the rate of recovery of riparian and upland vegetation following timber harvest, hydraulic processes, delivery of sediment and woody debris, heat transfer, and nutrient cycling (Spence *et al.* 1996). Given the sensitivity of the bull trout to many forest chemicals, their application is expected to have a moderate to high potential for adverse effects to the bull trout and its proposed critical habitat.

Riparian Reserve S&G RA-4 requires locating water drafting sites to minimize their impacts on aquatic resources. Water drafting could cause stream channels to become temporarily dry, could result in entrainment of early life stages of bull trout, and increase turbidity and sedimentation due to riparian disturbance from pump vehicles. While direct effects to the bull trout and its proposed critical habitat could occur, the potential for such effects is expected to be low.

Watershed and Habitat Restoration

Riparian Reserve S&Gs addressing watershed and habitat restoration stipulate that design and implementation of such projects must be, “in a manner that promotes long-term ecological integrity of ecosystems, conserves the genetic integrity of native species, and attains ACS objectives” (WR-1--ROD, page C-37). In addition, restoration is not to be used to mitigate or act as a substitute for preventing habitat degradation (WR-2--ROD, page C-37).

Some restoration efforts have the potential to cause short-term adverse impacts to the bull trout and its proposed critical habitat (e.g., road obliteration, road crossing upgrades, riparian thinning). However, these actions should provide a long-term benefit as well.

Fish and Wildlife Management

Riparian Reserve S&Gs for fish and wildlife management address fish and wildlife habitat restoration and enhancement, educational facilities, wild ungulate impacts, and fisheries management impacts and will meet ACS objectives (FW-1, 2, 3, 4--ROD, page C38).

As addressed under watershed and habitat restoration above, the bull trout and its proposed critical habitat can be adversely affected by certain types of restoration activities. The role of stocking in bull trout recovery is limited. In general, the use of stocking is supported only in areas where bull trout subpopulations have been extirpated, and where conditions that caused the original extirpation have been corrected (MBTSG 1996). Stocking of bull trout directed towards supplementation and range expansion (outside native range) is not supported because of the high risk that it carries in these applications (MBTSG 1996). Wild ungulate impacts could include such impacts as reduced bank stability, or water quality. Since these issues will be addressed through coordination with Federal, tribal, and State fish management agencies, the potential risk of adverse impacts to the bull trout is considered to be low. Wildlife interpretative and other user-enhanced facilities could have impacts similar to those discussed in the Recreation Management section above.

Research

Riparian Reserve S&Gs addressing research (RS-1, 2--ROD, page C-38) generally allow ongoing and proposed research activities if mandatory analysis ensures that they do not pose “significant risk to watershed values”, or the risk can be mitigated. In addition, current, funded, agency-approved research “is assumed to continue if analysis ensures that a significant risk to ACS objectives does not exist.” The S&Gs indicate that some research activities that are inconsistent with these objectives may be appropriate if the activities will test critical assumptions of S&Gs, will produce results important for restoring aquatic and riparian ecosystems, or the activities represent continuation of long-term research (RS-1--ROD, page C-38).

Key watersheds are expected to provide significant benefits to the bull trout, and research activities in them that would require project modification only when effects are predicted to cause significant risks to watershed values have the potential to adversely impact the bull trout or its proposed critical habitat. Research could include a variety of vegetation management treatments and the effect would be similar to those described in the Timber Management section above.

Summary of Riparian Reserve S&Gs

As amended by the proposed action, the NWFP Riparian Reserve S&Gs prohibit or regulate activities that retard or prevent attainment of the ACS Objectives at the 5^{th} field watershed scale over the long-term. However, as discussed above, Riparian Reserves S&Gs may not eliminate all adverse effect to the bull trout and its proposed critical habitat. To minimize adverse effects to listed species, the proposed action provides for an analytical process designed to evaluate, within the context of WA, potential localized and short-term impacts to the bull trout and proposed critical habitat. As described in the BA, resource values will be identified and potential impacts will be addressed during project design and the NEPA process, as well as during project-level ESA consultation. Through these analytical processes the physical and biological features that provide for the maintenance or creation, over time, of properly functioning freshwater aquatic habitat for the bull trout and its proposed critical habitat will be addressed, and this information will be used in the course of designing and implementing specific management activities.

Managed Late Successional Areas

These areas are similar to LSRs but certain silvicultural treatments and fire hazard reduction treatments, not normally allowed in LSRs, are permitted to "help prevent complete stand destruction from large catastrophic events such as high intensity, high severity fires; or disease or insect epidemics"(ROD, page C-23).

Table 6 displays bull trout habitat amounts located within the MLSAs land use allocation. For the complete GIS analysis, see Appendix 3.

Table 6. Managed Late-Successional Areas Land Use Allocation.

	Klamath River DPS	Columbia River DPS	Costal Puget Sound DPS
Spawning Habitat (mi)	-	6.1 mi	-
FMO Habitat (mi)	-	19.2 mi	-
Total Habitat (mi)	-	25 mi	-
Total Habitat as % of DPS habitat within the NWFP area	-	3 %	-
Total Habitat within MLSA in Key Watersheds	-	22 mi	-
% of Total Habitat within MLSA in Key Watersheds	-	86 %	-

Currently, only bull trout associated with the Columbia River DPS occur within MLSAs, and only a small portion of this DPS's habitat within the NWFP area occurs within this land use allocation. Notably, most of that habitat is within Key Watersheds.

The MLSAs are located primarily in the following Key Watersheds that drain into the Yakima River: American/Bumping Rivers (a bull trout stronghold); Rattesnake Creek (a bull trout stronghold); and Natches/Little Naches (an important migratory corridor).

According to the ROD (page C-22), the S&Gs for Key Watersheds and Riparian Reserves overlay MLSRs. Eighty-six percent of bull trout habitat within MLSRs is within Key Watersheds. Therefore, although the S&Gs for MLSRs (ROD – Page C-26) encourage an acceptance of higher risk to listed resources, the Service anticipates that management activities will maintain or restore refugial conditions as appropriate for Key Watersheds. In general, the potential effects to the bull trout and its critical habitat from activities in MLSR will be similar to those described above in the LSR section, with the exception that there will be a higher potential for adverse affects associated with the expected higher amounts of silvicultural treatments within MLSRs to address fire risk. For a discussion of these potential effects, see the effects section for LSRs above.

Adaptive Management Areas

The ROD (page C-19) describes AMAs as "landscape units designated to encourage the development and testing of technical and social approaches to achieving desired ecological, economic, and social objectives" (ROD, page C-21). AMAs are meant to provide freedom to develop "localized idiosyncratic approaches," (ROD, page D-1) and are specifically located "in sub-regions impacted socially and economically by reduced timber harvest" (ROD, page C-22). They were "selected to provide opportunities for innovation, provide examples in major physiographic provinces, and provide a range of technical challenges, from an emphasis on restoration of late-successional forest conditions and riparian zones to integration of commercial timber harvest with ecological objectives" (ROD, page C-22).

Table 7 displays bull trout habitat amounts located within the Adaptive Management Areas (AMA) land allocation. For the complete GIS analysis, see Appendix 3.

Table 7. Adaptive Management Area Land Use Allocation.

	Klamath River DPS	Columbia River DPS	Costal Puget Sound DPS
Spawning Habitat (mi)	-	25.6 mi	0.1 mi
FMO Habitat (mi)	-	16.6 mi	11.3 mi
Total Habitat (mi)	-	42 mi	11 mi
Total Habitat as a % of DPS habitat within the NWFP area (excluding private lands)	-	5 %	1 %
Total Habitat within AMA in Key Watersheds	-	22 mi	2 mi
% of Total Habitat within AMA in Key Watersheds	-	53 %	21%

There are three AMAs within the range of the Coastal-Puget Sound and Columbia River DPSs, encompassing approximately 436,100 acres. The Olympic NF manages the

125,000 acre, Olympic AMA and the Mount Baker-Snoqualmie NF manages the Finney AMA (98,400 acres) and Snoqualmie Pass AMA (212,700 acres).

The descriptions of AMAs in the ROD reveal that AMAs provide the highest degree of management flexibility of all land allocations. According to the ROD S&Gs within AMAs can be changed through site-specific analysis. Therefore, it is very difficult to assess the risk of adverse effects to the bull trout and its proposed critical habitat.

To minimize adverse effects to listed species, the proposed action provides for an analytical process designed to evaluate, within the context of WA, potential localized and short-term impacts to the bull trout and proposed critical habitat. As described in the BA, resource values will be identified and potential impacts will be addressed during project design and the NEPA process, as well as during project-level ESA consultation. Through these analytical processes the physical and biological features that provide for the maintenance or creation, over time, of properly functioning freshwater aquatic habitat for the bull trout and its proposed critical habitat will be addressed, and this information will be used in the course of designing and implementing specific management activities.

Effects of Individual LRMP Protections

The ROD formally amended FS and BLM RMPs by the addition of new land allocations (ROD, page 6-7), and S&Gs (ROD, Attachment A, as well as in its entirety). These amending land allocations and S&Gs generally override those in existing plans; except for any provisions of the existing plans that are more protective (see ROD, pages 11-12).

The Gifford Pinchot, Olympic, Siuslaw, Wenatchee, Willamette, and Columbia River Gorge RMP's are listed in the 1997 Biological Assessment prepared by the Forest Service and the Bureau of Land Management for RMPs in the NWFP area of Oregon and Washington, except for the coastal Oregon area, as including more stringent protections than the ROD. For other land management units within the range of the bull trout, no additional analysis was completed for this proposed action indicating whether other administrative units have additional or more stringent protective measures than the NWFP in their RMPs. The BA states that "the FS and BLM believe the RMPs have not materially changed since the issuance of the (2000) Plan-level BOs" (BA, Page 10). The Service analyzed these more stringent protections in the 2000 BO (pages 72-74). Although critical habitat for the bull trout was not proposed at the time, the 2000 BO analysis addresses relevant aspects of bull trout habitat. The analysis on the additional protection identified in the 2000 BO is hereby incorporated by reference.

Overall, additional RMP specific S&Gs are positive in terms of reducing potential adverse effects to the bull trout and its proposed critical habitat. The Service's analysis from the 2000 BO indicated that there were few S&Gs that were more stringent than those provided in the ROD.

Overall Effects Summary

1. Implementation of the ACS to meet the ACS Objectives should result in maintaining or restoring properly functioning aquatic ecosystem conditions within the NWFP area that will benefit the bull trout and its proposed critical habitat.

2. The overall intent of the ACS is generally beneficial to the bull trout and its proposed critical habitat. However, the level of protection afforded the bull trout and its proposed critical habitat under the proposed action is expected to vary given the range of existing conditions across the NWFP area and the variety of management activities that are implemented. Activities consistent with the ACS may adversely affect or be beneficial to the bull trout or its proposed critical habitat at multiple temporal and spatial scales.

3. Key watersheds are expected to provide refugia for the bull trout. As long as Key Watersheds are managed as refugia for the species, the effects of management activities that are implemented under the proposed action should be neutral or beneficial in the long-term to the bull trout and its proposed critical habitat in these areas.

4. Management direction established under the proposed action that requires completion of WAs (and establishes the expectation for periodically updating them) should benefit the conservation of the bull trout if those analyses adequately address bull trout habitat requirements at multiple scales and that information is used to design management activities that are implemented pursuant to the proposed action.

5. Watershed restoration should be beneficial to the bull trout and its proposed critical habitat. The BA indicates many projects have been implemented since the inception of the NWFP. However, the effectiveness of these projects relative to the bull trout and its proposed critical habitat has not been measured.

6. To the degree that Riparian Reserves are managed to provide primary emphasis to riparian-dependent species, and to the extent that past management actions have not compromised the ability of the Riparian Reserves to provide for essential aquatic habitat features, Riparian Reserves are expected to benefit the bull trout and its proposed critical habitat.

7. In general, the S&Gs provide limitations, restrictions, and directions to land managers regarding how to implement a project. These standards should minimize adverse effects to the bull trout and its proposed critical habitat, although the potential for adverse effects occurring still remains high in some land use allocations for certain management activities.

8. Under the proposed action, compliance with Riparian Reserve S&Gs that refer to the ACS Objectives requires project modification only when adverse effects are predicted at

the 5th field watershed or larger scales. Analyses at this broad scale may not detect adverse effects to local areas that are important to the conservation of the bull trout and its proposed critical habitat. To minimize adverse effects to listed species or proposed critical habitat, the proposed action provides for an analytical process designed to evaluate, at multiple temporal and spatial scales and within the context of WA, potential localized and short-term impacts to listed aquatic species, including the bull trout and its proposed critical habitat. As described in the BA, resource values would be identified and potential impacts will be addressed during project design and the NEPA process, as well as during project-level ESA consultation under the Act. Through these analytical processes, the physical and biological features that provide for the maintenance or creation, over time, of properly functioning freshwater aquatic habitat for the bull trout and its proposed critical habitat will be addressed, and this information will be used in the course of designing and implementing specific management activities.

CUMMULATIVE EFFECTS

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

Based on the Service’s GIS analysis in Appendix 3, non-Federal lands encompass about 47%, 64%, and 30% of the Columbia River, Coastal Puget Sound, and Klamath River DPSs, respectively, within the Action Area. Of the total amount of bull trout spawning and rearing habitat in the Action Area, about a quarter to one-third occurs on non-Federal lands (CRBT = 30%; CPSBT = 34%; KRBT = 23%). The majority of bull trout habitat on non-Federal lands is FMO habitat.

The NWFP FSEIS (USDA & USDI 1994a) presents an overview of management on non-Federal lands adequate to allow certain assumptions to be made regarding the probable fate of habitat for listed species on non-Federal lands within the range of the northern spotted owl. Late successional forests continue to be harvested on non-Federal lands throughout the range of the owl; however, to varying degrees, compliance with the ESA’s section 9 take prohibition would be expected to result in the maintenance of minimal habitat around centers of activity of known northern spotted owls. This could be a benefit where these areas occur in watersheds inhabited by the bull trout.

Permits authorized under section 10(a)(1) of the Act, may be issued to carry out otherwise prohibited activities involving endangered and threatened wildlife under certain circumstances. Permits are available for scientific purposes to enhance the propagation or survival of a species and for incidental "take" (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a listed species) in connection with otherwise lawful activities. Private landowners seeking permits for incidental take offer a means of protecting bull trout habitat through the voluntary development of Habitat Conservation Plans and Safe Harbor Agreements.

The Service considers HCPs to be one of the most important methods through which non-Federal landowners can resolve endangered species conflicts. To date, the Plum Creek I-90 and Washington Department of Natural Resources are two approved HCPs that will affect bull trout habitat within the NWFP areas of the Columbia River DPS. Similar to these two examples, there will likely be several other HCPs developed in the future that encompass important bull trout habitat. Furthermore, any incidental take permit issuance will be subject to section 7 consultation.

Safe Harbor Agreements between the Service and non-Federal landowners are another voluntary mechanism to encourage conservation of listed species and authorize incidental take permits. In general, these agreements provide (1) conservation benefits for listed species that would otherwise not occur except for the agreement, and (2) Endangered Species Act regulatory assurances to the landowner through a section 10 permit. Safe Harbor Agreements are intended for landowners who have few or no listed species (or listed species' suitable habitat) on their property, but who would be willing to manage their property in such a way that listed species may increase on their lands, as long as they are able to conduct their intended land-use activities. The landowner would receive a section 10 permit authorizing incidental take of bull trout consistent with the agreed upon conservation measures in the Safe Harbor Agreement. Safe Harbor Agreements for bull trout may be developed in the future.

As described in the "Ongoing Conservation Measures" in Appendix 1 of this document, several state conservation activities are expected to continue. The state of Oregon has taken several actions to address the conservation of the bull trout. The Oregon Plan for Salmon and Watersheds, more restrictive angling regulations and numerous individual outreach and research projects are expected to continue and provide conservation benefits to the bull tout. The State of Washington's draft Statewide Strategy to Recover Salmon, Extinction is not an Option, Salmon Recovery Act, Washington Forest Practices Board emergency rules, and several research and monitoring programs are also expected to continue and provide benefits to listed aquatic species, including the bull trout.

Virtually all late-successional forests on private lands in Washington and Oregon are targeted for harvest, and continuing harvest activities will impact bull trout through habitat reduction and fragmentation. Isolated bull trout subpopulations surviving in fragmented habitats on non-Federal lands may be subject to an increased risk of extirpation from stochastic events or from competition and predation from non-native species. The ability of the landscape to provide connectivity will decline. Increased road densities and human disturbance will adversely affect or further fragment bull trout subpopulations. If critical habitat is designated on non-Federal land, it receives consideration under section 7 of the Act with regard to actions carried out, authorized, or funded by a Federal agency. As such, designation may affect non-Federal lands only where such a Federal nexus exists.

Future non-timber development is another activity that could also accumulate adverse impacts that would further exacerbate degraded or fragmented habitat conditions for the bull trout. Many Washington and Oregon lands that were historically utilized for timber production are now being converted into housing and urban developments. It is reasonable to assume that some areas of bull trout habitat, especially migratory corridors between subpopulation strongholds, will eventually be converted, or in many cases further converted in this way. This urbanization can create a more lasting effect on streams than timber harvest activities due to the severity and permanence of the impacts. The increase in impervious surfaces in conjunction with non-point source pollution associated with development will drastically alter water quality and quantity of urban streams.

Additional non-timber activities include valuable materials extraction, oil and gas exploration, grazing, urban and rural development, recreational site construction and use, grazing, and right-of-way developments such as powerlines and pipelines. Riparian degradation, aquatic degradation, and expanded road construction and use resulting from these non-timber resource activities are impacts with the potential to adversely impact the bull trout.

Proper management of non-Federal lands is important to the conservation of bull trout because these lands encompass a large percentage of each DPS within the Action Area. Given the trend in land use activities on non-Federal lands, the future condition of the bull trout and its proposed critical habitat on non-Federal lands within the Action Area is uncertain. According to the 1994 FSEIS, page 3&4-203, “If measures are not taken to improve management practices on state and private lands, options for Federal land management may become more limited.”

CONCLUSION

After reviewing the current status of the bull trout, proposed bull trout critical habitat, the environmental baseline for the action area, the effects of the proposed action and cumulative effects, it is the Service's Biological/Conference Opinion that the continued implementation of BLM and FS RMPs in the NWFP area, as amended by the 1994 NWFP ROD and the 2003 FSEIS, is not likely to jeopardize the continued existence of the bull trout, and is not likely to destroy or adversely modify proposed critical habitat.

The Service reached this conclusion for the following reasons:

Reasons Common to all DPSs

As stated in the BA, the proposed action provides for an analytical process designed to evaluate, within the context of WA, potential localized and short-term impacts to the bull trout and its proposed critical habitat. As described in the BA, resource values will be identified and potential impacts will be addressed during project design and the NEPA process, as well as during project-level consultation under the Act. Through these analytical processes the physical and biological features that provide for the maintenance or creation, over time, of properly functioning freshwater aquatic habitat for the bull trout and its proposed critical habitat will be addressed, and this information will be used in the course of designing and implementing specific management activities throughout the range of bull trout DPSs within the NWFP area. Adequate consideration of this information is especially important given the status and trends of bull trout habitat on non-Federal lands within the Action Area. Adequate consideration of this information in the development of specific management actions should also help to provide for properly functioning bull trout habitat in non-Key Watershed areas.

Columbia River DPS

1. About 65% of bull trout habitat on Federal lands in the NWFP area within this DPS lies within Key Watersheds that will be managed as refugia. As noted on page B-18 of the ROD, "Refugia are a cornerstone of most species conservation strategies. They are designated areas that either provide, or are expected to provide, high quality habitat. A system of Key Watersheds that serve as refugia is crucial for maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species. These refugia include areas of high quality habitat as well as areas of degraded habitat. Key Watersheds with high quality conditions will serve as anchors for the potential recovery of depressed stocks. Those of lower quality habitat have a high potential for restoration and will become future sources of high quality habitat with the implementation of a comprehensive restoration program…" Based on this management direction, it is anticipated that the proposed action will provide for properly functioning aquatic habitat over the majority of Columbia River bull trout distribution within the NWFP area.

2. The majority of this DPS's habitat within the NWFP area lies within relatively protective land use allocations (LSRs, 38%, and Congressionally Reserved Areas, 21%, Administratively Withdrawn Area, 11%, and Riparian Reserves, 100%).

Coastal-Puget Sound DPS

1. About 38% of bull trout habitat on federal lands in the NWFP area within this DPS lie within Key Watersheds that will be managed as refugia (see discussion above). Based on this management direction, it is anticipated that the proposed action will provide for properly functioning aquatic habitat over a third of Coastal-Puget Sound bull trout distribution within the NWFP area.

2. The majority of this DPS's habitat within the NWFP area lies within relatively protective land use allocations (LSRs, 34%, Congressional Reserved Areas, 56%, and Riparian Reserves, 100%).

Klamath DPS

1. About 37% of bull trout habitat on federal lands in the NWFP area within this DPS lies within Key Watersheds that will be managed as refugia (see discussion above). Based on this management direction, it is anticipated that the proposed action will provide for properly functioning aquatic habitat over a third of Klamath bull trout distribution within the NWFP area.

2. The majority of this DPS's habitat within the NWFP area lies within relatively protective land use allocations (LSRs, 26%, Congressionally Reserved Areas, 62%, and Riparian Reserves, 100%).

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 attempt to engage in any such conduct. Harm is further defined by Service regulations to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering (50 CFR 17.3). Harass is defined by Service regulations as intentional or negligent actions that create the likelihood of injury to listed wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering (50 CFR 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, carrying out 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 a prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement.

Amount or Extent of Take

In the preceding "Effects of the Action" section we determined that there is the potential for adverse biological effects to the bull trout associated with projects developed in accordance with the standards, guidelines, management direction, and other governing criteria set forth in the proposed action. However, for the reasons explained in the "Effects of the Action" section, we are unable to determine, at the plan level, the likelihood or quantity of such effects that may conform to the regulatory definition of take. Therefore, any such incidental take will be addressed through project-level consultations.

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 that can be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and data bases. The Service has the following recommendations:

1. Connectivity. The FS and BLM should seek to restore or improve connectivity within and between isolated sub-populations of the bull trout, through all feasible means, except in cases where the risks of non-native species introductions (e.g., lake trout, brook trout)

override the risks of continued population isolation. Cooperative efforts with other State, tribal, and non-Federal land owners should be sought to achieve this objective.

2. Roads. The ROD requirement that no new roads be constructed in remaining RARE II roadless areas within Key watersheds should be strictly adhered to. The FS and BLM should emphasize interpreting the S&Gs for roads in Key Watersheds to actively seek net road reductions in bull trout watersheds, rather than the allowable interpretation of “where funding is not available...achieve no net increase” in roads. As indicated in Lee et al. (1997), overall watershed road densities of less than 1.0 miles per square mile may be necessary, in the long-run, to maintain viable well-distributed bull trout populations on Federal lands within the NWFP area. Strategies to reduce road densities should focus on the highest priority road impacts within a given geographic area. Focusing on reducing or eliminating high priority road impacts should insure that incremental road density reductions result in the highest proportional level of road-related impact reduction.

3. Watershed Analysis. Completing watershed analysis in existing NWFP Key Watersheds and non-Key Watersheds containing bull trout, should be a high priority. Project decisions should be guided by the results of watershed analysis.

4. Restoration Strategies. As part of watershed analyses, road inventories and other appropriate information should be used to collaborate with NOAA Fisheries and the Service in developing watershed-specific restoration strategies. Restoration strategies should be used to identify key processes needing attention, prioritize key locations and project types, address implementation and scheduling issues and provide a preliminary estimate of costs. Theses strategies will serve as the primary framework for implementation of integrated restoration activities.

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

REINITIATION NOTICE

This concludes formal consultation on the proposed action. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; 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.

Please contact me or Dave Wesley, Deputy Regional Director, at (503) 231-6118 if you have any questions regarding this opinion.

Sincerely,

Regional Director

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Appendix 1. Additional Information on the Rangewide Status of the Bull Trout

Listing History

On June 10, 1998, the Service issued a final rule listing the Columbia River and Klamath River populations of bull trout as threatened (63 FR 31647) under the authority of the Endangered Species Act of 1973. This decision conferred full protection of the Endangered Species Act on bull trout occurring in four northwestern States. The Jarbidge River population was listed as threatened on April 8, 1999 (64 FR 17110). The Coastal-Puget Sound and St. Mary-Belly River populations were listed as threatened on November 1, 1999 (64 FR 58910), which resulted in all bull trout in the coterminous United States being listed as threatened. The five populations discussed above are listed as distinct population segments, *i.e.*, they meet the joint policy of the U.S. Fish and Wildlife Service and NOAA Fisheries regarding the recognition of distinct vertebrate populations (61 FR 4722).

The Service proposed to designate critical habitat for the bull trout on November 29, 2002 (67 FR 71235).

Physical Description

The bull trout is a long slender fish with a large head and jaws relative to its body-size. Its tail fin is only slightly forked, and even less so in young fish. Bull trout coloration can be variable, but generally, the body's background color is gray infused with green. Bull trout found in lakes may be silvery grey. The body is covered with small white and/or pale yellowish spots with intermingling pink or red spots that not be always be present. The ventral region can range from white to orange. Bull trout typically have 15-19 gill rakers, 63-66 vertebrae, and 22-35 pyloric caeca. Bull trout of large size can be differentiated from Dolly Varden with bull trout having a larger head and jaws in addition to the head being more flat. Bull trout have spotless fins with the lower fins having white anterior borders. The spotless fin characteristic of bull trout is often used by fisheries agencies to help promote angler identification of bull trout versus other fish, such as brook trout (*Salvelinus fontinalis*)(Behnke 2002).

Taxonomy

The bull trout (*Salvelinus confluentus*, family Salmonidae) is a char native to the Pacific Northwest and western Canada, first described as *Salmo spectabilis* by Girard in 1856 from a specimen collected on the lower Columbia River, and subsequently described as *Salmo confluentus* and *Salvelinus malma* (Cavender 1978). Bull trout and Dolly Varden (*Salvelinus malma*) were previously considered a single species (Bond 1992; Cavender 1978). Cavender (1978) presented morphometric, meristic, osteological, and distributional evidence to document specific distinctions between Dolly Varden and bull trout. Bull trout and Dolly Varden were formally recognized as separate species by the American Fisheries Society in 1980 (Robins *et al.* 1980). Although bull trout and Dolly Varden co-occur in several northwestern Washington river drainages, there is little evidence of introgression (Haas & McPhail 1991), and the two species appear to be maintaining distinct genomes (Kanda *et al.* 1997; Leary *et al.* 1993; Spruell & Allendorf 1997; Williams *et al.* 1995). Lastly, the bull trout and the Dolly Varden each appear to be more closely related genetically to other species of *Salvelinus* than they are to each other (Phillips *et al.* 1989, Greene *et al.* 1990, Phillips *et al.* 1995). For example, the bull trout is most closely related to the Japanese char (*S. leucomaenis*) whereas the Dolly Varden is most closely related to the Arctic char (*S. alpinus*).

Distribution

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

Distinct Population Segments and Population Units

Population units of bull trout exist in which all fish share an evolutionary legacy and which are significant from an evolutionary perspective (Spruell *et al.* 1999). These population units can range from a local population to multiple populations, and theoretically should represent a DPS. Although such population units are difficult to characterize, genetic data have provided useful information on bull trout population structure. For example, genetic differences between the Klamath River and Columbia River populations of bull trout were revealed in 1993 (Leary *et al.* 1993). The boundaries of the five listed DPSs of bull trout are based largely on this 1993 information.

Since the bull trout was listed, additional genetic analyses have suggested that its populations may be organized on a finer scale than previously thought. Data have revealed genetic differences between coastal populations of bull trout, which includes the lower Columbia River and Fraser River, and inland populations in the upper Columbia River and Fraser River drainages (Williams *et al.* 1997, Taylor *et al.* 1999). There is also an apparent genetic differentiation between inland populations within the Columbia River basin. This differentiation occurs between the (a) mid-Columbia River (John Day, Umatilla) and lower Snake River (Walla Walla, Clearwater, Grande Ronde, Imnaha rivers, etc.) populations and the (b) upper Columbia River (Methow, Clark Fork, Flathead River, etc.) and upper Snake River (Boise River, Malheur River, Jarbidge River, etc.) populations (Spruell *et al.* 2000; Paul Spruell, University of Montana, pers. comm., 2002). Genetic data indicate that bull trout inhabiting the Deschutes River drainage of Oregon are derived from coastal populations and not from inland populations in the

Columbia River basin (Leary *et al.* 1993, Williams *et al.* 1997, Spruell and Allendorf 1997, Taylor *et al.* 1999, Spruell *et al.* 2000). In general, evidence since the time of listing suggests a need to further evaluate the distinct population segment structure of bull trout DPSs.

In the rules listing bull trout as threatened, the Service identified subpopulations (*i.e.*, isolated groups of bull trout thought to lack two-way exchange of individuals), for which status, distribution, and threats to bull trout were evaluated. Because habitat fragmentation and barriers have isolated bull trout throughout their current range, a subpopulation was considered a reproductively isolated group of bull trout that spawns within a particular river or area of a river system. Overall, 187 subpopulations were identified in the 5 distinct population segments, 7 in the Klamath River, 141 in the Columbia River, 1 in the Jarbidge River, 34 in the Coastal-Puget Sound, and 4 in the St. Mary-Belly River populations.

Life History

Bull trout exhibit both resident and migratory life-history strategies (Rieman & McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear one to four years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley & Shepard 1989; Goetz 1989), or in certain coastal areas, to saltwater (anadromous) (Cavender 1978; McPhail & Baxter 1996; WDFW 1997). Resident and migratory forms may be found together, and either form may give rise to offspring exhibiting either resident or migratory behavior (Rieman & McIntyre 1993). The size and age of bull trout at maturity depends upon life-history strategy. Resident fish tend to be smaller than migratory fish at maturity and produce fewer eggs (Fraley & Shepard 1989; Goetz 1989). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Fraley & Shepard 1989; Leathe & Graham 1982; Pratt 1992; Rieman & McIntyre 1996).

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

Migratory corridors link seasonal habitats for all bull trout life histories. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley & Shepard 1989), and resident bull trout in tributaries of the Bitterroot River move downstream to overwinter in tributary pools (Jakober 1995). The ability to migrate is important to the persistence of bull trout (Gilpin 1997; Rieman & Clayton 1997; Rieman & McIntyre 1993). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed, or stray, to non natal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants.

Bull trout are found primarily in cold streams, although individual fish are found in larger, warmer river systems throughout the Columbia River basin (Buchanan & Gregory 1997; Fraley & Shepard 1989; Rieman & Clayton 1997; Rieman & McIntyre 1993; Rieman & McIntyre 1995). Water temperature above 15 degrees Celsius (59 degrees Fahrenheit) is believed to limit bull trout distribution, a limitation that may partially explain the patchy distribution within a watershed (Fraley & Shepard 1989; Rieman & McIntyre 1995). Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Baxter & McPhail 1999; Pratt 1992; Rieman & Clayton 1997; Rieman & McIntyre 1993). Goetz (1989) suggested optimum water temperatures for rearing of about 7 to 8 degrees Celsius (44 to 46 degrees Fahrenheit) and optimum water temperatures for egg incubation of 2 to 4 degrees Celsius (35 to 39 degrees Fahrenheit). For Granite Creek, Idaho, Bonneau and Scarnecchia (1996) (Bonneau & Scarnecchia 1996)observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 to 9 degrees Celsius (46 to 48 degrees Fahrenheit), within a temperature gradient of 8 to 15 degrees Celsius (46 to 60 degrees Fahrenheit). In Nevada, adult bull trout have been collected at 17.2 degrees Celsius (63 degrees Fahrenheit) in the West Fork of the Jarbidge River (Werdon 1998) and have been observed in Dave Creek where maximum daily water temperatures were 17.1 to 17.5 degrees Celsius (62.8 to 63.6 degrees Fahrenheit)(Werdon 2001). In the Little Lost River, Idaho, bull trout have been collected in water having temperatures up to 20 degrees Celsius (68 degrees Fahrenheit); however, these fish made up less than 50 percent of all salmonids when maximum summer water temperature exceeded 15 degrees Celsius (59 degrees Fahrenheit) and less than 10 percent of all salmonids when temperature exceeded 17 degrees Celsius (63 degrees Fahrenheit) (Gamett 1999).

All life-history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley & Shepard 1989; Goetz 1989; Hoelscher & Bjornn. 1989; Pratt 1992; Rich 1996; Sedell & Everest 1991; Sexauer & James 1997; Thomas 1992; Watson & Hillman 1997). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that suitable winter habitat may be more restricted than summer habitat (Jakober 1995). Maintaining bull trout habitat requires stability of stream channels and of flow stability (Rieman & McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer & James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered streamflow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley & Shepard 1989; Pratt 1992; Pratt & Huston 1993).

Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel(Fraley & Shepard 1989) and water temperatures of 5 to 9 degrees Celsius (41 to 48 degrees Fahrenheit) in late summer to early fall (Goetz 1989). In the Swan River, Montana, abundance of bull trout redds (spawning areas) was positively correlated with the extent of bounded alluvial valley reaches, which are likely areas of groundwater to surface water exchange (Baxter *et al.* 1999). Survival of bull trout embryos planted in stream areas of groundwater upwelling used by bull trout for spawning were significantly higher than embryos planted in areas of surface-water recharge not used by bull trout for spawning (Baxter & McPhail 1999). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence (Pratt 1992). Bull trout typically spawn from August to November during periods of decreasing water temperatures. Water temperatures during spawning generally range from 4 to 10 degrees Celsius (39 to 51 degrees Fahrenheit). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989) (Pratt 1992; Rieman & McIntyre 1996). Migratory bull trout frequently begin spawning migrations as early as April and have been known to move upstream as far as 250 kilometers (155 miles) to spawning grounds in Montana (Fraley & Shepard 1989; Swanberg 1997). In Idaho, bull trout moved 109 kilometers (67.5 miles) from Arrowrock Reservoir to spawning areas in the headwaters of the Boise River (Flatter 1998). In the Blackfoot River, Montana, bull trout began spring migrations to spawning areas in response to increasing temperatures (Swanberg 1997). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence of fry may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992; Ratliff & Howell 1992).

Growth varies depending upon life-history strategy. Resident adults range from 150 to 300 millimeters (6 to 12 inches) total length, and migratory adults commonly reach 600 millimeters (24 inches) or more (Goetz 1989; Pratt 1985). The largest verified bull trout is a 14.6-kilogram (32-pound) specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson & Wallace 1982).

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, and small fish (Boag 1987; Donald & Alger 1993; Goetz 1989). Adult migratory bull trout feed on various fish species (Brown 1992; Donald & Alger 1993; Fraley & Shepard 1989; Leathe & Graham 1982). In coastal areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) in the ocean (WDFW 1997).

Population Dynamics

Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders *et al.* 1991). Burkey (1989) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth for local populations may be low and probability of extinction high (Burkey 1989, 1995).

Metapopulation concepts of conservation biology theory have been suggested relative to the distribution and characteristics of bull trout, although empirical evidence is relatively scant (Rieman and McIntyre 1993, Dunham and Rieman 1999; Rieman and Dunham 2000). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994). For inland bull trout, metapopulation theory is likely most applicable at the watershed scale where habitat consists of discrete patches or collections of habitat capable of supporting local populations; local populations are for the most part independent and represent discrete reproductive units; and long-term, low rate dispersal patterns among component populations influences the persistence of at least some of the local populations (Rieman and Dunham 2000). Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely. However, habitat alteration, primarily through the construction of impoundments, dams, and water diversions has fragmented habitats, eliminated migratory corridors, and in many cases isolated bull trout in the headwaters of tributaries (Rieman *et al.* 1997b, Dunham and Rieman 1999, Spruell *et al.* 1999, Rieman and Dunham 2000). Accordingly, human-induced factors as well as natural factors affecting bull trout distribution have likely limited the expression of the metapopulation concept for bull trout to patches of habitat within the overall distribution of the species (Dunham and Rieman 1999). However, despite the theoretical fit, the relatively recent and brief time period during which bull trout investigations have taken place does not provide certainty as to whether a metapopulation dynamic is occurring (e.g., a balance between local extirpations and recolonizations) across the range of bull trout or whether the persistence of bull trout in large or closely interconnected habitat patches (Dunham and Rieman 1999) is simply reflective of a general deterministic trend towards extinction of the species where the larger or interconnected patches are relics of historically wider distribution (Rieman and Dunham 2000). Recent research (Whiteley *et al.*2003) does, however, provide stronger genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River basin of Idaho.

Reasons for Decline

Bull trout distribution, abundance, and habitat quality have declined rangewide (Bond 1992; IDFG 1995; McPhail & Baxter 1996; Newton & Pribyl 1994; Rieman & McIntyre

1993; Schill 1992; Thomas 1992; Ziller 1992). Several local extirpations have been documented, beginning in the 1950's (Berg & Priest 1995; Buchanan *et al.* 1997; Donald & Alger 1993; Goetz 1994; Light *et al.* 1996; Newton & Pribyl 1994; Ratliff & Howell 1992; Rode 1990; WDFW 1998). Bull trout were extirpated from the southernmost portion of their historic range, the McCloud River in California, around1975 (Moyle 1976; Rode 1990). Bull trout have been functionally extirpated (*i.e.*, few individuals may occur there but do not constitute a viable population) in the Coeur d'Alene River basin in Idaho and in the Lake Chelan and Okanogan River basins in Washington (USFWS 1998). These declines result from the combined effects of habitat degradation and fragmentation, the blockage of migratory corridors; poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion or other device) into diversion channels and dams, and introduced non-native species. Specific land and water management activities that depress bull trout populations and degrade habitat include dams and other diversion structures, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development (Beschta *et al.* 1987; Chamberlain *et al.* 1991; Craig & Wissmar 1993; Frissell 1993; Furniss *et al.* 1991; Henjum *et al.* 1994; Light *et al.* 1996; MBTSG 1995a, b, c, d, e, 1996b, c, d, e, f, h; McIntosh *et al.* 1994; Meehan 1991; Nehlsen *et al.* 1991; Sedell & Everest 1991; USDA & USDI 1995, 1996, 1997; Wissmar *et al.* 1994).

Habitat Fragmentation

Migratory corridors allow individuals access to alternative suitable habitats, foraging areas, and refuges from disturbances (Saunders *et al.* 1991). Maintenance of migratory corridors for bull trout is essential to provide for the potential of connectivity and occasional genetic exchange among local populations, and enables the potential reestablishment of extirpated populations. Where migratory bull trout are not present, isolated populations cannot be replenished when a disturbance makes local habitats unsuitable (Rieman and McIntyre 1993, USDA and USDI 1997).

Isolation and habitat fragmentation resulting from migratory barriers have negatively affected bull trout by: (1) reducing geographical distribution; (2) increasing the probability of losing individual local populations (Rieman and McIntyre 1993); (3) increasing the probability of hybridization with the introduced brook trout (Rieman and McIntyre 1993); (4) reducing the potential for movements in response to developmental, foraging, and seasonal habitat requirements (MBTSG 1998); and (5) reducing reproductive capability by eliminating the larger, more fecund migratory form from many sub-populations (MBTSG 1998, Rieman and McIntyre 1993). Restoring connectivity among local populations and restoring the occurrence of the migratory form is an important factor in providing for the survival and recovery of bull trout. The manner and degree to which individual dams and diversions affect specific bull trout local populations is likely to vary depending on the specific physical factors at play and the demographic attributes of the local population in question.

Dams

Dams affect bull trout by altering habitats; flow, sediment, and temperature regimes; migration corridors; and creating additional interspecific interactions, mainly between bull trout and non-native species (Bodurtha 1995; Craig & Wissmar 1993; Rieman & McIntyre 1993; Rode 1990; WDW 1992; Wissmar *et al.* 1994) (USDA & USDI 1996, 1997). Impassable dams have caused declines of bull trout by preventing migratory fish from reaching spawning and rearing areas in headwaters and recolonizing areas where bull trout have been extirpated (MBTSG 1998; Rieman & McIntyre 1993).

The extirpation of bull trout in the McCloud River basin, California, has been attributed primarily to construction and operation of McCloud Dam, which began operation in 1965 (Rode 1990). McCloud Dam flooded bull trout spawning, rearing, and migratory habitats. The dam also resulted in elevated water temperatures.

Although dams negatively affect bull trout (Gilpin 1997; Rieman & McIntyre 1993), some dams can benefit bull trout by blocking introduced non native species from upstream areas (MBTSG 1995d). Some dams also increase the potential forage base for bull trout by creating reservoirs that support prey species (Faler & Bair 1991; Pratt 1992).

Some of the major effects to bull trout resulting from the Federal Columbia River Power System and from operation of other hydropower, flood control, and irrigation diversion facilities (see also Agricultural Practices) include the following:(1) fish passage barriers, (2) entrainment of fish into turbine intakes and irrigation canals, (3) inundation of fish spawning and rearing habitat, (4) modification of streamflows and water temperature regimes, (5) dewatering of shallow water zones during power peaking operations, (6) reduced productivity in reservoirs, (7) periodic gas supersaturation of waters downstream of dams, (8) water level fluctuations interfering with retention of riparian vegetation along reaches affected by power peaking operations, (9) establishment of non-native riparian vegetation along reaches affected by power peaking operations, and (10) severe reductions in reservoir levels to accommodate flood control operations.

Hungry Horse, Libby, Albeni Falls, Dworshak, Chief Joseph, Keechelus, Tieton, and Grand Coulee dams, as well as others in the Columbia River basin and throughout the range of bull trout in the coterminous United States, were built without fish passage facilities and are barriers to bull trout migration. These barriers have contributed to the isolation of local populations of migratory bull trout. The lower Snake, middle Columbia, and lower Columbia River hydropower projects have both adult and juvenile fish passage facilities, but these fishways were designed specifically for anadromous salmonids, not for resident fish such as bull trout. The designs, therefore, address the migration needs of anadromous, primarily semelparous (*i.e.*, fish that spawn only once in a lifetime) of the genus *Oncorhynchus* (except steelhead, which in some instances can spawn more than once in a lifetime), but do not include consideration for iteroparous fish (*i.e.*, those that can spawn more than once), or fish that merely wander both upstream and downstream as adults to forage. Bull trout have been observed using upstream fish passage facilities at many of the hydropower projects on the Snake and Columbia rivers.

However, as indicated above, even dams with fish passage facilities may be a factor in isolating bull trout local populations if they are not readily passable by bull trout and/or if the dams do not provide an adult downstream migration route.

Entrainment of bull trout may also occur at various projects in the Columbia River basin including Libby, Hungry Horse, Albeni Falls, Rocky Reach, Rock Island, Wells, Dworshak, Bonneville, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams. Fish can be killed or injured when passing the dams. Potential passage routes include through spill, the turbines, or the juvenile bypass systems, but the relative passage success of these routes for adult salmonids has not been thoroughly investigated. However, one study conducted in the early 1970's revealed that passage through turbines resulted in a 22 to 41 percent mortality rate for adult steelhead (Wagner 1973). Additionally, a 40 to 50 percent injury rate for adult salmonids passing through the juvenile fish bypass system at McNary Dam has been noted (Wagner & Hinson 1993; Wagner 1991). Adult bull trout may experience similar mortality rates. In addition, those adult fish that survive passage at projects that do no have upstream passage facilities are isolated in downstream reaches away from their natal (native) streams. As indicated above, the loss of these larger, more fecund migratory fish is detrimental to their natal populations.

The creation of mainstem Columbia and Snake river pools (*i.e.*, the areas of slow moving water behind the dams) combined with introductions of piscivorous species (*e.g.*, bass, walleye) have also affected the habitat of bull trout and salmonids. An increase in predator populations, both native (*e.g.*, northern pikeminnow) and non-native, as a result of creating artificial habitat and concentrating prey may be a factor in the decline of listed Snake River salmon species (NMFS 1991a, b, c). Ideal predator foraging environments have been created in these pools, particularly for warm water species in the summer. Smolts that pass through the projects are subjected to turbines, bypasses, and spillways, which may result in disorientation and increased stress, conditions that reduce their ability to avoid predators below the dams. Creation of the pools above the dams has resulted in low water velocities that increase smolt travel time and increase predation opportunity. Increased water temperatures, also a result of the impoundment of the river, have also been shown to increase predation rates on salmonid smolts (Viggs & Burley 1991). Because bull trout are apex (top) predators of other fish, negative effects to the salmonid smolt prey base, and the resulting decline in adult returns, are likely to affect bull trout negatively as well. Additionally, increased water temperatures, influenced by the presence of dams, also decreases the suitability of the lower Snake and Columbia river pools for bull trout in the late spring through early fall.

Uncontrolled spill, or even high levels of managed spill, at hydropower projects can produce extremely high levels of total dissolved gas that may impact bull trout and other species. These high levels of gas supersaturation can cause gas bubble disease trauma in fish. Gas bubble disease is caused by gas being absorbed into the bloodstream of fish during respiration. Effects can range from temporary debilitation to mortality, and supersaturation can persist for several miles below dams where spill occurs. The states of Oregon and Washington have established a 111 percent total dissolved gas level as State water quality standards. However, total dissolved gas levels of up to 120 percent have been experienced during recent years of managed spill in the Federal Columbia River Power System, with involuntary spill episodes resulting in total dissolved gas levels of as high as 140 percent at some sites (NMFS 2000). At levels near 140 percent, gas bubble disease may occur in over 3 percent of fish exposed. At levels of up to 120 percent the incidence of gas bubble disease decreases to a maximum of 0.7 percent of fish exposed (NMFS 2000).

Manipulated flow releases from storage projects alter the natural flow regime, affect water temperature, and have the potential to destabilize downstream streambanks, alter the natural sediment and nutrient loads, and cause repeated and prolonged changes to the downstream wetted perimeter (MBTSG 1998). Power peaking operations, which change the downstream flow of the river on a frequent basis, cause large areas of the river margins to become alternately wet and then dry, adversely affecting aquatic insect survival and production (Hauer & Stanford. 1997). Changes in water depth and velocity as a result of rapid flow fluctuations, and physical loss or gain of wetted habitat, can cause juvenile trout to be displaced, thus increasing their vulnerability to predation. Additionally, rapid flow reductions can strand young fish if they are unable to escape over and through draining or dewatered substrate. These effects also indirectly adversely affect bull trout by degrading the habitat of their prey (small fish) and the food upon which they depend (aquatic insects).

Reservoirs created by dams have also inundated bull trout habitat. For example, reservoirs created by the construction of Libby and Hungry Horse dams have inundated miles of mainstem river and tributary habitat previously used by many local populations of bull trout (BPA *et al.* 1999). Reservoir water level manipulations can create migration barriers at the confluence of tributaries entering the reservoir, as well as negatively affecting littoral rearing habitats for prey species of bull trout. Reservoir levels are often drawn down substantially during drought years, or annually as operators evacuate flood control reservoirs to make room for spring snow melt runoff. Reduced volumes of water in reservoirs can affect their overall productivity, which may ultimately reduce the food base of predators such as bull trout. Some reservoir levels have periodically been reduced so severely that bull trout and other species have had to be physically removed and relocated to ensure their survival. Other reservoirs are unproductive and provide poor habitat for bull trout compared to natural riverine habitats (*e.g.*, Noxon and Cabinet Gorge). However, reservoirs such as Libby, Hungry Horse, and Dworshak now provide suitable habitat for adfluvial populations of bull trout that was not available prior to dam construction.

Forest Management Practices

Forest management activities, including timber extraction and road construction, affect stream habitats through a variety of impacts or alterations to watershed structural conditions and functional capacity. These include altering recruitment of large woody debris, erosion and sedimentation rates, runoff patterns, the magnitude of peak and low flows, water temperature, and annual water yield (Cacek 1989; Furniss *et al.* 1991;

Spence *et al.* 1996; Spencer & Schelske 1998; Swanson *et al.* 1998; Wissmar *et al.* 1994). Potential adverse effects also include introduction of pollutants (fuels, fertilizers, pesticides, and herbicides) into watercourses while conducting harvest, site preparation, and stand maintenance activities.

Activities that promote excessive substrate movement reduce bull trout production by increasing egg and juvenile mortality, and reducing or eliminating habitat (*e.g.*, pools filled with substrate) important to later life-history stages (Brown 1992; Fraley & Shepard 1989). The length and timing of bull trout egg incubation and juvenile development (typically more than 200 days during winter and spring) and the strong association of juvenile fish with stream substrate make bull trout vulnerable to changes in peak flows and timing that affect channels and substrate (Goetz 1989; MBTSG 1998; McPhail & Baxter 1996; Pratt 1992). Hydrologic changes that alter normal bedload movement and scour and fill patterns can excavate or bury redds, exposing eggs to stream flow, and trapping or crushing eggs or fry. Increasing levels of fine sediments affects developing eggs by filling interstitial spaces within stream substrate, reducing or eliminating water flow through the redd, supply of oxygen to developing eggs, removal of waste products, and may be sufficient to reduce or eliminate the ability of juvenile fish to emerge from the redd.

Hydrologic and sediment regimes can be altered by vegetation removal, site disturbance, and soil compaction associated with timber harvest. The nature and magnitude of these changes is moderated by local climatic, geologic, and topographic characteristics as well as re-vegetation patterns (Spence et al. 1996). Harvest and site preparation that disturbs soils such as tractor skidding, cable yarding, burning and scalping or scarification alter the ability of soils to accept water, increasing the potential for overland flow, and altering normal pathways for water entry to streams (Chamberlin et al. 1991). Canopy removal also alters the amount (Troendle and Olsen 1993), frequency, and intensity of precipitation delivery to forest floors. These disturbances may also lead to increased amounts of sediment introduced into streams and mobilization of sediments within the stream channel, moderated again by local conditions.

Bull trout require colder water temperatures than most salmonids and these requirements vary by life cycle stages. Timber harvest has the potential to affect stream temperatures primarily through reducing streamside canopy levels. The potential for riparian vegetation to mediate stream temperatures is greatest for small to intermediate size streams and diminishes as streams increase in size, lower in the floodplain (Spence et al. 1996). Generally, small and intermediate streams represent the majority of total aggregate stream length within a watershed (Chamberlin et al. 1991). Given these relationships, maintaining adequate canopy conditions on small and medium sized streams (including intermittent streams) is necessary to avoid altering natural temperature regimes.

Groundwater entering streams (especially small streams) may be an important determinant of stream temperatures (Spence et al. 1996) or may provide localized thermal refugia in larger stream systems. Where groundwater flows originate above the neutral zone (in general, 16-18 meters below the surface) groundwater temperatures will vary seasonally, as influenced by air temperature patterns (Spence et al. 1996). Timber harvest from upland areas exposes the soil surface to greater amounts of solar radiation than under forested conditions (Carlson and Groot 1997), elevating daytime temperatures of both air and soil (Fleming et al. 1998, Buckley et al. 1998, Morecroft et al. 1998) and increasing diurnal temperature fluctuations (Carlson and Groot 1997). Relationships between shallow source groundwater flows and air and soil temperatures indicate that harvest activities in upland areas may increase stream temperatures (depending on ambient air and soil temperatures), via increasing the temperature of shallow groundwater inflows. Other pathways for harvest actions to influence stream temperature include changing the volume and timing of peak flows, elevating suspended sediment levels, and altering channel characteristics (Chamberlin et al. 1991, Spence et al. 1996, USDA and USDI 1998).

Land management activities, including timber management, can alter processes that create and maintain riparian and aquatic habitats. This often results in reductions of habitat complexity and the diversity of aquatic species (Elmore and Beschta 1987, FEMAT 1993, USDA and USDI 1998). In watersheds containing bull trout, changes in habitat features associated with reductions in habitat complexity include decreases in: large woody debris, pool quality, channel stability, substrate quality, groundwater inflows, and suitable habitat serving as corridors between habitat patches (e.g. resulting from increases in water temperature [MBTSG 1998]).

Roads constructed for forest management are a prevalent feature on managed forested and rangeland landscapes. Under present conditions, roads represent one of the most pervasive impacts of management activity to native fish communities. There are few benefits that accrue to the bull trout from roads. Roads have the potential to adversely affect several habitat features, (*e.g.*, water temperature, substrate composition and stability, sediment delivery, habitat complexity, and connectivity) (Baxter *et al.* 1999; Trombulak & Frissell 2000). Roads may also isolate streams from riparian areas, causing a loss in floodplain and riparian function.

Any roads built or located near bull trout streams, or that cross streams or unstable landslide prone areas, are reasonably likely to have detrimental effects to the bull trout in the affected watershed. The construction, use and maintenance of forest roads have been shown to be a primary source of sediment impacts in developed watersheds (FEMAT 1993). Roads can alter both subsurface and surface water flows which, in turn, may alter both peak and base stream flows (USDC 1997, Jones and Grant 1996, FEMAT 1993). Improperly designed, blocked, or poorly placed culverts can prevent upstream or downstream movement of adults or juveniles. This can be a serious adverse effect, as bull trout adults require access to upstream spawning and rearing areas.

The aquatic assessment portion of the Interior Columbia Basin Ecosystem Management Project provided a detailed analysis of the relationship between road densities and bull trout status and distribution (Quigley & Arbelbide 1997). The assessment found that bull trout are less likely to use streams in highly roaded areas for spawning and rearing, and do not typically occur where average road densities exceed 1.1 kilometers per square kilometer (1.7 miles per square mile). Lee et al. (1997) note that over 205,000 km of roads exist throughout the Columbia Basin on USFS and BLM managed lands, with an attendant high number of stream crossings that occur at higher densities on steep dissected terrain. FEMAT (1993) indicates that approximately 180,000 km of roads, with an estimated 250,000 stream crossings exist on Federal lands within the range of the northern spotted owl. The road network is identified as a current and potential source of damage to riparian and aquatic habitats, and a majority of the stream crossings are not expected to tolerate more than a 25-year return interval storm without failure, leading to severe impacts to water quality and habitat (FEMAT 1993). Although the estimated road mileage between the Columbia Basin and NWFP area are roughly comparable, the total NWFP road mileage occurs in an area roughly one third the size. Given prevailing climatic conditions for western forests and expected overall higher road densities within the NWFP area, road-related impacts are likely more pronounced within the NWFP area.

Lee et al. (1997) and FEMAT (1993) also note that although improvements in road construction and logging methods can reduce sediment delivery to streams, sedimentation increases may be unavoidable even when utilizing the most cautious logging and construction methods. Bull trout are very sensitive to sediment increases, hydrologic alterations, and impacts to stream structure and function imposed by extensive road networks and high road densities. Roads are also conduits for a host of non-management related impacts such as noxious weed introductions, illegal transplants of predatory or competing non-native fishes, increased harvest pressure and potential for poaching, dispersed recreation impacts, and potential introduction of toxicants from spills and roadside application of herbicides. Additional information on the relationship of roads to bull trout biological characteristics can be found in the road analysis contained in Lee et al. (1997).

Roads may affect aquatic habitats considerable distances away. For example, increases in sedimentation, debris flows, and peak flows affect streams longitudinally so that the area occupied by a road can be small compared to the entire downstream area subjected to its effects (Jones *et al.* 2000; Trombulak & Frissell 2000). Upstream from road crossings, large areas of suitable habitats may become inaccessible to the bull trout due to fish passage barriers (*e.g.*, culverts).

Although bull trout occur in watersheds where timber has been harvested, bull trout strongholds primarily occur in watersheds with little or no past timber harvest, such as the wilderness areas of central Idaho and the South Fork Flathead River drainage in Montana (Henjum *et al.* 1994; MBTSG 1995d) (Rieman *et al.* 1997a; USDA & USDI 1997). However, the Swan River basin, Montana, has had extensive timber harvest and road construction, and is a bull trout stronghold (Watson & Hillman 1997). The overall effects of forestry practices on the bull trout in parts of this basin are difficult to assess because of the complex geomorphology and geology of the drainage (MBTSG 1996f).

Livestock Grazing

Improperly managed livestock grazing degrades bull trout habitat by removing riparian vegetation, destabilizing streambanks, widening stream channels, promoting incised channels and lowering water tables, reducing pool frequency, increasing soil erosion, and altering water quality (Henjum *et al.* 1994; Howell & Buchanan. 1992; MBTSG 1995a, b, e; Mullan *et al.* 1992; Overton *et al.* 1993; Platts *et al.* 1993; Uberuaga 1993; USDA & USDI 1996, 1997). These effects reduce overhead cover, increase summer water temperatures, and promote formation of anchor ice (ice attached to the bottom of an otherwise unfrozen stream, often covering stones, etc.) in winter, and increase sediment in spawning and rearing habitats.

Bull trout vulnerability to direct effects of grazing is greatest during early development stages. During early phases of their life cycle, fish have little or no capacity for mobility, and large numbers of embryos or young are concentrated in small areas. Cattle entering spawning areas can trample redds, and destroy or dislodge embryos and fry. Embryo and fry mortality can also result from localized sedimentation of spawning beds (Bjornn and Reiser 1991). Accumulations of silt, if delivered in sufficient quantity, can fill interstitial spaces in stream bed material impeding water flow through redds, reducing dissolved oxygen levels, and restricting removal of wastes from redds. As development progresses, vulnerability to mortality from direct effects decreases.

Effects to bull trout habitat from grazing include compacting stream substrates, collapsing undercut banks, destabilized stream banks and localized reduction or removal of herbaceous and woody vegetation along stream banks and within riparian areas (Platts 1991). Increased levels of sediment can result through the resuspension of material within existing stream channels as well as increased contributions of sediment from adjacent stream banks and riparian areas. Impacts to stream and riparian areas resulting from grazing are dependent on the intensity, duration, and timing of grazing activities (Platts 1989) as well as the capacity of a given watershed to assimilate imposed activities, and the pre-activity condition of the watershed (Odum 1981).

Increases in stream temperature and reduced allochthonous inputs, increased sedimentation from in-stream, riparian and upland sources, and decreased in-stream, riparian and upland water storage capacity caused by grazing can work in concert to reduce the health and vigor of stream biotic communities (Armour et al. 1991, Platts 1991, USDI 1992, Chaney et al. 1990). Increased sediment loads reduce primary production in streams. Reduced in-stream plant growth and woody and herbaceous riparian vegetation limits populations of terrestrial and aquatic insects, the basic food source for juvenile and resident bull trout. Persistent degraded conditions adversely influence resident fish populations (Meehan 1991).

Negative effects of livestock grazing on bull trout habitat may be minimized if grazing is managed appropriately for conditions at a specific site. Practices generally compatible with the preservation and restoration of bull trout habitat include fences to exclude livestock from riparian areas, rotation schemes, relocation of water and salting facilities away from riparian areas, and use of herders.

Recreation

Recreation has the potential to affect bull trout habitat by: 1) altering upland and riparian soil and vegetation conditions that may lead to increased erosion and runoff, loss of cover and food resources and reductions in water quality; and, 2) in-stream changes that affect stream morphology, water quality, streamflow, substrate and debris. Bull trout are also sensitive to the multiple adverse effects of roads (see discussion on roads, above). Dispersed recreation and increased human activity and access may adversely affect the bull trout, particularly if use is frequent or if recreation sites are located in or near key bull trout staging, spawning, and rearing areas. Such effects include, but are not limited to, reductions in shade or LWD recruitment to streams due to firewood gathering at campgrounds, localized compaction of soils, trailing and bank trampling, alteration of drainage patterns (e.g., disruption of springs or seeps), increased surface erosion from road surfaces used to provide access for recreation opportunities, erosion and sedimentation from off-road vehicle use and direct and indirect harm and harassment from rafting and boating activities. Bull trout may be adversely affected by poaching and introductions of non-native fish that occur via increased human access to remote areas (see discussion on fisheries management, below). Angling as a result of recreational development and trail maintenance and construction may lead to direct angling mortality.

Agricultural Practices

Agricultural practices, such as cultivation, irrigation diversions, and chemical application, contribute to non point source pollution in some areas within the range of bull trout (IDHW 1991; MDHES 1994; WDE 1992). These practices can release sediment, nutrients, pesticides, and herbicides into streams; increase water temperature; reduce riparian vegetation; and alter hydrologic regimes, typically by reducing flows in spring and summer. Irrigation diversions also affect bull trout by altering stream flow and allowing entrainment. The effects of the myriad of small irrigation diversion and hydropower projects throughout the range of bull trout are likely of even greater significance than the large hydropower and flood control projects. Many of these are located further up in watersheds and either physically block fish passage by means of a structure (*i.e.*, a dam), or effectively block passage by periodically dewatering a downstream reach (*e.g.*, diversion of flows through a penstock to a powerhouse; diversion of flows for the purposes of irrigation). Even if diversions are not so severe as to dewater downstream reaches, reduced flows can result in structural and thermal passage barriers. Other effects include water quality degradation resulting from irrigation return flows and runoff from fields and entrainment of bull trout into canals and fields (MBTSG 1998). Some irrigation diversion structures are reconstituted annually with a bulldozer as “push up” berms and not only affect passage, but also significantly degrade the stream channel. The prevalence of these structures throughout the range of bull trout has resulted in the isolation of bull trout populations in the upper watersheds in many areas.

Bull trout may enter unscreened irrigation diversions and become stranded in ditches and agricultural fields. Diversion dams without proper passage facilities prevent bull trout from migrating and may isolate groups of fish (Dorratcaque 1986; Light *et al.* 1996). Other effects of agricultural practices on aquatic habitat include stream channelization, and large woody debris removal (Spence *et al.* 1996).

Transportation Networks

Roads degrade bull trout habitats by creating flow constraints in ephemeral, intermittent, and perennial channels; increasing erosion and sedimentation; creating passage barriers; channelizing stream reaches; and reducing riparian vegetation (Furniss *et al.* 1991; Ketcheson & Megahan 1996; Trombulak & Frissell 2000). In the Clearwater River basin of Idaho, for example, Highway 12 is adjacent to much of the Clearwater River, and crosses the river at eight different bridge sites. The highway has constrained the river in some areas and highway maintenance may negatively affect bull trout and their habitats (CBBTTAT 1998). Moreover, the proximity of the highway to the Clearwater River increases the likelihood of hazardous materials or fuel spills entering the river. For example, in January, 2002, a truck overturned and spilled approximately 11,000 gallons in the Clearwater upstream of Lewiston. Similar situations exist along primary and secondary highways across the range of bull trout.

A dirt road is adjacent to much of the West Fork of the Jarbidge River in Nevada and Idaho. McNeill *et al.* (1997) determined that construction and maintenance of the Jarbidge Canyon Road has influenced the morphology and function of the river (McNeill *et al.* 1997). Within a single 4.8 kilometer (3 mile) reach, there are seven bridge crossings, and the largest bridge spans only 62 percent of the average width of the river (McNeill *et al.* 1997). Maintenance of the road and bridges requires frequent channel and floodplain modifications that affect bull trout habitat, such as channelization; removal of riparian trees and beaver dams; and placement of rock, sediment, and concrete (Frederick 1998; McNeill *et al.* 1997).

Transportation networks also affect bull trout habitats in protected areas such as National Parks. Roads have been constructed to provide access to the Hoh River and Quinault River basins, including areas within Olympic National Park. These roads were typically built following river valleys and often constrain the floodplains. As a result, these roads have been subjected to high flow events and shifts in river channels, forcing extensive streambank armoring to maintain them (Chad 1997; USNPS 2000). Bank armoring impairs bull trout habitats through reduced habitat complexity, stream channelization, reduced riparian vegetation, and bank erosion downstream. Within Olympic National Park, about 1,770 meters (5,476feet) of rip-rap were documented along the Hoh River in 1997 (Chad 1997), and additional bank stabilization projects have occurred since then.

Mining

Mining degrades aquatic habitats used by bull trout by altering water chemistry (*e.g.*, pH); altering stream morphology and flow; and causing sediment, fuel, and heavy metals to enter streams (Martin & Platts 1981; Spence *et al.* 1996). The types of mining that occur within the range of the bull trout include extraction of hard rock minerals, coal, gas, oil, and sand and gravel. Past and present mining activities have adversely affected the bull trout and bull trout habitats in Idaho, Oregon, Montana, Nevada, and Washington (Johnson & Schmidt 1988; MBTSG 1995b, e, 1996b, d; McNeill *et al.* 1997; Moore *et al.* 1991; Platts *et al.* 1993; Ramsey 1997; WDW 1992).

For example, it is thought that the bull trout was widely distributed in the Coeur d'Alene River drainage, Idaho (Maclay 1940). However, extensive mining and associated operations have modified stream channels and floodplains, created barriers to fish movement, and released toxic substances, especially in the South Fork Coeurd'Alene River (PBTTAT 1998). Portions of the system were essentially devoid of aquatic life during surveys conducted in the 1940's. Bull trout have been functionally extirpated in the Coeur d'Alene River basin since 1992 (USFWS 1998).

Residential Development and Urbanization

Residential development is rapidly increasing within portions of the range of bull trout. Residential development alters stream and riparian habitats through contaminant inputs, storm water runoff, changes in flow regimes, streambank modification and destabilization, increased nutrient loads, and increased water temperatures (MBTSG 1995a). Indirectly, urbanization within floodplains alters groundwater recharge by rapidly routing water into streams through drains rather than through more gradual subsurface flow (Booth 1991).

Urbanization negatively affects the lower reaches of many of the large rivers and their associated side channels, wetlands, estuaries, and near-shore areas of Puget Sound, Washington. Activities such as dredging; removing large woody debris (e.g., snags, log jams, drift wood); installing revetments, bulkheads, and dikes; and filling side channels, estuarine marshes, and mud flats have led to the reduction, simplification, and degradation of habitats (PSWQAT 2000; Spence *et al.* 1996; Thom *et al.* 1994). Pollutants associated with urban environments such as heavy metals, pesticides, fertilizers, bacteria, and organics (oil, grease) have contributed to the degradation of water quality in streams, lakes, and estuaries (NRC 1996; Spence *et al.* 1996).

Decline and Loss of Anadromous Salmon

Bull trout are a piscivorous fish whose existence and historical abundance throughout much of their range was historically connected with, and most likely dependent on, healthy salmon populations (Armstrong and Morrow 1980; Brown 1992; Nelson and Caverhill 1999; Torgersen and Baxter, *in litt.* 2003). In parts of their range, especially in the Coastal-Puget Sound Distinct Population Segment, salmon continue to provide an important food source (Kraemer, *in litt*. 2003). Food resources provided by salmon include dislodged eggs, emergent and migrating fry, and smolts. In addition, bull trout benefit from the increased productivity supplied by the decomposing carcasses of adult salmon.

Recent publications have documented the recent declines and low abundance of Pacific salmon populations throughout much of their range within the coterminous United States (WDF *et al.* 1993; NMFS 1991a,b,c; National Oceanographic Atmospheric Administration, *in litt.* 2003). In 1991, the American Fisheries Society published a status list of 214 naturally spawning stocks of salmon, steelhead, and cutthroat trout from California, Oregon, Idaho and Washington. Their assessment included 101 stocks at high risk of extinction, 58 stocks at moderate risk of extinction, 54 stocks of special concern, and one classified as threatened under the Endangered Species Act (Nehlsen *et al.* 1991).

In some areas of their range it is likely that bull trout have been isolated from anadromous salmonid prey resources by a variety of physical barriers for several thousand years. However, populations of migratory bull trout require abundant fish forage and it is likely that many bull trout populations have been affected by declines in salmon populations. For example, in several river basins where bull trout evolved with large populations of juvenile salmon, bull trout abundance declined when salmon declined (Ratliff and Howell 1992; Rieman and McIntyre 1993).

Currently, the WDFW is working with the Yakima Nation to supplement wild spring and fall chinook and to reestablish self-sustaining populations of coho in the Yakima River subbasin through the Yakima-Klickitat Fisheries Program. A hatchery facility was constructed at Cle Elum with several acclimation ponds in the upper basin. Because bull trout are a piscivorous fish whose existence and historical abundance throughout much of their range was historically connected with, and most likely dependent on, healthy salmon populations (Armstrong and Morrow 1980, Brown 1992, Nelson and Caverhill 1999, Torgerson and Baxter *in litt.* 2003), reintroductions of native salmon where they have been extirpated are likely to benefit bull trout in the long term..

Fisheries Management

Introductions of non-native species by the Federal government, State fish and game departments, and private parties, across the range of the bull trout have contributed to declines in abundance, local extirpations, and hybridization of the bull trout (Bond 1992; Donald & Alger 1993; Howell & Buchanan. 1992; Leary *et al.* 1993; MBTSG 1995a, c, 1996a, g; Palmisano & Kaczynski 1997; Platts *et al.* 1995; Pratt & Huston 1993).

Introduced brook trout threaten the bull trout through hybridization, competition, and possibly predation (Clancy 1993; Leary *et al.* 1993; MBTSG 1996a; Rieman & McIntyre 1993; Thomas 1992; WDW 1992). Hybridization between brook trout and the bull trout has been reported in Montana (Hansen & DosSantos. 1997; MBTSG 1995a, e, 1996d, e, f), Oregon (Markle 1992; Ratliff & Howell 1992), Washington (WDFW 1998), and Idaho (Adams 1996; Burton 1997). Hybridization results in offspring that are frequently sterile (Leary *et al.* 1993), although recent genetics work has shown that reproduction by hybrid fish is occurring at a higher level than previously suspected (Kanda 1998). Hybrids maybe competitors; Dunsmoor and Bienz (Dunsmoor 1997) noted that hybrids are aggressive and larger than resident bull trout, suggesting that hybrids may have a competitive advantage. Brook trout mature at an earlier age and have a higher reproductive rate than bull trout. This difference may favor brook trout over bull trout when they occur together, often leading to replacement of bull trout with brook trout (Clancy 1993; Leary *et al.* 1993; MBTSG 1995a). The magnitude of threats from non-native fishes is highest for resident bull trout because they are typically isolated and exist in low abundance.

Brook trout apparently adapt better to degraded habitats than bull trout (Clancy 1993; Dunsmoor 1997; Rich 1996), and brook trout also tend to occur in streams with higher water temperatures (Adams 1994; MBTSG 1996g). Because elevated water temperatures and sediments are often indicative of degraded habitat conditions, bull trout may be subject to stresses from both interactions with brook trout and degraded habitat (MBTSG 1996a). In laboratory tests, growth rates of brook trout were significantly greater than those for bull trout at higher water temperatures when the two species were tested alone, and growth rates of brook trout were greater than those for the bull trout at all water temperatures when the species were tested together (McMahon *et al.* 1998, 1999).

Non-native lake trout (*i.e.*, west of the Continental Divide) also negatively affect the bull trout (Donald & Alger 1993; Fredenberg 2000; MBTSG 1996a). A study of 34 lakes in Montana, Alberta, and British Columbia, Canada, found that lake trout likely limit foraging opportunities and reduce the distribution and abundance of migratory bull trout in mountain lakes (Donald & Alger 1993). Over 250 introductions of lake trout and other non-native species have occurred in nearly 150 western Montana waters within the range of bull trout (Vashro 2000). The potential for introduction of lake trout into the Swan River basin and Hungry Horse Reservoir on the South Fork Flathead River, both in Montana, is considered a threat to bull trout (MBTSG 1995d, 1996f). The presence of several lake trout has been recently documented in Swan Lake (MFWP 1999). In Idaho, lake trout and habitat degradation were factors in the decline of the bull trout from Priest Lake (Mauser *et al.* 1988; Pratt & Huston 1993). Lake trout have invaded Upper Priest Lake and are a threat to the bull trout there (Fredericks 1999). Juvenile lake trout are also using some riverine habitats in Montana, possibly competing with bull trout (MBTSG 1996a).

Introduced brown trout are established in several areas within the range of the bull trout and likely compete for food and space and prey on bull trout (Platts *et al.* 1993; Pratt & Huston 1993; Ratliff & Howell 1992). In the Klamath River basin for example, brown trout occur with bull trout in three streams and have been observed preying on bull trout in one (Light *et al.* 1996). Brown trout may compete for spawning and rearing areas and superimpose redds on bull trout redds (Light *et al.* 1996; MBTSG 1996a; Pratt & Huston 1993). Elevated water temperatures may favor brown trout over bull trout in competitive interactions (MBTSG 1996a). Brown trout may have been a contributing factor in the decline and eventual extirpation of bull trout in the McCloud River, California, after dam construction altered bull trout habitat (Rode 1990).

Non-native northern pike have the potential to negatively affect the bull trout. Northern pike were introduced into Swan Lake in the 1970's (MFWP 1997), and predation on juvenile bull trout has been documented (MBTSG 1996f), but the bull trout population has not declined. Northern pike were also introduced into Salmon, Inez, Seeley, and Alva lakes in the Clearwater River basin, and a tributary to the Blackfoot River, Montana (MBTSG 1996f). Northern pike numbers have increased in Salmon Lake and Lake Inez, having a negative effect on bull trout (Berg 1997). Northern pike in Seeley Lake and Lake Alva are also expected to increase in numbers (Berg 1997).

Introduced bass (*Micropterus spp*.) may negatively affect the bull trout (MFWP 1997). In the Clark Fork River, Montana, Noxon Rapids Reservoir supports fisheries for both smallmouth bass (*M. dolomieui*) and largemouth bass (*M. salmoides*). Both have been high priority sport fish species in management of Noxon Rapids Reservoir. The Montana fishery management objective for Cabinet Gorge Reservoir, downstream of Noxon Rapids Reservoir, is to enhance bull trout while managing the existing bass fishery (MFWP 1997). However, a 1999 Federal Energy Regulatory Commission settlement with the Avista Corporation for dam relicensing makes recovery of bull trout a management priority (Kleinschmidt & Pratt 1998).

Managers are now attempting to balance these potentially conflicting objectives. In the North Fork Skokomish River, Washington, Cushman Reservoir supports largemouth bass, which may prey on juvenile bull trout rearing in the reservoir and lower river above the reservoir (WDFW 1998).

Opossum shrimp (*Mysis relicta*), a crustacean native to the Canadian Shieldarea, was widely introduced in the 1970's as supplemental forage for kokanee and other salmonids in several lakes and reservoirs across the northwest (Nesler & Bergersen 1991). The introduction of opossum shrimp in Flathead Lake changed the lake's trophic dynamics resulting in expanding lake trout populations and causing increased competition and predation on bull trout (MBTSG 1995c; Weaver 1993). Conversely, in Swan Lake, Montana, introduced opossum shrimp and kokanee increased the availability of forage for bull trout, contributing to the significant increase in bull trout numbers in the Swan River basin (MBTSG 1996f).

Non-native fish threaten bull trout in relatively secure, unaltered habitats, including roadless areas, wildernesses, and national parks. For instance, brook trout occur in tributaries of the Middle Fork Salmon River within the Frank Church-River of No Return Wilderness, including Elk, Camas, Loon, and Big creeks (Thurow 1985) and Sun Creek in Crater Lake National Park (Light *et al.* 1996). Glacier National Park has self-sustaining populations of introduced non-native species, including lake trout, brook trout, rainbow trout, Yellowstone cutthroat trout, lake whitefish, and northern pike (MBTSG 1995c). Although stocking in Glacier National Park was terminated in 1971, only a few headwater lakes contain exclusively native species, including bull trout. The introduction and expansion o flake trout into the relatively pristine habitats of Kintla Lake, Bowman Lake, Logging Lake, and Lake McDonald in Glacier National Park has nearly extirpated the bull trout due to predation and competition (Fredenberg 2000; Marnell 1995; MBTSG 1995c).

Some introduced species, such as rainbow trout and kokanee, may benefit large adult bull trout by providing supplemental forage (Faler & Bair 1991; Pratt 1992; Vidergar 2000). However, introductions of non-native game fish can be detrimental due to increased angling and subsequent incidental catch and harvest of bull trout (Bond 1992; MBTSG 1995c; Rode 1990; WDW 1992).

Altered Disturbance Regimes

Disturbances, such as floods and fires, have increased in frequency and magnitude within the range of bull trout (Henjum *et al.* 1994; USDA & USDI 1997). Passage barriers and unsuitable habitat that prevent recolonization, have resulted in bull trout extirpation through these landscape disturbances (USDA & USDI 1997). Also, isolated populations are typically small, and more likely to be extirpated by local events than larger populations (Rieman & McIntyre 1995), and can exhibit negative genetic effects.

Land management activities have also altered the frequency and duration of floods or high flows (USDA & USDI 1997). Roads and clear cutting of forested areas tend to magnify the effects of floods, leading to higher flows, erosion, and bedload that scour channels (McIntosh *et al.* 1994; Spencer & Schelske 1998; Swanson *et al.* 1998; USDA & USDI 1997), and degrade bull trout habitat (Henjum *et al.* 1994). Erosion from road landslides increases bedload to stream flows (Furniss *et al.* 1991). Increased bedload increases the scouring effect of high stream flows, increasing channel instability and loss of habitat diversity, especially pools (Henjum *et al.* 1994; McIntosh *et al.* 1994). Bull trout eggs and fry in the gravels during scouring likely survive at low rates (Henjum *et al.* 1994). For instance, hundreds of landslides associated with roads on the Clearwater National Forest and Panhandle National Forests resulted from high water in 1995 (Patten & Penzkover 1996), likely reducing survival of bull trout eggs and fry. Habitat degradation has also reduced the number and size of bull trout spawning areas (USDA & USDI 1997).

Inadequacy of Existing Water Quality Standards

Temperature regime is one of the most important water quality factors affecting bull trout distribution (Adams & Bjornn 1997; Rieman & McIntyre 1995). Given the temperature requirements of bull trout (Buchanan & Gregory 1997), existing water quality criteria developed by the States under sections 303 and 304 of the Clean Water Act may not adequately support spawning, incubation, rearing, migration, or combinations of these life-history stages (62 FR 41162) (Hicks 2000; NDEP 1998; Oregon 1996; Washington 1997).

The U.S. Environmental Protection Agency is working with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, State environmental quality agencies, and tribes in Oregon, Idaho, and Washington to develop regional temperature guidance. The goals for this project are to develop U.S. Environmental Protection Agency regional temperature criteria guidance that: (1) meet the biological requirements of native salmonid species for survival and recovery pursuant to the Endangered Species Act, provide for the restoration and maintenance of surface water temperature to support and protect native salmonids pursuant to the Clean Water Act, and meet the Federal trust responsibilities with treaty tribes for rebuilding salmon stocks, (2) recognize the natural temperature potential and limitations of water bodies, and (3) can be effectively incorporated by states and Tribes in programs concerned with water quality standards. States and Tribes will use the new criteria guidance to revise their temperature standards, and if necessary, the U.S. Environmental Protection Agency and other agencies will use the new criteria guidance to evaluate State and Tribal standard revisions.

The Environmental Protection Agency is currently engaged in formal consultation with the U.S. Fish and Wildlife Service and National Marine Fisheries Service regarding their approval of numeric water quality criteria for (non conventional) toxic pollutants in the State of Idaho. Consultation on conventional pollutants (pH, dissolved oxygen, temperature) for the State of Oregon was completed in July 1999. We anticipate formal consultation on water quality criteria for temperature, dissolved oxygen, ammonia, and anti degradation in the State of Washington in 2003. Water quality criteria establish water column concentrations for various constituents, above which any waters of the State (excluding those waters on Tribal lands) should not exceed for the protection of aquatic life. These criteria will be used to evaluate discharge permits (National Pollution Discharge Elimination System and Total Maximum Daily Limits) and formulate consumption advisories where appropriate. Many states' waters contain elevated levels of toxic pollutants that are present in fish tissues and have resulted in fishing advisories throughout the range of bull trout (www.epa.gov/ost/fish). We do not anticipate formal consultation on current surface water quality standards for non conventional pollutants in the states of Washington, Oregon, Nevada, and Montana in the near future.

Elevated levels of contaminants may result in either lethal (e.g. mortality) or sublethal effects to bull trout. Sublethal impacts may include reduced egg production, reduced survival of any life stage, reduced growth, impaired osmoregulation, and many subtle endocrine, immune, and cellular changes. Contaminants may also affect the food chain and indirectly harm bull trout by reducing prey availability due to reduced habitat suitability for prey species. Lethal impacts from contaminant inputs are most likely from spills, whereas sublethal impacts may occur from such land uses as agriculture, residential/urban, mining, grazing, and forestry.

Consulted-on Effects

Consulted-on effects are those effects that have been analyzed through section 7 consultation as reported in a biological opinion. These effects are an important component of objectively characterizing the current condition of the species. To assess consulted-on effects to bull trout, we analyzed all of the biological opinions received by the Regional Offices of Regions 1 and 6, from the time of listing until August 2003; this summed to 137 biological opinions. Of these, 124 biological opinions (91 percent) applied to activities affecting bull trout in the Columbia Basin DPS, 12 biological opinions (9 percent) applied to activities affecting bull trout in the Coastal-Puget Sound DPS, 7 biological opinions (5 percent) applied to activities affecting bull trout in the

Klamath Basin DPS, and 1 biological opinion (<1 percent) applied to activities affecting the Jarbidge and St. Mary Belly DPSs (Note: these percentages do not add to 100, because several biological opinions applied to more than one DPS). The geographic scale of these consultations varied from individual actions (e.g., construction of a bridge or pipeline) within one basin to multiple-project actions occurring across several basins.

Due to the variability in consultation techniques (single project versus batched versus plan-level) quantifying effects by tallying the number of biological opinions is not particularly meaningful without some qualification. Inconsistencies across biological opinions in quantifying effects to bull trout or habitat components preclude us from using any other metric. Therefore, we examined the number of biological opinions by basin and activity type, qualifying (and quantifying where possible - based on the best available information) the effects analyzed in those opinions. Our results are presented below:

Columbia Basin DPS

Clearwater River Basin

Consulted-on Federal actions involving habitat disturbance activities in the Clearwater River Basin included 1 multiple project action (1 biological opinion), 1 hydropower action (1 biological opinion), and 1 habitat restoration action (1 biological opinion).

The multiple project action consisted of 900 activities within the St. Joe and North Fork of the Clearwater River Watersheds. These actions included timber sales and harvest; road construction, obliteration and repair; grazing; noxious weed management; and mining. Effects of these activities was unquantifiable but were expected to result in sedimentation causing degradation of spawning and rearing habitat; and the disruption of bull trout breeding, feeding, and sheltering.

The Bureau of Reclamation’s operations and maintenance activities in the Snake River Basin upstream of Lower Granite Dam Reservoir was expected to result in barriers to, or delays to, migration and entrainment of at least 7 percent of the bull trout, annually, in Arrowrock, Anderson Ranch, Beulah Reservoir and other BR facilities.

There was one consulted-on habitat restoration action within the Clearwater River Basin, the Red River Meadow Restoration Project (phases III and IV) which consisted of 2,800 feet of stream channel reconstruction, reshaping, realignment, dewatering of the existing channel using staged diversions, and the establishment of native riparian and meadow plant species. Although some short-term adverse effects were anticipated from this restoration action, we expected long-term benefits to the bull trout through improvements to habitat complexity along 6.5 miles of the Red River.

Several research actions have undergone consultation in the Clearwater River Basin (3 biological opinions). Studies include: (1) monitoring the migrations of wild Snake River spring/summer chinook salmon smolts; (2) a genetic monitoring and evaluation program for supplemented populations of chinook salmon and steelhead in the Snake River Basin, and (3) issuance of 10(a)(1)(A) permits. These studies were expected to result in the possibility of injury and mortality from electrofishing, handling and temporary confinement in nets or traps, however, adverse effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

Operation of the Lower Snake River Compensation Plan Program (1 biological opinion) in this basin was expected to result in obstacles or barriers, which detain or delay migrating fish. Harassment of about 400 fish per year, across multiple basins, (via catch and release) was expected as a result of scientific monitoring and evaluation of salmonids. Displacement (release of hatchery-reared fish cause loss of food and cover utilized by bull trout), in-stream flow reductions (along an average of 200 meters of stream reach at each of 19 facilities that have water diversions), and increased levels of nutrients and sediment (along an average of 100 meters of stream reach at each of 26 facilities that discharge effluent) were also expected. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in this Clearwater River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

The issuance of a Section 10(a)(1)(B) Incidental Take Permit to Plum Creek Timber Company for the Proposed Native Fish Habitat Conservation Plan (NFHCP) in the States of Washington, Idaho, and Montana affected this basin. This 30-year permit included various management activities such as silvicultural activities (tree planting, site preparation, prescribed burning, timber harvest in riparian and upland areas, stand maintenance, forest nurseries, and seed orchards), as well as related actions of logging road construction and maintenance and gravel quarrying for roads. Other forestry activities included forest fire suppression, open range cattle grazing, miscellaneous forest and land product sales, and conservation activities. Additional land use activities that are non-forest actions and special forest uses include commercial outfitting, recreation, electronic facility sites, and mill site facilities that manufacture various forest products. The effect of these actions was unquantifiable, but adverse effects to bull trout were expected to be infrequent and localized.

Coeur D'Alene Lake Basin

One multiple project action (1 biological opinion) involved habitat disturbance activities in the Coeur D'Alene Lake Basin. This multiple project action consisted of 900 activities within the St. Joe and North Fork of the Clearwater River Watersheds. These actions included timber sales and harvest; road construction, obliteration and repair; grazing; noxious weed management; and mining. Effects of these activities was unquantifiable but were expected to result in sedimentation causing degradation of spawning and rearing habitat; and the disruption of bull trout breeding, feeding, and sheltering.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (1 biological opinion) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Coeur D'Alene Lake Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Deschutes River Basin

Consulted-on Federal actions involving habitat disturbance activities in the Deschutes River Basin included one multiple project action (1 biological opinion) and one bridge-work action (1 biological opinion).

The multiple project action, was comprised of a batch of actions within the Deschutes River Basin for the Deschutes National Forest and Bureau of Land Management, Prineville District, and included timber sales/harvest, prescribed burning, thinning cuts, fuel treatments, campground and trail rehabilitation and use, road maintenance and management actions, grazing allotments, throughout the Deschutes River Basin. The adverse effects of these land management actions were expected to have unquantifiable effects to spawning, rearing, and migratory bull trout habitat. Parameters that were likely to be adversely affected included water temperature, substrate quality, bank stability, food supply, spawning success, and suspended sediment levels.

The Warm Springs Reservation Bridge Replacements (replacement of three bridges, instream work to remove concrete slabs, and placement of riprap) was expected to have unquantifiable adverse effects to water temperature, food supply, substrate quality, suspended sediment, and spawning success in the short-term, with long-term benefits to fish passage.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The single hydropower action (1 biological opinion) in the Deschutes River Basin, the non-capacity license amendment for the continued operation of the Pelton Round Butte Project (3 dams), included installation of two turbine runners, operation of store-and-release facilities in peaking mode, and implementation of a fish conservation strategy (fish bypass, Merwyn trap fish collection, mark/tag and monitoring). Effects from this action were unquantifiable but were expected to include mortality by entrainment into project turbines, migration delays for upstream movement, and increased cannibalism due to lack of cover available to juvenile fish. Conservation measures proposed as part of the action were expected to partially off-set some of these adverse effects.

The Oregon Conservation Reserve Enhancement Program (1 biological opinion) was expected to have unquantifiable short-term adverse effects with long-term benefits to bull trout recovery.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Deschutes River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Grande Ronde River Basin

Consulted-on Federal actions involving habitat disturbance activities in the Grande Ronde River Basin included several bridge replacements (2 biological opinions), one multiple project action (1 biological opinion), one noxious weed program (1 biological opinion), and one habitat restoration action (1 biological opinion).

The effects of the Catherine Creek Bridge Replacement (1 biological opinion) included heightened sedimentation up to 1000 feet downstream of the action, having short-term affects to both spawning and migratory bull trout in Catherine Creek.

The Lower Perry Interchange Bridges were expected to result in disturbance 100 feet upstream of the action, downstream to the confluence of next major stream. Disturbances were anticipated to delay or alter bull trout movements and decrease their use of foraging resources in project area.

Ongoing and proposed actions in the Lostine and Wallowa Watersheds included road maintenance; campground, trailhead, and horse camp maintenance improvement projects; and wilderness trail and campsite restoration projects throughout these watersheds in the Wallowa Whitman National Forest. Adverse effects of these activities were expected to result in low-level increases in sedimentation effecting spawning and rearing habitat along 10 miles of stream reach.

The BLM's Vale District integrated noxious weed management program (for calendar years 2001 to 2011; 1 biological opinion) was expected to have unquantifiable but sub-lethal effects to migratory bull trout from the application of herbicides.

The Milk Creek habitat enhancement project was expected to restore approximately 930 feet of Milk Creek to its natural condition with only minor short-term adverse effects, which included increases in sedimentation during construction.

The Oregon Conservation Reserve Enhancement Program (1 biological opinion) was expected to have unquantifiable short-term adverse effects with long-term benefits to bull trout recovery.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Grande Ronde River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Hells Canyon Complex

Consulted-on Federal actions involving habitat disturbance activities in the Hells Canyon Complex included one multiple project action (1 biological opinion) and 1 programmatic weed management action (1 biological opinion).

The multiple project action involves ongoing and proposed Forest Service actions in the Pine Creek watershed on the Wallowa Whitman National Forest. Activities under this biological opinion included timber sales and related activities, livestock grazing, mining, road maintenance, and recreation activities (i.e., outfitters/guides). Adverse effects of these activities include low-level short-term sediment pulses, short-term displacement of fish, and injury or mortality to eggs, fry, and spawning bull trout along 39 miles of spawning and rearing habitat.

The BLM's Vale District integrated noxious weed management program (for calendar years 2001 to 2011; 1 biological opinion) was expected to have unquantifiable but sub-lethal effects to migratory bull trout from the application of herbicides.

The Oregon Conservation Reserve Enhancement Program (1 biological opinion) was expected to have unquantifiable short-term adverse effects with long-term benefits to bull trout recovery.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Hells Canyon Complex were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Hood River Basin

Consulted-on Federal actions involving habitat disturbance activities in the Hood River Basin included 1 multiple project action (3 biological opinions; same action undergoing consultation on an annual basis), 5 habitat restoration actions (2 biological opinions) and 1 irrigation system improvement action (1 biological opinion).

The multiple project action in the Hood River Basin involved ongoing Forest Service and BLM activities within the Willamette and a portion of the Deschutes Provinces (1999-2002) for road maintenance, aquatic habitat restoration, trail maintenance and construction, repair of storm damaged roads, road decommissioning and obliteration, instream surveys, water withdrawal permits, use of haul roads from rock quarries, boat ramp use, public use of developed recreation sites and dispersed recreation. Effects of these activities were expected to result in unquantifiable short-term adverse effects to suspended sediment, substrate quality, bank stability, water temperature, and food supply. We also expected some unquantifiable beneficial effects to bull trout from management actions.

The five habitat restoration actions included creek channel realignment, placement of large wood/logs/trees, restore riparian flood prone area, culvert removal and bridge construction, and removal of 1,500 feet of riprap levee within the Hood River and its tributaries. Effects of these restoration activities included 1.1 miles of short-term adverse effects and long-term benefits to bull trout recovery.

The Farmers Irrigation District irrigation system improvement project on the Hood River was expected to have unquantifiable adverse effects to the bull trout at fish screens or during short-term instream work.

The Oregon Conservation Reserve Enhancement Program (1 biological opinion) was expected to have unquantifiable short-term adverse effects with long-term benefits to bull trout recovery.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Hood River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Imnaha/Snake River Basins

Consulted-on Federal actions involving habitat disturbance activities in the Imnaha/Snake River Basins included 1 multiple project action (1 biological opinion), replacement of 2 bridges (1 biological opinion) and 1 programmatic weed management action (1 biological opinion).

The multiple project action, ongoing and proposed actions in the Imnaha Subbasin, Wallowa County, Oregon, encompassed 60 actions including bridge replacement and repair, culvert replacement and repair, road maintenance, and a screened water diversion (2.8 cfs). Effects of these actions were expected to result in unquantifiable short-term sedimentation or disturbance from road work, changes in peak/base flows, and injury or death to individual bull trout that are trapped between the fish screen and water diversion.

The replacement of two bridges within these basins was expected to cause short-term adverse effects to bull trout from disturbance and increased sedimentation, with long-term beneficial effects due to the removal of creosote-treated timbers.

The BLM's Vale District integrated noxious weed management program (for calendar years 2001 to 2011; 1 biological opinion) was expected to have unquantifiable but sub-lethal effects to migratory bull trout from the application of herbicides.

The Oregon Conservation Reserve Enhancement Program (1 biological opinion) was expected to have unquantifiable short-term adverse effects with long-term benefits to bull trout recovery.

Several research actions have undergone consultation in the Imnaha/Snake River Basins (3 biological opinions). Studies include: (1) monitoring the migrations of wild Snake River spring/summer chinook salmon smolts; (2) a genetic monitoring and evaluation program for supplemented populations of chinook salmon and steelhead in the Snake River Basin, and (3) issuance of 10(a)(1)(A) permits. These studies were expected to result in the possibility of injury and mortality from electrofishing, handling and temporary confinement in nets or traps, however, adverse effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

Operation of the Lower Snake River Compensation Plan Program (1 biological opinion) in the Imnaha/Snake River Basins was expected to result in obstacles or barriers, which detain or delay migrating fish. Harassment of about 400 fish per year, across multiple Units, (via catch and release) was expected as a result of scientific monitoring and evaluation of salmonids. Displacement (release of hatchery-reared fish cause loss of food and cover utilized by bull trout), in-stream flow reductions (along an average of 200 meters of stream reach at each of 19 facilities that have water diversions), and increased levels of nutrients and sediment (along an average of 100 meters of stream reach at each of 26 facilities that discharge effluent) were also expected. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) and the revision to the Land Management Plans for the Boise, Payette, and Sawtooth National Forests in the Imnaha/Snake River Basins were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

John Day River Basin

Consulted-on Federal actions involving habitat disturbance activities in the John Day River Basin included 1 multiple project action (1 biological opinion), 1 programmatic grazing action (5 biological opinions issued on an annual basis) and 1 weed management action (1 biological opinion).

The multiple project action, the Malheur National Forest's year 2000 ongoing and new activities in the Middle Fork John Day sub-basin included its recreation program (providing, maintaining and monitoring 2 developed campgrounds and 3 Forest camps, numerous trail heads and associated roads, and several hundred dispersed campsites) and transportation program (general road maintenance, road closure and obliteration, drainage structure maintenance, logging out, and bridge maintenance). Effects to spawning and migratory habitat included adverse affects to behavior, spawning success, suspended sediment, streambank quality, bank stability, water temperature and food supply along 39 miles of stream reach.

Use of 19 grazing allotments on the Malheur National Forest was expected to result in unquantifiable but low-level adverse effects because of implementation of conservation measures and utilization standards.

The BLM's Vale District integrated noxious weed management program (for calendar years 2001 to 2011; 1 biological opinion) was expected to have unquantifiable but sub-lethal effects to migratory bull trout from the application of herbicides.

The Oregon Conservation Reserve Enhancement Program (1 biological opinion) was expected to have unquantifiable short-term adverse effects with long-term benefits to bull trout recovery.

Several research actions have undergone consultation in the John Day River Basin (3 biological opinions). Studies include: (1) monitoring the migrations of wild Snake River spring/summer chinook salmon smolts; (2) a genetic monitoring and evaluation program for supplemented populations of chinook salmon and steelhead in the Snake River Basin, and (3) issuance of 10(a)(1)(A) permits. These studies were expected to result in the possibility of injury and mortality from electrofishing, handling and temporary confinement in nets or traps, however, adverse effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the John Day River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Klamath River Basin

Consulted-on Federal actions involving habitat disturbance activities in the Klamath River Basin included 1 programmatic road-work consultation (1 biological opinion), 1 programmatic grazing action (1 biological opinion), 1 project-scale grazing action (1 biological opinion) and 1 programmatic habitat restoration action (1 biological opinion).

The programmatic road-work consultation involved road repair, road fill, culvert replacement, improving drainage on roads, and road decommissioning within four basins on the Fremont National Forest. Adverse effects from these activities were unquantifiable due to the scale of analysis.

The Fremont National Forest grazing programmatic biological opinion and the grazing consultation on the Silver Creek pasture of the Foster Butte Allotment in the Fremont National Forest concluded that effects to bull trout from grazing was expected to be minimal to undetectable given that no grazing would occur near bull trout occupied streams.

The Degree restoration project and the North Fork Sprague River Stream Restoration Projects on the Sprague River in the Fremont National Forest included the restoration or maintenance of late- and old-structure forest stands; restoration of meadows and/or riparian areas; silvicultural treatments, commercial and pre-commercial thinning; road closure and obliteration; and, three miles of bank excavation and angle reduction, and revegetation. These activities were anticipated to have short-term adverse effects with long-term benefits to bull trout recovery.

The Oregon Conservation Reserve Enhancement Program (1 biological opinion) was expected to have unquantifiable short-term adverse effects with long-term benefits to bull trout recovery.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Klamath River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Little Lost River Basin

There has been only one Federal action involving a habitat disturbance activity in the Little Lost River Basin, the Little Lost River flood control project (1 biological opinion). This action included the seasonal (winter) dewatering of 10.5 miles of the Little Lost River by diversion of stream flow into sink trenches. We anticipated that 53 large fluvial individual bull trout would be killed or injured each year, along a 10.5 mile long reach this river.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (1 biological opinion) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Little Lost River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Lower Columbia River Basin

Consulted-on Federal actions involving habitat disturbance activities (e.g., grazing, road work, bridge work, mining, timber sales/harvest, recreation, flood control, erosion control, pipeline projects, landslide remediation, instream crossing for vehicles, navigation channel improvement/dredging, and levee repair) in the Lower Columbia River Basin (7 biological opinions) were generally anticipated to result in short-term, localized or minor, increases in turbidity and sedimentation in bull trout migratory corridors and/or spawning streams. Actions comprised of research, handling fish, fishery surveys, and scientific take permits (3 biological opinions) were expected to cause injury or mortality to individual fish, however, such affects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the PACFISH/INFISH land and resource management plan (1 biological opinion) in the Lower Columbia River Basin were unquantifiable due to the scale of analysis, but future projects under this programmatic consultation were expected to result in only short-term localized or minor increases in turbidity and sedimentation in affected streams.

Malheur River Basin

Consulted-on Federal actions involving habitat disturbance activities in the Malheur River Basin included 1 multiple project action (1 biological opinion), grazing activities on the Malheur National Forest (7 biological opinions), 1 hydropower project (1 biological opinion), 1 programmatic recreation action (1 biological opinion), 1 bridge-work action (1 biological opinion), and 1 programmatic weed management action (1 biological opinion).

The multiple project action covered the Malheur National Forest's 2000, North Fork Malheur sub-basin ongoing activities, including its recreation program (providing, maintaining and monitoring 3 developed campgrounds, numerous trail heads and associated roads, and numerous dispersed campsites) and its transportation program (general road maintenance, road closure and obliteration, drainage structure maintenance, logging out, and bridge maintenance). Effects to spawning and migratory habitat included adverse affects to behavior, spawning success, suspended sediment, streambank quality, bank stability, water temperature and food supply along 39 miles of stream reach.

Use of 19 grazing allotments on the Malheur National Forest (7 biological opinions) was expected to result in unquantifiable but low-level adverse effects because of implementation of conservation measures and utilization standards.

The Bureau of Reclamation’s operations and maintenance activities in the Snake River Basin upstream of Lower Granite Dam Reservoir was expected to result in barriers to, or delays to, migration and entrainment of at least 7 percent of the bull trout, annually, in Arrowrock, Anderson Ranch, Beulah Reservoir and other BR facilities.

The programmatic recreation action analyzed the effects of 2003-2004 trail maintenance activities for the North Fork Malheur River, Sheep Creek, and Crane Creek Trails. The effects of these trail maintenance activities were unquantifiable, but were expected to be only short-term increases in sedimentation, with no long-term ramifications.

The BLM's Vale District integrated noxious weed management program (for calendar years 2001 to 2011; 1 biological opinion) was expected to have unquantifiable but sub-lethal effects to migratory bull trout from the application of herbicides.

The Oregon Conservation Reserve Enhancement Program (1 biological opinion) was expected to have unquantifiable short-term adverse effects with long-term benefits to bull trout recovery.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) and the Southeast Oregon Resources Management Plan (1 biological opinion) in the Malheur River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Middle Columbia River Basin

Consulted-on Federal actions involving habitat disturbance activities in the Middle Columbia River Basin (1 biological opinion) were anticipated to have short-term, localized or minor, increases in turbidity and sedimentation in migratory corridors and/or spawning streams.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (3 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Middle Columbia River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

One hydropower action has undergone formal consultation (1 biological opinion) in the Middle Columbia River Basin. This action, the construction of a 13.6-megawatt run-of-the-river hydroelectric project at the base of Tieton Dam, was expected to result in an unquantifiable amount of entrainment of fish out of Rimrock Lake, a bull trout stronghold in the Yakima Basin.

Northeast Washington River Basins

The effects of three road work actions (3 biological opinions) in these basins included the degradation of spawning and rearing habitat at 33 stream crossings and along 1.25 miles of stream, sedimentation in spawning and rearing habitat from 2.5 miles of stream adjacent to a road, and sedimentation effects to unquantified amount of spawning and rearing habitat at 30 stream crossings and from 18 miles of road. All of these road-related effects were within the Le Clerc Creek watershed on the Colville National Forest.

The single grazing action (1 biological opinion) consulted on in these basins was also in Le Clerc Creek and was expected to have unquantifiable effects from sedimentation, streambank devegetation, trampling effects, and stream temperature increase causing degradation of spawning and rearing habitat and loss of eggs, fry, and alvins.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Northwest Washington River Basins were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Odell Lake Watershed

Consulted-on Federal actions involving habitat disturbance activities in the Odell Lake watershed included 1 multiple project action (1 biological opinion) and 1 habitat restoration action (1 biological opinion).

The multiple project action, was comprised of a batch of actions within the Deschutes River Basin for the Deschutes National Forest and Bureau of Land Management, Prineville District, and included timber sales/harvest, prescribed burning, thinning cuts, fuel treatments, campground and trail rehabilitation and use, road maintenance and management actions, grazing allotments, throughout the Deschutes River Basin. The adverse effects of these land management actions were expected to have unquantifiable effects to spawning, rearing, and migratory bull trout habitat. Parameters that were likely to be adversely affected included water temperature, substrate quality, bank stability, food supply, spawning success, and suspended sediment levels.

The habitat restoration action involved re-routing of Trapper Creek, on the Deschutes National Forest, and the construction of a new channel to create habitat elements more suitable for bull trout spawning and rearing. This action was expected to result in death or injury to 3 age classes of juvenile fish because of short term degradation of water quality and other habitat elements in a 0.8 mile of stream reach; however, the long-term benefits were expected to outweigh the short-term adverse effects.

The Oregon Conservation Reserve Enhancement Program (1 biological opinion) was expected to have unquantifiable short-term adverse effects with long-term benefits to bull trout recovery.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) and the Southeast Oregon Resources Management Plan (1 biological opinion) in the Odell Lake watershed were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Snake River Basin in Washington

Several research actions have undergone consultation in this basin (3 biological opinions). Studies include: (1) monitoring the migrations of wild Snake River spring/summer chinook salmon smolts; (2) a genetic monitoring and evaluation program for supplemented populations of chinook salmon and steelhead in the Snake River Basin, and (3) issuance of 10(a)(1)(A) permits. These studies were expected to result in the possibility of injury and mortality from electrofishing, handling and temporary confinement in nets or traps, however, adverse effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

Operation of the Lower Snake River Compensation Plan Program (1 biological opinion) in the Snake River Basin in Washington was expected to result in obstacles or barriers, which detain or delay migrating fish. Harassment of about 400 fish per year, across multiple Units, (via catch and release) was expected as a result of scientific monitoring and evaluation of salmonids. Displacement (release of hatchery-reared fish cause loss of food and cover utilized by bull trout), in-stream flow reductions (along an average of 200 meters of stream reach at each of 19 facilities that have water diversions), and increased levels of nutrients and sediment (along an average of 100 meters of stream reach at each of 26 facilities that discharge effluent) were also expected. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

Umatilla-Walla Walla River Basins

Consulted-on Federal actions involving habitat disturbance activities in the Umatilla-Walla Walla River Basins included 1 bridge-work action (1 biological opinion) and 1 habitat restoration action (1 biological opinion), 1 instream crossing (1 biological opinion), and 1 programmatic weed management action (1 biological opinion).

The McKay Creek Bridge scour repair project involved excavating streambed, placing riprap, and a temporary cofferdam for dewatering of the excavation area. Effects to migratory bull trout habitat were limited to short-term increases in turbidity and sedimentation due to instream equipment and the displacement of individual fish.

The Milton Freewater 1135 setback levee project was intended to restore a 1,200-foot section of the Walla Walla River, near Milton Freewater, Oregon, through the removal of riprap, car bodies and manmade debris. The short-term adverse effects of increased sedimentation are expected to be offset by long-term benefits to properly functioning aquatic conditions.

The private access to South Fork Walla Walla Road included seven instream vehicle crossings (each 80-100 feet wide) of the South Fork Walla Walla River. Effects to migratory, spawning, and rearing bull trout included intermittent vehicular use (driving across river) causing disturbance to stream substrate, stream bank and riparian habitat, and potential introduction of contaminants, which was expected to directly or indirectly affect fish along a 2.5-mile reach of river.

The BLM's Vale District integrated noxious weed management program (for calendar years 2001 to 2011; 1 biological opinion) was expected to have unquantifiable but sub-lethal effects to migratory bull trout from the application of herbicides.

The Oregon Conservation Reserve Enhancement Program (1 biological opinion) was expected to have unquantifiable short-term adverse effects with long-term benefits to bull trout recovery.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Umatilla-Walla Walla River Basins were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Upper Columbia River Basin

The continued use and associated maintenance of five water diversions and ditches for water conveyance across National Forest lands (1 biological opinion) was expected to adversely affect bull trout by removing present and future adult reproduction, as well as causing direct mortality to fluvial fish. We also anticipated that the water diversions would continue to affect fluvial and adfluvial bull trout through altered peak and base flows in about 23 miles of stream.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (3 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Upper Columbia River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

One early winter stream habitat restoration project (1 biological opinion) was expected to have unquantifiable long-term benefits to bull trout with minor short-term adverse effects to food supply and water quality, in the form of increased sedimentation over 0.5 miles for up to 10 days.

Willamette River Basin

Consulted-on Federal actions involving habitat disturbance activities in the Willamette River Basin included 1 multiple project action (3 biological opinions; issued on an annual basis), 2 hydropower actions (2 biological opinions), 1 batched timber sale/harvest actions (2 biological opinions; the second superceded the first), multiple batched habitat restoration actions (1 biological opinion), and 1 levee repair action (1 biological opinion).

The multiple project action in the Willamette River Basin involved ongoing Forest Service and BLM activities within the Willamette and a portion of the Deschutes Provinces (1999-2002) for road maintenance, aquatic habitat restoration, trail maintenance and construction, repair of storm damaged roads, road decommissioning and obliteration, instream surveys, water withdrawal permits, use of haul roads from rock quarries, boat ramp use, public use of developed recreation sites and dispersed recreation. Effects of these activities were expected to result in unquantifiable short-term adverse effects to suspended sediment, substrate quality, bank stability, water temperature, and food supply. We also expected some unquantifiable beneficial effects to bull trout from management actions.

One of the hydropower projects was the water temperature control project at Cougar Dam in the McKenzie River sub-basin. The effects of this action were expected to be unquantifiable death and injury from short-term adverse effects to water quality, reduced flows, entrainment, migration delays, and from the capture and handling of individual fish.

The other hydroelectric project in this basin was the issuance of the original hydropower license for the McKenzie Hydroelectric Project. The proposed action included continued operation of a run-of-river hydroelectric dam, installation of fish screens and bypass, installation of an adult fish barrier in the tailrace, and annual removal of sediment at headgate. This hydropower project was expected to result in an unquantifiable amount of death and injury due to entrainment into turbines prior to construction of fish screens, migration delays for upstream migrating fish, and sediment and temperature effects. Part of this proposed action included the operation of new fish passage facility.

One of the timber sales within the Willamette River Basin was the Staley, Upper Liz, Tumbler and Happy Bird timber sales in the Upper Fork of the Willamette River, on the

Willamette National Forest. These timber sales and harvests encompassed 675 acres of shelterwood harvest, seed trees with reserves harvest, and commercial thinning. The action also included construction of temporary roads, and a moderate-level road reconstruction. Due to the elevation and distance from the stream project effects were anticipated to be negligible.

Batched habitat restoration actions occurred under the Middle Fork Willamette River, Upper South Fork McKenzie, and Roaring River Aquatic Restoration projects, Lane County, Oregon. Activities under this opinion included placement of large woody material (logs, single pieces and multiple complexes) into tributaries and side channels, culvert treatment for fish passage, and riparian silviculture treatment (thinning overstocked stands, riparian zone conifer planting). Although some short-term adverse effects were anticipated, the long-term benefits included the restoration of 34 miles of stream.

The Willamette National Forest Salmon Creek levee reconstruction project consisted of repairing 2,050 feet of a flood damaged levee by diverting a stream and dewatering 5 sites along the levee, excavation and placement of fill, and construction of fish habitat enhancement rock structures. Effects of this action were limited to short-term disturbance from instream construction equipment and increases in turbidity and sedimentation in a migratory corridor.

The Oregon Conservation Reserve Enhancement Program (1 biological opinion) was expected to have unquantifiable short-term adverse effects with long-term benefits to bull trout recovery.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the Northwest Forest Plan (1 biological opinion) in the Willamette River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Salmon River Basin

Consulted-on Federal actions involving habitat disturbance activities in the Salmon River Basin included 1 multiple project action (1 biological opinion), 2 road-work actions (2 biological opinions), 4 programmatic grazing actions (4 biological opinions), 2 habitat restoration action (2 biological opinion), 1 mining action (1 biological opinion), and 1 landslide remediation action (1 biological opinion).

The multiple project action included ongoing actions within the Sawtooth Valley subpopulation of the bull trout and consisted of a water diversion for irrigation, construction of a fish barrier, and campground maintenance and recreation. We anticipated that these actions would result in an unquantifiable amount of death, injury, and alteration of normal behavior patterns caused by in-stream flow reductions, diversion, entrainment and entrapment, barriers to fish passage, and effects from recreational activities.
The two road work actions (Warren Profile Gap Road, and road reconstruction and emergency watershed protection projects on Forest Development Roads (FDR) 340 and 337, including the replacement of Midvale telephone lines and a road-use agreement in the Lower South Fork Salmon River) were expected to result in unquantifiable adverse affects due to heightened amounts of sediment.

The four grazing actions [(1) ongoing actions affecting bull trout in the Panther Creek subpopulation, (2) ongoing actions in the Lemhi River watershed, (3) Ongoing actions within the East Fork of the Salmon River, and (4) ongoing actions within Upper Canyon subpopulation (of bull trout) watershed] were all expected to have unquantifiable adverse effects to the bull trout from sedimentation, nutrient loading, streambank devegetation and trampling effects.

One habitat restoration action was the replacement of an existing round culvert with an open bottom arch culvert, construction of instream fish habitat improvement structures (stone weirs), and placement of wood debris into the East Fork of John Day Creek, in the Lower Salmon River sub-basin. The project also included the temporary dewatering of a small section of East Fork of John Day Creek during construction and the capture and relocation of fish from the project site. Adverse effects of this long-term beneficial project included a short-term disturbance to water quality and bull trout habitat and potential death or injury to bull trout from capturing, handling and relocating fish along 300 feet of stream.

The Clean Slate Ecosystem Management Project was a watershed aquatic restoration and terrestrial vegetative community restoration action on the Nez Perce National Forest, involving prescribed burning, timber harvest (2,900 acres), road stabilization and construction, riparian enhancement (planting, thinning, fertilizing), restoration of whitebark pine, and drainage improvement. This action was expected to result in short-term modifications to breeding, feeding, and sheltering of resident and migratory bull trout with the potential for death and injury to eggs, fry and juvenile fish. Restoration activities were expected to lead to the long-term improvement of bull trout habitat conditions within the Slate Creek drainage on the Nez Perce National Forest.

The mining action (the Golden Hand No. 3 and No. 4 Lode Mining Claims Proposed Plan of Operations in Idaho and Valley Counties, Idaho) consisted of developing mine claims; road construction and maintenance; installation of culverts, a log-stringer bridge and geo-grid fords; heavy equipment use and fuel transport; drill operations; stream water withdrawal; and site reclamation. Adverse effects of this mine development included sedimentation, stream flow reductions, and the potential for chemical contamination.

The landslide remediation action on Highway 95 in Idaho, along the Salmon River, consisted of the removal of slide material, placement and retention of fill in Salmon River, and was expected to have negligible effects to the bull trout.

Several research actions have undergone consultation in this Salmon River Basin (4 biological opinions). Studies include: (1) monitoring the migrations of wild Snake River spring/summer chinook salmon smolts; (2) a genetic monitoring and evaluation program for supplemented populations of chinook salmon and steelhead in the Snake River Basin, (3) a study of marine nutrients from spawning salmon in Columbia and Snake River Basins, and (4) issuance of 10(a)(1)(A) permits. These studies were expected to result in the possibility of injury and mortality from electrofishing, handling and temporary confinement in nets or traps, however, adverse effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Salmon River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Southwest Idaho River Basins

Consulted-on Federal actions involving habitat disturbance activities in the Southwest Idaho River Basins included 3 multiple project actions (3 biological opinions), 1 grazing action (1 biological opinion), 1 mining action (1 biological opinion), and 2 hydropower actions (2 biological opinions).

Multiple project actions included ongoing and proposed actions within the Lower Boise River subpopulation (of bull trout) watershed, the Weiser River Watershed, and the South Fork Boise River Watershed. Activities included grazing, road construction, mining landscape vegetation management (timber harvest, skid trail construction, prescribed fire, silvicultural treatments, skid trail obliteration, site rehabilitation, road removal and obliteration, road reconstruction, culvert replacement), irrigation ditch operation and maintenance (water diversion, installation of fish screens, ditch cleaning, installation of temporary weirs), and fish surveys (snorkeling, trapping, electrofishing). Effects of these activities included injury and mortality from electrofishing and handling, trampling of redds and streambanks, sedimentation, altered stream temperatures, reduced amount of woody debris (all expected to be short term effects caused by disturbance of spawning and rearing habitat) along an unquantified distance of stream. Effects also included diversion entrainment and entrapment that was minimized by fish screens.

The grazing action in the Southwest Idaho River Basins was the ongoing and proposed actions within the Bear Valley watershed. Effects of grazing on the Bear Valley bull trout subpopulation included an unquantifiable amount of sedimentation, nutrient loading, streambank devegetation, and trampling effects.

The mining action in the Southwest Idaho River Basins was the ongoing and proposed actions in the west-half South Fork Boise River which was expected to result in an unquantifiable amount of sediment in the Boise River Watershed on the Boise National Forest.
One of the hydropower actions within this Southwest Idaho River Basins, the Atlanta Power Station Hydroelectric Project License Application, included construction and operation of a fish screen at the powerhouse intake and the construction and operation of a downstream fish passage facility. Adverse effects included the possible delay of upstream and downstream migration and bull trout entrainment or entrapment.

The Bureau of Reclamation's operations and maintenance activities in the Snake River Basin upstream of Lower Granite Dam Reservoir was expected to result in barriers to, or delays to, migration and entrainment of at least 7 percent of the bull trout, annually, in Arrowrock, Anderson Ranch, Beulah Reservoir and other BR facilities.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

Operation of the Lower Snake River Compensation Plan Program (1 biological opinion) in the Southwest Idaho River Basins was expected to result in obstacles or barriers, which detain or delay migrating fish. Harassment of about 400 fish per year, across multiple Units, (via catch and release) was expected as a result of scientific monitoring and evaluation of salmonids. Displacement (release of hatchery-reared fish cause loss of food and cover utilized by bull trout), in-stream flow reductions (along an average of 200 meters of stream reach at each of 19 facilities that have water diversions), and increased levels of nutrients and sediment (along an average of 100 meters of stream reach at each of 26 facilities that discharge effluent) were also expected. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Southwest Idaho River Basins were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Clark Fork River Basin

Consulted-on Federal actions involving habitat disturbance activities in the Clark Fork River Basin included 4 multiple project actions (4 biological opinions), 4 timber sales/harvest actions (4 biological opinion), 2 grazing actions (2 biological opinion), 5 bridge-work actions (5 biological opinions), 3 road-work actions (3 biological opinions), 4 mining actions (4 biological opinions), 3 recreation actions (3 biological opinions), 1 pipeline action (1 biological opinion), 1 hydropower action (1 biological opinion), 1 water diversion or irrigation system action (1 biological opinion), and 1 habitat restoration action (1 biological opinion).

Multiple project actions included timber harvest, salvage logging following fire prescribed burning, ground and aerial application of herbicides, road obliteration, road maintenance and travel plan revision, soil stabilization, dam and mine site reclamation, culvert removal, and elimination of fish barriers on the Lolo, Flathead, Bitterroot, and Helena National Forests. These activities were expected to result in the short-term degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply. Increases in sedimentation were anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.

The four timber sale actions in the Clark Fork River Basin (all occurring on the Lolo National Forest, with one spanning the Lolo and Beaverhead Deerlodge National Forest) were anticipated to result in over 6,500 acres of harvest with several hundred acres of prescribed burning, and the construction of over 28 miles of new roads, noxious weed spraying and road obliteration. Effects of these actions were expected to be unquantifiable and in the form of degradation to aquatic habitat parameters including substrate quality, rearing habitat, and food supply. Increases in sedimentation were anticipated to adversely affect feeding and sheltering patterns of adult and juvenile fish.

Grazing actions included grazing in 3 allotments on the Swan River Watershed, Flathead National Forest and 20 allotments in the Upper Clark Fork River, Rock Creek and Middle Clark Fork River subbasins. Effects of these actions were expected to be unquantifiable but in the form of degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply. Increases in sedimentation and damage to riparian vegetation from grazing was expected to adversely affect eggs, larval and juvenile fish and impair spawning, feeding and sheltering patterns of juvenile and adult fish.

The replacement of 5 bridge structures and the installation of rip-rap and approach roads were anticipated to result in short-term adverse effects to migratory and spawning habitat due to instream construction disturbances and increased suspended sediment.

Construction or reconstruction of approximately 67 miles of roads in this basin was also expected to have short-term adverse effects to migratory and spawning habitat due to instream construction disturbances and increased suspended sediment.

Mining operations in the Clark Fork River Basin ranged from small-scale operations (suction dredge placer mining in 1,300 linear feet of the Vermillion River on the Kootenai National Forest) to a large number of mining operations across the Lolo National Forest. The Kootenai National Forest also contained a portion of the Sterling Corporation Rock Creek Silver/Copper Mine on Rock Creek, which included 483 surface acres of ground disturbance, 9 miles of road construction, a water treatment facility and discharge to the river, a tailings paste facility, a rail loadout, evaluation adit, and underground mine workings. In our biological opinion for this action, we determined that it is likely that the long-term effects of mining operations would continue indefinitely after mine closure. The fourth mining project having undergone consultation in the Clark Fork River Basin was the Washington Gulch Mining Plan of Operation, which included a placer mining pit operation on Washington Creek in the Helena National Forest. Associated activities included: a stream diversion for gravel washing, clearing all streamside vegetation and trees at mining site, upgrading access roads, construction of haul roads, and site reclamation, including revegetation of site at the end of each mining season. Effects of these mining activities included short and long-term adverse effects from degradation of aquatic habitat parameters including substrate quality, rearing habitat, and food supply; an increase in sedimentation which we anticipated would adversely affect feeding and sheltering patterns of adult and juvenile fish.

Recreation activities consulted on included upgrade of a boat launch, operation and maintenance of Snowbowl Ski Area, and permitting of outfitter services on the Flathead National Forest. Adverse effects from these activities included short term degradation of aquatic habitat parameters including substrate quality, pool quality and frequency, rearing habitat, and food supply, horses trampling redds, impairment of essential breeding behavior, and death or injury to bull trout through incidental catch during the legal harvest of other game fish.

The pipeline action consulted on was to reroute the Yellowstone pipeline away from a creek and was only expected to have short-term adverse effects associated with ground disturbance near the stream.

The Big Fork Hydroelectric Project on the Swan River in Montana was expected to result in a small, but unquantifiable amount of death, injury, and disruption of bull trout breeding, feeding, and sheltering from sediment input, entrainment and impingement of all fish life stages, and from operation and maintenance of fish screens.

The operations and maintenance of the Big Flat and Frenchtown Irrigation Diversions included unscreened diversion of water from two rivers for the purpose of irrigation, the obstruction of flow of a river side-channel, application of a biocide, and periodic manipulation of bedload and gravel bar deposits. The effects of this action were unquantifiable, but were expected to result in entrainment of bull trout into the unscreened irrigation system resulting in the permanent loss of individual fish from bull trout populations in the Bitterroot and Clark Fork rivers.

The Chicken Creek emergency sandbag placement project on a tributary to the West Fork of the Bitterroot River, Flathead National Forest, may have resulted in the death or injury to a small number of bull trout along 100 feet of Chicken Creek.

The issuance of a Section 10(a)(1)(B) Incidental Take Permit to Plum Creek Timber Company for the Proposed Native Fish Habitat Conservation Plan (NFHCP) in the States of Washington, Idaho, and Montana affected the Clark Fork River Basin. This 30 year permit included various management activities such as silvicultural activities (tree planting, site preparation, prescribed burning, timber harvest in riparian and upland areas, stand maintenance, forest nurseries, and seed orchards), as well as related actions of logging road construction and maintenance and gravel quarrying for roads. Other forestry activities included forest fire suppression, open range cattle grazing, miscellaneous forest and land product sales, and conservation activities. Additional land use activities that are non-forest actions and special forest uses include commercial outfitting, recreation, electronic facility sites, and mill site facilities that manufacture various forest products. The effect of these actions was unquantifiable, but adverse effects to the bull trout were expected to be infrequent and localized.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Clark Fork River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Kootenai River Basin

Consulted-on Federal actions involving habitat disturbance activities in the Kootenai River Basin included 2 multiple project actions (2 biological opinion), 2 road-work actions (2 biological opinions), 1 mining action (1 biological opinion), and 1 habitat restoration action (1 biological opinion).

The Kootenai National Forest's Spar and Lake Subunits Forest Health Project (multiple project action) included vegetation management and watershed restoration; timber harvest treatments (2,200 acres) including fuel treatments, regeneration harvests, thinning cuts, salvage; road decommissioning (5.4 miles), replacement of culverts; and road reconstruction (7.4 miles). The effects of these actions on bull trout were unquantifiable but were expected to result in death, injury, and modifications to normal breeding, feeding, and sheltering behavior from sedimentation and turbidity adversely affecting eggs, larval and juvenile life stages.

The other multiple project action (Blue Grass Bound Timber Sale, Boundary Creek Road obliteration, and Grass Creek range allotment) included timber harvest on 2,567 acres, road construction (1 mile), decommissioning (97 miles) and obliteration (5 miles); bridge repair and culvert replacement; and grazing. Adverse effects of this action included short-term turbidity and sedimentation along 10 miles of stream reach and unquantifiable effects related to grazing which was expected to result in sedimentation, nutrient loading, streambank devegetation, and trampling. In the long term, road decommission and obliteration was expected to have beneficial effects to the bull trout.

Other road construction activities included the reconstruction (widening and straightening) of 20 miles of road in Pleasant Valley, Montana. Highway 2 construction

also included replacement of culverts and the enhancement of 2.5 miles of stream. This was expected to result in short-term adverse effects with some long-term benefits in those areas undergoing restoration activities.
The one mining activity consulted-on in the Kootenai River Basin was the Northwest Montana Gold Prospectors Association, William Gross - Crazyman Placer, and Linda and Robert Taylor suction dredging operations, which included ongoing and proposed placer, sluicing, and suction dredge mining activities. Adverse effects from these operations included unquantifiable degradation of aquatic habitat parameters including adverse effects to substrate quality, rearing habitat, and food supply. Increases in sedimentation and changes in channel and habitat complexity associated with this action were anticipated to adversely affect eggs, larval and juvenile life stages by impairing feeding, spawning, and sheltering patterns.

The Wigwam watershed restoration project on the Kootenai National Forest included various watershed restoration activities to restore the natural drainage patterns of tributary channels to the Wigwam River. Watershed restoration activities involved removal of 47 culverts and 2 log bridges, installation of ditch relief channels, and translocation of fish from project sites. This restoration action was expected to have some short-term adverse effects with long-term benefits to bull trout recovery.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (2 biological opinions) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the INFISH/PACFISH land management plan (1 biological opinion) in the Kootenai River Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Coastal Puget Sound DPS

Olympic Peninsula

Consulted-on Federal actions involving habitat disturbance activities on the Olympic Peninsula included 1 multiple project action (1 biological opinion), 3 road-work actions, and 1 erosion control action (1 biological opinion).

The multiple project action (Falls Creek channel restoration and bridge replacement project) consisted of a trail bridge replacement, removal of fishway, placement of in-channel flow structures, removal of hazard trees, and streambank stabilization. Effects of these actions were anticipated to be minor and short-term along 1,150 feet of stream reach with long-term benefits to the bull trout.

The road actions involved decommissioning, stabilizing, and repairing roads. Although short-term adverse effects were anticipated over 26.5 miles of stream, all three projects were expected to result in long-term benefits to the bull trout.
The erosion control project, Olympic National Park Upper Hoh Road Protection project at mile post 1.55 and 1.75 included riprapping riverbank at two locations, along 250 feet at each site and 45 feet into channel. This was anticipated to cause localized short-term increases in turbidity and sediment and adverse effects to bull trout food supply within 4 miles of stream until the area stabilized.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (1 biological opinion) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the Northwest Forest Plan (1 biological opinion) on the Olympic Peninsula were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

Puget Sound Basin

Consulted-on Federal actions involving habitat disturbance activities in the Puget Sound Basin included 2 bridge-work actions (2 biological opinions), 1 road-work action (1 biological opinion), and 2 land exchanges (2 biological opinions).

One of the bridge actions (the Hood Canal Bridge Retrofit) involved construction of bridge approaches, a floating bridge and anchoring; pile driving and graving dock operations; and demolition of old bridge and piers. These activities were expected to disrupt migratory and foraging behaviors of bull trout within 300 feet of the construction zone and to injury or kill anadromous adult and sub-adult bull trout within 100 feet of pile driving and graving docks. The other bridge action was the demolition of the Haller/Nugents Bridge on the Stillaguamish River. This action was expected to result in short-term adverse effects to bull trout within 600 feet of stream around the structure as it was demolished.

The road-work action, State Route 522, Paradise Lake Road to Cathart Road widening and improvements, included road resurfacing and construction; placement of stormwater outfall and riprap; and the temporary dewatering and diversion of flow. Adverse effects to bull trout within 600 feet of stream were expected to be short-term.

One of the land exchanges was exchange of 11,556 acres of Forest Service lands for 31,705 acres of Plum Creek Timber Company. The effects of this exchange were undetermined. The other exchange involved the transfer of 324 acres of Tribal lands (Muckleshoot Indian Tribe) into trust status by Bureau of Indian Affairs; land uses include 217 acres for fish and wildlife management, 98 acres for development of amphitheater and related features, and 9 acres for the construction of a Counseling Center. The effects of this land-use designation were anticipated to include short- to long-term effects to bull trout habitat components and food supply along a 0.28-mile reach of stream.

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (1 biological opinion) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

The effects of the Northwest Forest Plan (1 biological opinion) in the Puget Sound Basin were unquantifiable due to the scale of analysis but future projects under this programmatic consultation were expected to cause only short-term, localized or minor, increases in turbidity and sedimentation in affected streams.

St. Mary Belly River DPS

St. Mary Belly Rivers

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (1 biological opinion) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

Jarbidge River DPS

Jarbidge River

Consulted-on Federal actions comprised of research, handling fish, fishery surveys, and scientific take permits (1 biological opinion) were expected to cause injury or mortality to individual fish, however, such effects were anticipated to be of low-magnitude. The long-term effect of these research-oriented actions was expected to promote recovery of the bull trout.

<u>Ongoing Conservation Actions</u>

Currently there are several Federal, State, Tribal, and Canadian programs being developed or implemented to address the conservation needs of bull trout in the coterminous United States.

Federal Conservation Actions

Recovery Plan: The Service has developed a draft *Bull Trout Recovery Plan*, which was released for public review in November 2003. Recovery planning for the bull trout was developed under the direction of an overall recovery team and individual "recovery unit" teams that addressed bull trout conservation needs at specific geographic locations. Membership on the recovery unit teams was generally-extended to any and all interested parties, including biologists and experts in related disciplines from local, State, Tribal and Federal entities, stakeholder groups representing timber interests, water users, agriculture, power producers and distributors, landowners, conservation groups, tourism advocates, and local government. The bull trout recovery planning process is based in part, on previous State and locally-driven conservation planning efforts throughout the range of the species. Some of these efforts are described below.

PACFISH/INFISH: Management plans for Bureau of Land Management and Forest Service lands within the range of bull trout have been amended by the *Interim Strategy for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California* (PACFISH; USDA and USDI 1995) and the *Interim Strategy for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and Portions of Nevada* (INFISH; USDA 1995b). PACFISH was developed by the Bureau of Land Management and the Forest Service and is intended to be an ecosystem-based, aquatic habitat and riparian-area management strategy for Pacific salmon, steelhead, and sea-run cutthroat trout habitat on lands administered by the two agencies that are outside the area subject to the Northwest Forest Plan. INFISH was developed by the Forest Service to provide an interim strategy for inland native fish in areas outside those where PACFISH and the Northwest Forest Plan apply. The Bureau of Land Management also implements INFISH in areas where bull trout occur on their lands.

In December 1998, regional executives for the Service, NOAA-Fisheries, the Forest Service and the Bureau of Land Management established "The Interagency Implementation Team." This Team is integral to coordinating the implementation of PACFISH and INFISH, under the direction of the regional executives. The Team has directed the establishment of a PACFISH/INFISH Monitoring Task Team for developing a program to track implementation and effectiveness of PACFISH/INFISH.

Northwest Forest Plan: On April 13, 1994, the Secretaries of the Department of Agriculture and the Department of the Interior adopted the Northwest Forest Plan for management of late-successional forests within the range of the northern spotted owl (*Strix occidentalis caurina*). The plan contains objectives, standards, and guidelines to provide for a functional late-successional and old-growth forest ecosystem. Included in the plan is an aquatic conservation strategy involving riparian reserves, key watersheds, watershed analysis, and habitat restoration.

Plum Creek Native Fish Habitat Conservation Plan: In 1999 the Plum Creek Timber Company developed a Habitat Conservation Plan in coordination with the Service to address bull trout and other native salmonids occurring on over 688,500 hectares (1.7 million acres) of corporate lands, primarily in the Columbia River basin. The majority of the land under consideration occurs in Montana (87 percent) with the remainder in Idaho and Washington.

Seven categories of conservation commitments were included in the Habitat Conservation Plan. The seven categories are: (1) road management; (2) riparian management; (3) livestock grazing; (4) land-use planning; (5) legacy management and other restoration opportunities; (6) administration and implementation measures; and (7) monitoring and adaptive management. The conservation benefits of activities in the seven categories include reducing sediment delivery to streams from roads and grazing, increasing canopy cover in riparian areas, restoring stream bank integrity and overall habitat complexity, and providing fish passage at road culverts and water diversion structures.

Washington Department of Natural Resources Habitat Conservation Plan: The Washington Department of Natural Resources developed a Habitat Conservation Plan that was adopted on January 1, 1999. The plan covers about 647,500 hectares (1.6 million acres) of forested State trust lands that lie within the range of the northern spotted owl. The Habitat Conservation Plan contains riparian conservation strategies that were designed to protect salmonid and riparian species for lands west of the Cascade Mountains crest. It includes a streamside no-harvest buffer strategy, a minimal-harvest area for ecosystem restoration, and a low-harvest area for selective removal of single trees or groups of trees and thinning and salvage operations. In addition to riparian buffers, road management standards were developed to ensure that mass-wasting (erosion and landslides) is not artificially accelerated and that sediment delivery remains near natural levels. The Habitat Conservation Plan also includes monitoring and adaptive management components. Minimization and mitigation actions that are being implemented under the plan will address the habitat requirements of bull trout and cumulatively will reduce adverse effects to bull trout in comparison to previous forest management practices (Service 1998d).

Northwest Power and Conservation Council Fish and Wildlife Program: Congress, through the Pacific Northwest Electric Power Planning and Conservation Act of 1980, directed the Northwest Power and Conservation Council (Council) to develop a Fish and Wildlife Program (note: the Council was formerly called the Northwest Power Planning Council). The program is intended to give the citizens of Idaho, Montana, Oregon, and Washington a stronger voice in the future of electricity generated by the Federal hydropower dams in the Columbia River basin and fish and wildlife affected by the dams and their operation.

One of the Council's major responsibilities is to develop a program to protect and rebuild fish and wildlife populations affected by hydropower development in the Columbia River basin. State, Tribal, and local governments often work closely with the Council as it develops power, and fish and wildlife plans. The Bonneville Power Administration provides funding for implementation of the Council's Fish and Wildlife Program. In

2000, the Council amended its Fish and Wildlife Program to include development of subbasin plans. Subbasin planning, beginning in 2002, is a means for identifying projects that will be funded to protect, mitigate, and enhance the Columbia River basin's fish and wildlife resources. These plans are viewed as crucial efforts for implementing the Endangered Species Act responsibilities of the Bonneville Power Administration, U.S. Army Corps of Engineers, and the Bureau of Reclamation in the Columbia River basin.

The primary objective of subbasin planning is to develop a unifying element for implementation of the Council's Fish and Wildlife Program. It will also assist in the implementation of Endangered Species Act recovery activities. One of the goals of the subbasin planning process is to provide specific products that can be integrated directly into the Endangered Species Act recovery planning and implementation process.

Federal Caucus Fish and Wildlife Plan: The Federal Caucus is a group of nine Federal agencies, formed as a result of the Federal Columbia River Power System consultation, that have responsibilities for natural resources affecting species listed under the Endangered Species Act. The involved agencies are: NOAA-Fisheries; the Service, Bureau of Reclamation, Bonneville Power Administration, U.S. Army Corps of Engineers, BIA, Forest Service, Bureau of Land Management, and the EPA. The Federal Caucus has drafted a basin-wide recovery strategy for listed anadromous fish in the Columbia River basin which addresses management of habitat, hatcheries, harvest, and hydropower. This recovery strategy, entitled *The Conservation of Columbia River Basin Fish*: *Final Basin-Wide Recovery Strategy*, will provide the framework for development of recovery plans for individual species and for effects determinations for actions under consultation. As recovery plans for individual species are developed following the basin-wide strategy, and measures to address biological needs of all stages of the life cycle are implemented, conditions for listed aquatic species (including bull trout) are expected to improve sufficiently to provide for their survival and recovery. The Strategy concludes that restoring tributary and estuary habitat is essential to recovering listed fish. The Strategy focuses on actions to restore tributary (both Federal and non-Federal), mainstem, and estuary habitat.

For long-term actions, the Strategy endorses the Council plan to conduct subbasin assessments, to develop subbasin plans, and to prioritize the implementation of restoration actions based on those plans. Once the assessments are complete, the Federal agencies will participate with State agencies, local governments, Tribes and stakeholders to develop subbasin plans.

U.S. Department of Agriculture Programs: The U.S. Department of Agriculture offers landowners financial, technical, and educational assistance to implement conservation practices on privately owned land. With this assistance farmers and ranchers apply practices that reduce soil erosion, improve water quality, and enhance forest land, wetlands, grazing lands, and wildlife habitat. U.S. Department of Agriculture assistance also helps individuals and committees restore areas affected by floods, fires, or other natural disasters.

This assistance is provided to landowners via Farm Bill programs administered by the U.S. Department of Agriculture, Farm Service Agency and the Natural Resources Conservation Service. The implementation of practices associated with these programs may improve conditions for bull trout. In particular, the Conservation Reserve Enhancement Program is targeted to areas in Oregon and Washington where other listed fish occur and may provide direct benefits to bull trout.

The Conservation Reserve Easement Program is an addition to the Conservation Reserve Enhancement Program. A Conservation Reserve Enhancement Program for the State of Oregon and the State of Washington was approved during October 1998, via Memoranda of Agreements between the United States Department of Agriculture, the Commodity Credit Corporation and the states of Oregon and Washington. The Conservation Reserve Easement Program is a partnership between Federal agencies, State agencies, and private landowners. Land enrolled in this program is removed from production and grazing, under 10 to 15-year contracts. In return, landowners receive annual rental, incentive, maintenance and cost share payments.

The Oregon Conservation Reserve Easement Program is a voluntary program offering annual payments to landowners for establishment of riparian buffers along streams and for restoration of wetlands. The Oregon Conservation Reserve Easement Program seeks to enroll up to 40,469 hectares (100,000 acres) located along streams inhabited (or once inhabited) by federally listed fish. Up to 5,000 of these acres may be cropped wetlands which are either hydrologically connected to these streams or located in coastal estuaries.

In Washington, eligible stream designations were originally based on spawning habitat for stocks designated as critical or depressed under the 1993 Salmon and Steelhead Stock Inventory. About 9,656 km (6,000 miles) of eligible streams were included. Recent changes allow for the nomination of additional stream segments where riparian habitat is a significant limiting factor, and a new cap of 16,093 km (10,000 miles) of eligible streams has been established.

Other Farm Bill programs encourage farmers to convert highly erodible cropland or other environmentally sensitive acreage to native vegetative cover, provide incentives for landowners to restore function and value to degraded wetlands on a long-term or permanent basis, assist landowners with habitat restoration and management activities specifically targeting fish and wildlife (including threatened and endangered species), provide technical and financial assistance to farmers and ranchers that face threats to soil, water, and related natural resources, and support forest management practices on privately owned, non-industrial forest lands.

State Conservation Actions

Idaho: The Idaho Department of Fish and Game, in cooperation with several Federal and State agencies, developed a management plan for bull trout in 1993 (Conley 1993). The State of Idaho approved the *State of Idaho Bull Trout Conservation Plan* (Idaho Plan) in July 1996 (Batt 1996). The Idaho Plan identifies an overall objective of maintaining or restoring interacting groups of bull trout throughout the species' native range in the State, and four goals to accomplish this objective: (1) maintenance of habitat conditions in areas supporting bull trout; (2) instituting cost-effective strategies to improve bull trout abundance and habitats; (3) establishing stable or increasing bull trout populations in a set of well-distributed sub-watersheds; and (4) providing for the economic viability of industries in Idaho (Batt 1996). The overall approach of the Idaho Plan is to use existing, locally-developed groups established by Idaho legislation (watershed and basin advisory groups) to strengthen water quality protection and improve compliance with the Clean Water Act. The chapters of the Service's 2002 draft *Bull Trout Recovery Plan* that address Idaho relies on information contained in the draft and final problem assessments for key watersheds developed under the Idaho Plan.

The watershed advisory groups in Idaho have drafted 21 problem assessments involving 59 key watersheds. To date, a conservation plan has been completed only for the Pend Oreille watershed.

Angling regulations in Idaho have become more restrictive than in the past. Several conservation actions identified in the problem assessments have been completed or are ongoing (e.g., activities improving bull trout access to habitat, investigations of methods to reduce abundance of non-native fish species in bull trout habitats, and angler education).

Montana: Development of the Service's 2002 draft bull trout recovery plan relative to Montana relied heavily upon, and was integrated with, State of Montana bull trout conservation planning efforts that began in 1992 with the implementation of the Montana Bull Trout Restoration planning process and resulted in the *Montana Bull Trout Restoration Plan* issued in 2000 (MBTRT 2000), which defines strategies for ensuring the long-term persistence of bull trout in Montana. In 1993, the Governor of Montana appointed the Montana Bull Trout Restoration Team (MBTRT) to produce a plan that maintains, protects, and increases bull trout populations. The team appointed a scientific group, the Montana Bull Trout Scientific Group (MBTSG), to provide the restoration planning effort with technical expertise. The Scientific Group produced 11 basin-specific status reports (MBTSG 1995a-e, 1996a-f) and 3 technical, peer-reviewed papers concerning the role of hatcheries (MBTSG 1996g), suppression of non-native fish species (MBTSG 1996h), and land management (MBTSG 1998).

Watershed groups have been formed in some areas to initiate localized bull trout restoration efforts. Some habitat restoration projects (such as removal of fish passage barriers, screening irrigation diversions, riparian fencing, stream restoration projects, and habitat monitoring) have been completed or are underway (P. Graham, Montana Fish, Wildlife, Parks, and B. Clinch, Montana Department of Natural Resources and Conservation, *in litt*. 1997). Some recovery actions are occurring throughout the State with funding from State and Federal resource management agencies, as well as from habitat improvement funds (e.g., Montana Fish, Wildlife, Parks Future Fisheries Improvement Program and the Service's Partners for Fish and Wildlife Program), and from mitigation projects (e.g., in the Clark Fork, Flathead, and Kootenai Rivers).

Angling regulations have also become more restrictive than in the past, brook trout are no longer stocked, and there are ongoing genetic studies of bull trout populations.

Nevada: The Nevada Division of Wildlife prepared a *Bull Trout Species Management Plan* that recommends management alternatives to ensure that “human activities will not jeopardize the future of bull trout in Nevada” (Johnson 1990). The recommended program identifies actions including: (1) bull trout population and habitat inventories, life history research, and potential population reestablishment; (2) State involvement in watershed land use planning; (3) angler harvest assessment; (4) official State sensitive species designation for regulatory protection; (5) non-native fish stocking evaluation and prohibition; and (6) potential non-native fish eradications. The Nevada Division of Wildlife scheduled these activities for implementation from 1991 to 2000, although many have yet to be initiated or fully implemented.

State angling regulations have become more restrictive in an attempt to protect bull trout in the Jarbidge River in Nevada. Bull trout harvest prohibitions and reduced daily and possession limits on other trout within the basin are in place throughout the Jarbidge River system. The State has also initiated public and angler awareness and education efforts relative to bull trout identification. The Nevada Division of Wildlife did not stock rainbow trout in the Jarbidge River system in 1999, nor have they since (G. Weller, Nevada Department of Wildlife, *pers. comm.*, 1999).

Oregon: Since 1990, the State of Oregon has taken several actions to address the conservation of bull trout. Initially, working groups were established that consisted primarily of State, Federal, and private individuals with bull trout expertise. After gathering initial information, membership on the working groups was expanded when the Oregon Department of Fish and Wildlife bull trout coordinator was hired in 1995. Membership on these groups currently includes individuals representing a range of interests.

Bull trout working groups have been established in the Klamath, Deschutes, Hood, Willamette, Odell Lake, Umatilla and Walla Walla, John Day, Malheur, and Pine Creek river basins for the purpose of developing bull trout conservation strategies.

More restrictive harvest regulations were established in Oregon in 1990; by 1994, harvest of bull trout was prohibited throughout the State with the sole exception of Lake Billy Chinook in central Oregon.

The Oregon Department of Fish and Wildlife reduced the stocking of hatchery-reared rainbow trout and brook trout into areas where bull trout occurs, and genetic analyses for most bull trout populations was completed in 1997. Angler outreach and education efforts are also being implemented in river basins occupied by bull trout. Bull trout identification posters were placed at various campgrounds and trail heads, and bull trout identification cards were produced for distribution by the Malheur National Forest and the Oregon Department of Fish and Wildlife.

Research to further examine life history, genetics, habitat needs, and limiting factors of bull trout in Oregon was initiated in 1995, based on funding from the Fish and Wildlife Program of the Northwest Power Planning Council.

In 1998, a project was initiated to transfer bull trout fry from the McKenzie River watershed to the adjacent Middle Fork of the Willamette River, which is historical unoccupied, isolated habitat. Recent surveys documented several age classes of bull trout at release sites in the Middle Fork of the Willamette River **(**Ziller and Taylor 2000**).**

The Oregon Department of Environmental Quality (DEQ) sets standards for water quality and administers Oregon's water quality program. In recognition of the conservation needs of bull trout, the DEQ established a water temperature standard such that surface water temperatures may not exceed 10 degrees Celsius (50 degrees Fahrenheit) in waters that support or are necessary to maintain the viability of bull trout in the State (Oregon 1996).

On January 14, 1999, then Governor Kitzhaber expanded the Oregon Plan for Salmon and Watersheds (Oregon 1997) to include all at-risk wild salmonids throughout the State. The goal of the Oregon Plan is to "restore populations and fisheries to productive and sustainable levels that will provide substantial environmental, cultural, and economic benefits". Components of this plan include: (1) coordination of efforts by all parties; (2) development of action plans with relevance and ownership at the local level; (3) monitoring progress; and (4) making appropriate corrective changes in the future. Implementation of the Oregon Plan includes chartering 84 locally-formed and represented “watershed councils” across the State. Membership on the watershed councils includes: landowners; business interests; agricultural interests; sport fishers; irrigation/water districts; individuals; State, Federal, and Tribal agencies; and local government officials. Information on watershed conditions prepared by local councils and working groups has been used by the Service in preparing the 2002 draft *Bull Trout*

Recovery Plan.

Washington: The draft report entitled *Statewide Strategy to Recover Salmon, Extinction is not an Option*, prepared by the Washington Governor's Salmon Recovery Office (Washington Governor’s Salmon Recovery Office 1999) and the Joint Natural Resources Cabinet, has been used by the Service in preparing the 2002 draft *Bull Trout Recovery Plan*. Although the draft Strategy focuses primarily on salmon, many of the same factors affecting salmon also impact bull trout. The draft Strategy describes how State agencies and local governments will work together to address habitat, harvest, hatcheries, and hydropower as they relate to recovery of listed species. The overall goals and strategies identified in this document for restoring healthy populations of salmon are consistent with actions needed for bull trout recovery. The Service’s 2002 draft *Bull Trout Recovery Plan* also relies on information from the *Washington State Salmonid Inventory for Bull Trout/Dolly Varden* (WDFW 1998) and *Bull Trout and Dolly Varden Management Plan* (WDFW 2000), both prepared by the Washington Department of Fish and Wildlife.

In 1999 the Washington State legislature established the Salmon Recovery Act (ESHB 2496) and Watershed Management Act (ESHB 2514) to assist in salmon recovery efforts. The Watershed Management Act provides funding and a planning framework for locally-based watershed management to address water quality and quantity. The Salmon Recovery Act provides direction for the development of limiting factors analyses on salmon habitat and creates a list of prioritized restoration projects at the major watershed level. Actions implemented under the authority of these laws are expected to benefit bull trout.

The Washington Department of Fish and Wildlife no longer stocks brook trout in streams or lakes connected to bull trout-occupied waters. Fishing regulations in Washington prohibit the harvest of bull trout, except for a few areas where stocks are considered "healthy."

The Washington Department of Fish and Wildlife is also currently involved in a mapping effort to update bull trout distribution data within the State of Washington, including all known occurrences, spawning and rearing areas, and potential habitats. The salmon and steelhead inventory and assessment program is currently updating their database to include the entire State, which consists of an inventory of stream reaches and associated habitat parameters important for the recovery of salmonid species and bull trout.

In January 2000, the Washington Forest Practices Board (2000) adopted new emergency forest practice rules based on the "Forest and Fish Report" process. These rules address riparian areas, roads, steep slopes, and other elements of forest practices on non-Federal lands. Although some provisions of the forest practice rules may provide more protection for aquatic species over previous regulations, they rely on an adaptive management program for assurance that the new rules will meet the conservation needs of bull trout. Research and monitoring being conducted to address areas of uncertainty for bull trout include protocols for detection of bull trout, habitat suitability, forestry effects on groundwater, field methods or models to identify areas influenced by groundwater, and forest practices influencing cold water temperatures. The process to develop the Forest and Fish Report relied on broad stakeholder involvement and included State agencies, counties, Tribes, forest industry and environmental groups. A similar process is also being used for agricultural communities in Washington and is known as "Agriculture, Fish, and Water."

Tribal Conservation Activities

In Oregon, members of the Confederated Tribes of the Umatilla Reservation, Confederated Tribes of the Warm Springs Reservation, Burns Paiute Tribe, and the Klamath Tribe all participate on bull trout conservation working groups in their geographic areas of interest. The Confederated Tribes of the Warm Springs Reservation and the Burns Paiute Tribe are implementing projects, funded through the Bonneville Power Administration, which focus on bull trout. The Confederated Tribes of the

Umatilla Indian Reservation has multiple projects funded through the Bonneville Power Administration that address anadromous fish, but that also benefit bull trout (e.g., habitat surveys, passage at dams and diversions, habitat improvement, and movement studies).

In Montana, the Confederated Salish and Kootenai Tribes was a full participant in the Montana Bull Trout Restoration Team and the Montana Bull Trout Scientific Group. They have been actively involved in the development of the Service's 2002 draft *Bull Trout Recovery Plan*. The Blackfeet Nation is expected to play a pivotal role in addressing the needs of bull trout in the St. Mary-Belly River portion of its range. Much of the St. Mary River drainage in Montana occurs on Tribal lands.

In Idaho, the Coeur d'Alene Tribe, Kootenai Tribe of Idaho, Nez Perce Tribe, and Shoshone-Bannock Tribe are participating on various teams associated with the development of the Service's bull trout recovery plan.

In Washington, the Spokane Tribe, Confederated Tribes of the Colville Reservation, and the Kalispel Tribe are participating on a team associated with the development of the Service's bull trout recovery plan. The Kalispel Tribe is implementing projects funded through the Bonneville Power Administration, Salmon Recovery Funding Board, and the Pend Oreille County Public Utility District that benefit bull trout (e.g., habitat surveys and habitat improvement projects). The Yakama Nation is participating on several teams associated with the development of the Service's bull trout recovery plan. The Yakama Nation is implementing many projects that address anadromous fish, which also benefit bull trout (e.g., habitat surveys, habitat improvement projects, and passage at dams and diversions). In western Washington, the Quinault Indian Nation and the Skokomish Tribe are participants in the development of the Service's bull trout recovery plan. The Stillaguamish Tribe and Nooksack Tribe are also involved. These Tribes, as well as others within western Washington, are currently involved in habitat restoration, watershed assessment, habitat and fisheries monitoring projects, and management forums focused on the recovery and maintenance of anadromous salmon populations within the Puget Sound region and on the Washington Coast. Many of these efforts will also benefit bull trout.

Canadian Government Activities

Bull trout currently receives no legal protection in Canada, although legislation to protect wildlife species at risk has been introduced in the House of Commons. The provinces of Alberta (Berry 1994) and British Columbia (British Columbia Environment 1994) have both developed strategic plans for recovery of bull trout. Both provinces have increased research and management efforts for this species in recent years and have implemented site-specific activities to improve bull trout habitat, increase migratory capabilities, and enforce stricter angling regulations. Alberta has adopted bull trout as the Provincial fish, and has developed an extensive public relations campaign.

Conservation Needs

Conservation needs reflect those biological and physical requirements of a species for its long-term survival and recovery. Based on the best available scientific information (Rieman and McIntyre 1993, MBTSG 1998, Hard 1995, Healey and Prince 1995, Rieman and Allendorf 2001), the conservation needs of the bull trout are:

1. Maintain and restore multiple, interconnected populations in diverse habitats across the range of each DPS.

2. Preserve the diversity of life-history strategies (e.g., resident and migratory forms, emigration age, spawning frequency, local habitat adaptations).

3. Maintain genetic and phenotypic diversity across the range of each DPS.

4. Protect populations from catastrophic fires across the range of each DPS.

Maintain and Restore Multiple, Interconnected Populations in Diverse Habitats Across the Range of Each DPS

Multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events (Rieman and McIntyre 1993, Rieman and Allendorf 2001, Spruell *et al.* 1999, Healey and Prince 1995, Hard 1995). Current patterns in the distribution and other empirical evidence, when interpreted in view of emerging conservation theory, indicate that further declines and local extinctions are likely (Rieman *et al.* 1997a; Spruell *et al.* 2002; Rieman and Allendorf 2001; Dunham and Rieman 1999). Based in part on guidance from Rieman and McIntyre (1993), bull trout core areas with fewer than five local populations are at increased risk; core areas with between 5 to 10 local populations are at intermediate risk; and core areas which have more than 10 interconnected local populations are at diminished risk.

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

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

Allendorf 2001). Changes in habitats and prevailing environmental conditions are increasingly likely to result in extinction of bull trout if genetic and phenotypic diversity is lost.

Preserve the Diversity of Life-history Strategies

The bull trout has multiple life history strategies, including migratory forms, throughout its range (Rieman and McIntyre 1993). Migratory forms appear to develop when habitat conditions allow movement between spawning and rearing streams and larger rivers or lakes where foraging opportunities may be enhanced (Frissell 1993). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem of the Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams and lakes, greater fecundity resulting in increased reproductive potential, and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Rieman and McIntyre 1993, MBTSG 1998, Frissell 1999).

Maintain the Genetic Diversity and Evolutionary Potential of Bull Trout Populations

When the long-term persistence of a species, taxon, or phylogenetic lineage is considered, it is necessary to consider the amount of genetic variation necessary to uphold evolutionary potential which is needed for that taxon to adapt to a changing environment. Effective population size provides a standardized measure of the amount of genetic variation that is likely to be transmitted between generations within a population. Effective population size is a theoretical concept that allows one to predict potential future losses of genetic variation within a population due to small population size and genetic drift. Individuals within populations with very small effective population sizes are also subject to inbreeding depression because most individuals within small populations share one or more immediate ancestors (parents, grandparents, etc.) after only a few generations and will be closely related.

The effective population size parameter (N_e) incorporates relevant demographic information that determines the evolutionary consequences of members in a population contributing to future generations (Wright 1931). When prioritizing populations for conservation, N_e is an important parameter because it is inversely related to the rate of loss of genetic diversity and the rate of increase in inbreeding in a population that is finite, but otherwise randomly mating (Waples 2002). Within a population, the census number of sexually mature adults per generation (N) and N_e are the same when the following conditions are met: constant and large population size, variance in reproductive success is binomial (number of progeny per parent follows a Poisson distribution), and sex ratio is equal. Because most populations do not conform to these conditions, the N_e to N ratio is usually below 1.0 (Frankham 1995), and the N_e to N ratio is thought to be between 0.15 and 0.27 in bull trout populations based on computer modeling (Rieman and Allendorf 2001).

A N_e of 50 or more is recommended to avoid the immediate effects of inbreeding and should be considered a minimum requirement for the short-term conservation of populations (Franklin 1980, Soulé 1987). Increased homozygosity of deleterious recessive alleles is thought to be the main mechanism by which inbreeding depression decreases the fitness of individuals within local populations (Allendorf and Ryman 2002). Deleterious recessive alleles are introduced into the genome via random mutations, and natural selection is slow to purge them because they are usually found in the heterozygous form where they are not detrimental. When populations become small, heterozygosity decreases at the rate of $1/(2\ N_e)$ per generation which in turn causes an increase in the frequency of homozygosity of the deleterious recessive alleles. Hedrick and Kalinowski (2000) provide a review of studies demonstrating inbreeding depression in wild populations.

Effective population sizes of 500 to 5000 have been recommended for the retention of evolutionary potential (Franklin and Frankham 1998; Lynch and Lande 1998). Populations of this size are able to retain additive genetic variation for fitness related traits gained via mutation (Franklin 1980).

Bull trout specific benchmarks have been developed concerning the minimum N_e necessary to maintain genetic variation important for short-term fitness and long-term evolutionary potential. These benchmarks are based on the results of a generalized, age-structured, simulation model, VORTEX (Miller and Lacy 1999), used to relate effective population size to the number of adult bull trout spawning annually under a range of life histories and environmental conditions (Rieman and Allendorf 2001). In this study, the authors estimated N_e for bull trout to be between 0.5 and 1.0 times the mean number of adults spawning annually. Rieman and Allendorf (2001) concluded that an average of 100 (i.e., 100 x 0.5 = 50) adults spawning each year would be required to minimize risks of inbreeding in a population and 1000 adults (i.e., 1000 x 0.5 = 500) is necessary to maintain genetic variation important for long-term evolutionary potential. This latter value of 1000 spawners may also be reached with a collection of local populations among which gene flow occurs.

The combination of resident forms completing their entire life cycle within a stream and the homing behavior of the migratory forms returning to the streams where they hatched to spawn promotes reproductive isolation among local bull trout populations. This reproductive isolation creates the opportunity for genetic differentiation and local adaptations to occur. Nevertheless, within a core area local populations are usually connected through low rates of migration. This connection of local populations, linked by migration, is termed a metapopulation (Hanski and Gilpin 1991). Within a metapopulation, evolution primarily occurs at the local population level (i.e., it is the main demographic and genetic unit of concern). However, when longer time frames are considered (e.g., 10 plus generations), metapopulations become important. For example, metapopulations allow for the reintroduction of lost alleles and recolonization of extinct local breeding populations. Migration and gene flow among local populations ensures that the alleles within a metapopulation will be present in most local breeding populations and can be acted upon by natural selection (Allendorf 1983).

Maintain Phenotypic Diversity

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

Protect Bull Trout from Catastrophic Fires

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

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

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

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Appendix 2. Proposed Bull Trout Critical Habitat within the Northwest Forest Plan Area*.

Unit Name	Stream Miles		Acres Lake/ Marsh
Klamath River	91		0
Deschutes River	194		18,743
Entiat River	52		0
Hood River	103		91
Klickitat River	298		0
Lewis River	72		11,998
Methow River	268		56
Odell Lake	15		6,439
Wenatchee River	262		2,438
White Salmon River	15		80
Willamette River	200		8,899
Yakima River	520		14,987
Total	2,091		63,732

* Does not include proposed critical habitat on the Columbia River.

Appendix 3
Klamath River DPS GIS Analysis

Bull Trout Critical Habitat (BTCH) Distribution on Northwest Forest Plan (Federal) Lands
Within the Klamath River Basin DPS

Land Allocation	Spawning Habitat (mi)	FMO Habitat (mi)	Unk Habitat	Total (Mi)	Pct DPS Habitat(Mi)
LSR	10.9	0.0		11	26%
Matrix	3.4	1.2		5	11%
Cong Reserve	25.3	0.3		26	62%
Admin W/draw	0.1	0.3		0	1%
Riparian Reserve					
Managed LSR	0.0	0.0		0	0%
Adap Mgmt	0.0	0.0		0	0%
Totals	39.7	1.8	0	41	100%
Key & LSR	6.2	0.0		6	15%
Key & Matrix	3.3	0.9		4	10%
Key & Cong Reserve	4.7	0.0		5	11%
Key & Admin W/draw	0.0	0.2		0	1%
Key & R.R					
Key & Managed LSR	0.0	0.0		0	0%
Key & Adap Mgmt	0.0	0.0		0	0%
Key Watershed Total	14.2	1.1	0	15	37%

	Klamath River Basin DPS
BTCH Total - NWFP Area(Mi)	41.5

Results calculated from GIS analysis overlay of NWFP Land Allocations (1994-OR,1996-WA), Key Watersheds (1994) and Draft BTCH(2002).

Percent of each
Land Aollocation that contains
BTCH in Key Watersheds

	%
LSR	57%
Matrix	93%
Cong Reserve	18%
Admin W/draw	47%
Riparian Reserve	
Managed LSR	0%
Adap Mgmt	0%

2-Jul-03 Original Analysis
Updated format 19-Nov-03

Appendix 3
Columbia River DPS GIS Analysis

Bull Trout Critical Habitat (BTCH) Distribution on Northwest Forest Plan (Federal) Lands
Within the Columbia River DPS

Land Allocation	Spawning Habitat (mi)	FMO Habitat (mi)	Unk Habitat	Total (Mi)	Pct DPS Habitat(Mi)
LSR	238.5	84.3	12.5	335	38%
Matrix	120.3	78.2	0.7	199	22%
Cong Reserve	162.8	28.4		191	21%
Admin W/draw	52.8	43.8	0.4	97	11%
Riparian Reserve					
Managed LSR	6.1	19.2		25	3%
Adap Mgmt	25.6	16.6		42	5%
Totals	606.1	270.5	13.6	890	100%
Key & LSR	172.7	70.7	2.7	246	28%
Key & Matrix	66.7	29.5		96	11%
Key & Cong Reserve	113.1	25.4		138	16%
Key & Admin W/draw	30.2	26.9		57	6%
Key & R.R					
Key & Managed LSR	6.1	15.7		22	2%
Key & Adap Mgmt	20.6	1.8		22	3%
Key Watershed Total	409.4	170.0	2.7	582	65%

	Columbia River DPS
BTCH Total - NWFP Area(Mi)	890.3

Results calculated from GIS analysis overlay of NWFP Land Allocations (1994-OR,1996-WA), Key Watersheds (1994) and Draft BTCH(2002).

Percent of each
Land Aollocation that contains
BTCH in a Key Watershed

	%
LSR	73%
Matrix	48%
Cong Reserve	72%
Admin W/draw	59%
Riparian Reserve	
Managed LSR	86%
Adap Mgmt	53%

2-Jul-03 Original Analysis
Updated format 19-Nov-03

Appendix 3
Costal Puget Sound DPS GIS Analysis

Bull Trout Critical Habitat (BTCH) Distribution on Northwest Forest Plan (Federal) Lands
Within the Coastal-Puget DPS (Does not include shoreline habitat)

Land Allocation	Spawning Habitat (mi)	FMO Habitat (mi)	Unk Habitat	Total (Mi)	Pct DPS Habitat(Mi)
LSR	303.1	67.9		371	34%
Matrix	80.9	0.2		81	7%
Cong Reserve	536.4	75.5		612	56%
Admin W/draw	9.4	0.6		10	1%
Riparian Reserve					
Managed LSR	0.0	0.0		0	0%
Adap Mgmt	0.1	11.3		11	1%
Totals	929.9	155.5	0	1,085	100%
Key & LSR	244.4	5.2		250	23%
Key & Matrix	64.7	0.0		65	6%
Key & Cong Reserve	92.1	1.2		93	9%
Key & Admin W/draw	3.3	0.0		3	0%
Key & R.R					
Key & Managed LSR	0.0	0.0		0	0%
Key & Adap Mgmt	0.0	2.4		2	0%
Key Watershed Total	404.4	8.8	0	413	38%

	Coastal-Puget DPS
BTCH Total - NWFP Area(Mi)	1,085.4

Results calculated from GIS analysis overlay of NWFP Land Allocations (1994-OR,1996-WA), Key Watersheds (1994) and Draft BTCH(2002).

Percent of each Land Aollocation that contains BTCH in a Key Watershed

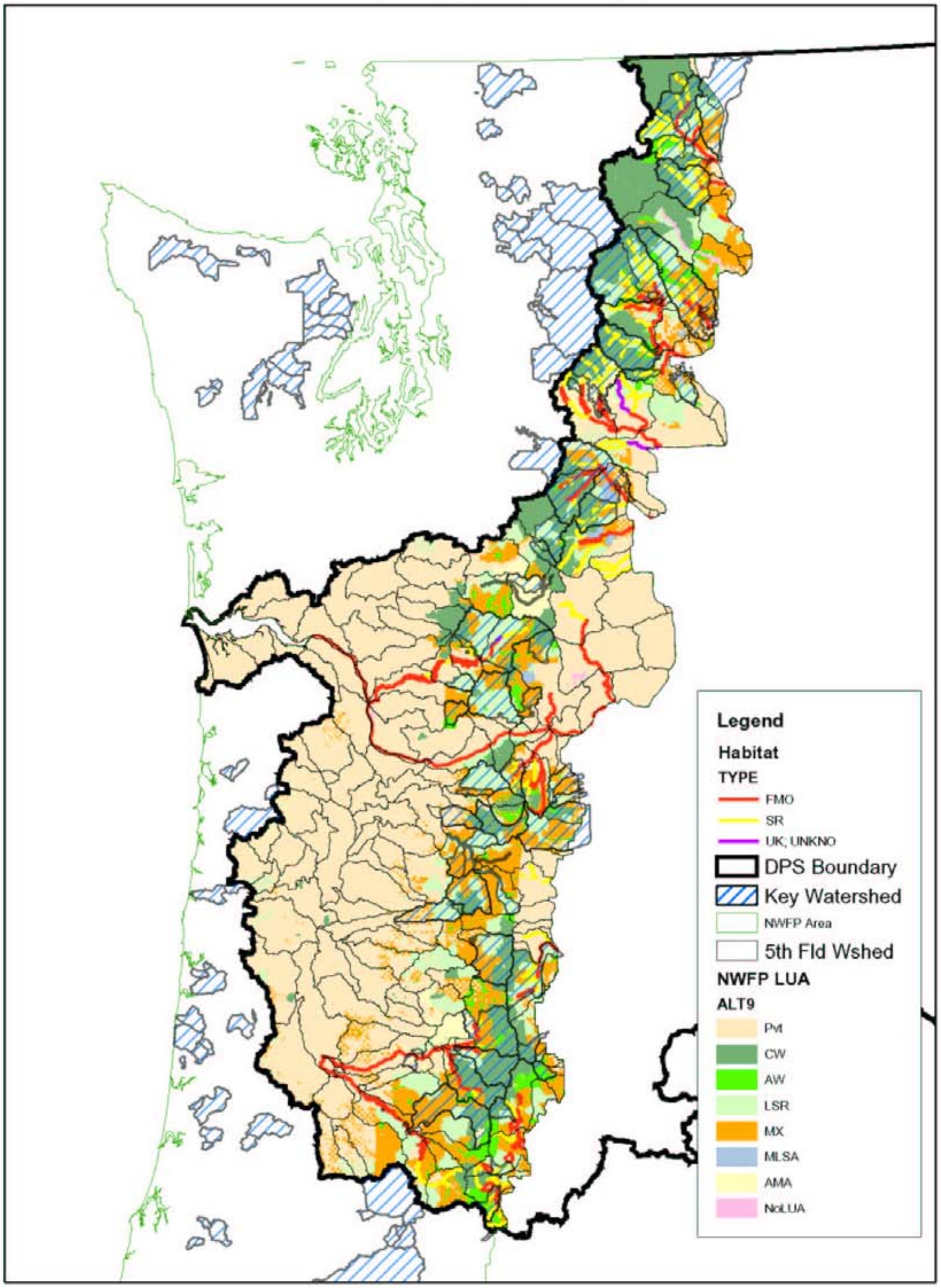
	%
LSR	67%
Matrix	80%
Cong Reserve	15%
Admin W/draw	34%
Riparian Reserve	
Managed LSR	0%
Adap Mgmt	21%

2-Jul-03 Original Analysis
Updated format 19-Nov-03

Bull Trout Critical Habitat Distribution in Northwest Forest Plan Area Including Federal Lands and Non-Federal Lands Within the Columbia River, Klamath and Coastal Puget DPSs

DPS	Spawning Habitat (mi)	FMO Habitat (mi)	Unk Habitat	Total (Mi)	Pct DPS Habitat(Mi)
Columbia River DPS					
Federal Land Totals	606.1	270.5	13.6	890	53%
Non-Federal Lands	255.1	522.4	15.4	793	47%
	861.3	793.0	29.0	1,683.2	100%
Klamath River DPS					
Federal Land Totals	39.7	1.8	0.0	41.5	70%
Non-Federal Lands	16.1	1.4	0.0	18	30%
	55.8	3.2	0.0	59.0	100%
Coastal Puget Sound DPS					
Federal Land Totals	929.9	155.5	0.0	1,085.4	36%
Non-Federal Lands	481.3	1,468.5		1,950	64%
	1,411.2	1,624.0	0.0	3,035.3	100%

Bull Trout Habitat Analysis in the Columbia River DPS within the NWFP Area



Data used: alt9_or(1994), alt9_wa(1996), nso_range(1994), btcrit(2002), bt_ca_0503(2003), huc13 (2002)

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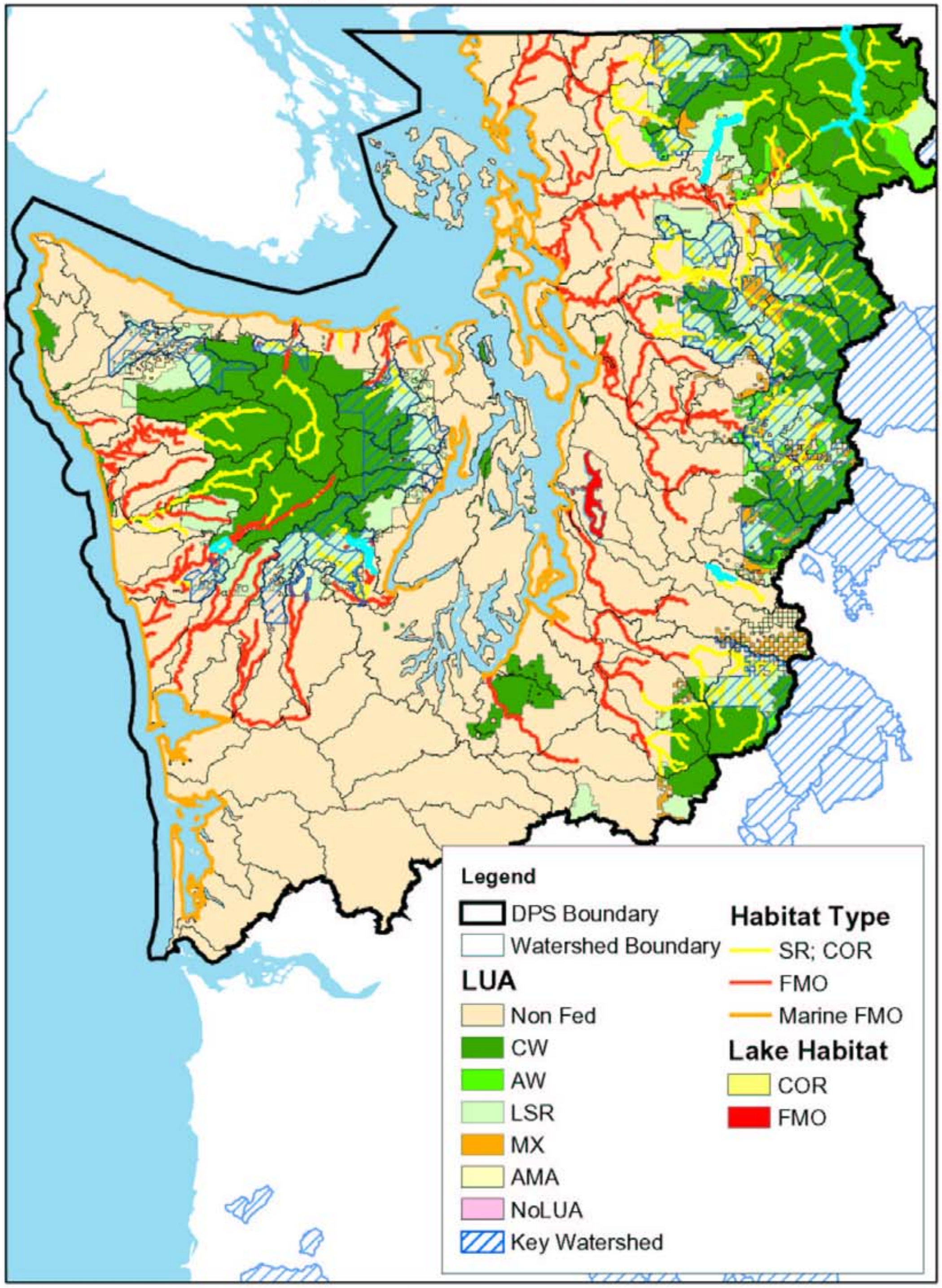
Bull Trout Habitat Analysis in the Coastal - Puget DPS within the NWFP Area



Data used: alt9_wa(1996), nso_range(1994), key_wshed, bt_ca_0503(2003), WWFWO BT Habitat data.

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July 17, 2003