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Biological Assessment

Western Oregon Proposed Resource Management Plan

Prepared by
USDI Bureau of Land Management
Oregon / Washington State Office
Portland, Oregon

In Partnership with USDC NMFS NOAA Fisheries and
USDI Fish and Wildlife Service

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I. Introduction

The Bureau of Land Management (BLM) is revising the resource management plans (RMPs) for the Coos Bay District, Eugene District, Medford District, Roseburg District, Salem District, and the Klamath Falls Field Office of the Lakeview District. This is known as the Resource Management Plan Revision for Western Oregon and the preferred alternative in the final Environmental Impact Statement (EIS) is the Proposed Resource Management Plan (PRMP).

The PRMP is the federal action subject to the Endangered Species Act consultation. The PRMP does not authorize, fund or carry out any on-the-ground action but the plan does direct the agency actions that could result in a direct effect to Endangered Species Act (ESA)-listed species or designated critical habitat (CH). The Coquille Tribe Forest Plan is interrelated to the PRMP. By Federal law, those tribal lands must be managed consistent with the adjacent federal forest plan which is the Coos Bay District RMP. Because those lands will be managed consistent with the standards and guidance in the PRMP, plan-level effects for the Tribal Forest Plan would be similar to those concluded in this Biological Assessment (BA). At the plan scale, there are no other tribal, state, or federal plans that would be interrelated or interdependent actions that would be associated with this PRMP.

Project-level actions that ultimately will be authorized under a subsequent National Environmental Policy Act (NEPA) decision are not analyzed in this BA since the specific location, timing, and intensity of such activities is currently unknown. These projects may be considered interrelated or interdependent because they will be implemented later in time, and are dependent upon the PRMP for their direction. Projects that will be implemented subsequent to, and consistent with the PRMP and Record of Decision (ROD), will be subject to Section 7 consultation if they are determined to may affect ESA-listed species and/or their designated CH.

There are no additional species proposed for listing under the ESA or related proposed designation of CH within the action area. Effects of the proposed action to Lower Columbia River coho salmon are evaluated in this biological assessment. The species currently does not have CH designated, but it may occur in the future.

A. Statutory and Regulatory Background

The ESA and implementing regulations (50 CFR 402) requires federal agencies, in consultation with and with the assistance of the Secretary, to insure that any action it authorizes, funds, or carries out, in the United States or upon the high seas, is not likely to jeopardize the continued existence of any listed species or results in the destruction or adverse modification of CH. The federal agency must conference with the Secretary to ensure the action does not jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat. This BA has utilized the best scientific and commercial data available as required by the ESA.

B. Purpose of Biological Assessment

The purpose of this BA is to assess the effects of the PRMP on ESA-listed fish species and their designated CH at the programmatic level. A full description of the PRMP and potential environmental impacts resulting from programs implemented under the Record of Decision (ROD) are contained in the "Proposed Resource Management Plan/Final Environmental Impact Statement for the Resource Management Plans for Western Oregon." Projects that will be implemented subsequent to, and consistent with the PRMP and ROD, will be subject to Section 7 consultation if they are determined to may affect ESA-listed species and/or their designated CH.

C. Framework for this Biological Assessment

The ROD for the PRMP will revise the existing BLM RMPs. These plans cover broad geographic areas that are inhabited by one or more ESA-listed fish species and may contain designated CH for those species. The PRMP establishes common management direction for each of the individual BLM RMPs that are subject to this revision. To facilitate the National Marine Fisheries Service (NMFS) and the United States Fish and Wildlife Service (USFWS) jeopardy analysis for each of the listed Evolutionarily Significant Units (ESUs), Distinct Population Segments (DPS) and Recovery Units (RU), this BA will analyze by each potential program. This will provide a context for the relative scope and magnitude of programs that may ultimately be implemented throughout the planning area.

This document uses the format of a traditional BA and where appropriate, incorporates by reference information from the FEIS and PRMP. Information specific to the effects determination for listed species or designated CH is included in this document. Specifically:

- To facilitate the development of the biological opinion (BO), the description of the proposed action and its purpose and need are repeated in this BA.
- The environmental baseline and effects to the species in this BA references Chapter 3 of the Final EIS. The effects analysis from the Final EIS has been assessed for effects to the listed fish species and/or designated CH and an ESA effects determination is provided in this BA.
- The ESA cumulative effects section of this BA describes future state and private management plans that guide actions reasonably certain to occur within the planning area.
- Chapter VII of this BA includes a summary of the effects determinations for each listed species and/or its designated CH within the planning area along with the overall effects determination for the planning area.

D. Consultation History

As part of the consultation process, the BLM engaged both National Marine Fisheries Service and U.S. Fish and Wildlife Service (Services) in an early review of draft concepts and content for the Biological Assessment beginning in May 2015. This additional step in the consultation process was designed as a way to 'front load' the consultation, allowing the Services to provide input as to the content and format of the BA prior to receiving the formal BA and initiating consultation. The Services met with the BLM several times between June and December 2015 and provided verbal and written feedback to help shape the BA, including, but not limited to, additional information and analysis to incorporate, as well as input on determining and

describing effects. The BLM reviewed and incorporated the Services input where appropriate, and provided explanation to the Services where input was not incorporated. Consultation was initiated in February 2016.

E. Species and Critical Habitat Subject to this Consultation

ESA-listed fish species and/or designated CH for which the implementation of PRMP programs would result in a "May Affect" determination are the subject of this consultation (**Table 1**, **Table 2**). Note that Columbia River chum salmon (*Oncorhynchus keta)*, while occurring in the planning area, are not present, nor is there designated CH, in streams within or adjacent to BLM-administered lands. The BLM has determined that the administration of the PRMP will result in "No Effect" to the species or their designated CH.

Table 1. Anadromous fish species and designated critical habitat addressed in this BA.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (*Oncorhynchus tshawytscha*)			
Lower Columbia River	T 6/28/05; 70 FR 37160 4/14/14; 79 FR 20802	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 6/28/05; 70 FR 37160 4/14/14; 79 FR 20802	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Coho salmon (*Oncorhynchus kisutch*)			
Lower Columbia River	T 6/28/05; 70 FR 37160 4/14/14; 79 FR 20802	Proposed 01/14/13; 78 FR 2726	6/28/05; 70 FR 37160
Southern Oregon/Northern California Coasts	T 6/28/05; 70 FR 37160 4/14/14; 79 FR 20802	5/5/99; 64 FR 24049	6/28/05; 70 FR 37160
Oregon Coast	T 6/20/11; 76 FR 35755 4/14/14; 79 FR 20802	2/11/08; 73 FR 7816	2/11/08; 73 FR 7816
Steelhead (*Oncorhynchus mykiss*)			
Lower Columbia River	T 1/05/06; 71 FR 834 4/14/14; 79 FR 20802	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 1/05/06; 71 FR 834 4/14/14; 79 FR 20802	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Green Sturgeon (*Acipenser medirostris*)			
Green sturgeon (Southern DPS)	T 4/7/06; 71 FR 17757	10/9/09; 74 FR 52300	6/2/10; 75 FR 30714
Pacific Eulachon (*Thaleichthys pacificus*)			
Pacific eulachon (Southern DPS)	T 3/18/10; 75 FR 13012	10/20/11; 76 FR 65323	ESA section 9 prohibitions apply

Table 2. Resident fish species and designated critical habitat addressed in this BA.

Species	Listing Status	Critical Habitat	Protective Regulations
Lost River sucker (*Deltistes luxatus*)	E 7/18/88; 53 FR 27130	12/11/12; 77 FR 73740	Not relevant for Endangered species
Shortnose sucker (*Chasmistes brevirostris*)	E 7/18/88; 53 FR 27130	12/11/12; 77 FR 73740	Not relevant for Endangered species
Bull trout (*Salvelinus confluentus*)	T 11/1/99; 64 FR 58910	10/18/10: 75 FR 63898	11/1/1999; 64 FR 58910

II. Proposed Action

A. Overview

The BLM is revising the RMPs for the Coos Bay District, Eugene District, Medford District, Roseburg District, Salem District, and the Klamath Falls Field Office of the Lakeview District.

The BLM administers the use of a variety of natural resources on approximately 2.5 million acres within an area of approximately 22 million acres, which is the western Oregon planning area. The RMPs define the management direction for specified areas of BLM-administered lands (typically, for individual BLM districts or BLM resource areas). Resource management plans are formally evaluated periodically to determine whether there is a significant cause for amending or revising them.

The primary purpose for managing the approximately 2.1 million acres of what are called the O&C lands that lie within the approximately 2.5 million acres of BLM-administered lands in western Oregon is derived from the statutory authority of the Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act (O&C Act). The remaining BLM-administered lands within the western Oregon planning area are public domain lands, and other statutory authorities provide the purposes for managing those lands. The primary direction for the administration of all those lands is the Federal Land Policy and Management Act (FLPMA) of 1976.

The BLM RMP evaluations concluded that a plan revision is needed to address the changed circumstances and new information that has led to a substantial, long-term departure from the timber management outcomes predicted under the 1995 RMPs. Moreover, the BLM needs to revise existing plans to replace the 1995 RMPs land use allocations and management direction because of new scientific information and policies related to the northern spotted owl.

The purpose of the RMP revision is to:

- Provide a sustained yield of timber
- Contribute to the conservation and recovery of threatened and endangered species, including:
    - maintaining a network of large blocks of forest to be managed for late-successional forests
    - maintaining older and more structurally complex multi-layered conifer forests
- Provide clean water in watersheds
- Restore fire-adapted ecosystems
- Provide recreation opportunities
- Coordinate management of lands surrounding the Coquille Forest with the Coquille Tribe

The PRMP components include land use allocations, management objectives and management direction.

Land use allocations. Areas where specific activities are allowed, restricted, or excluded in all or part of a planning area.
Management objectives. Describe the desired outcomes from the management of particular resources.
Management direction. Provide measures that will be applied to planning activities to achieve the management objectives for resources.

Programs have been identified that will operate within and across the different land use allocations (LUAs). These programs are essential in meeting the BLM Multiple Use Mission mandate and are identified in Sections II.B and II.C of this BA. Note that management objectives are displayed below for each LUA. Management direction for each LUA is displayed in Appendix A. The specific type, location, size, and nature of activities that will operate under each of these programs cannot be defined at this scale of planning and are not subject to this consultation.

Land Use Allocations

The five major land use allocations (LUA) of the PRMP are listed below and described in this section. The BLM-administered lands within the planning area would be allocated to one of the following major land use allocations:

1. Late-Successional Reserve
2. Riparian Reserve
3. Other Reserves
4. Harvest Land Base
5. Eastside Management Area

Table 3 displays acres and percentages by LUA for the PRMP.

Table 3. Acres and percentages by land use allocation for the Proposed Resource Management Plan.

Allocation	Acres	Total Acres (%)	Sub-allocation	Acres	Total Acres (%)
Late-Successional Reserve*	948,466	38.3%	Structurally-complex Forest	427,881	17%
			Large Block Forest Reserve (Moist)	250,546	10%
			Large Block Forest Reserve (Dry)	186,949	8%
			Occupied Marbled Murrelet Sites	42,174	2%
			Predicted Marbled Murrelet Sites†	31,242	1%
			Occupied Red Tree Vole Sites#	128	<1%
			Predicted Red Tree Vole Sites#	9,546	<1%
Riparian Reserve‡	635,717	25.7%	Riparian Reserve (Class I sub-watersheds)	497,331	20%
			Riparian Reserve (Class II sub-watersheds)	107,453	4%
			Riparian Reserve (Class III sub-watersheds)	30,933	1%
Other Reserves	263,647	10.6%	Congressionally Reserved	40,505	2%
			District Designated Reserves§	223,142	9%
Harvest Land Base	469,215	18.9%	Moderate Intensity Timber Area	180,549	7%
			Low Intensity Timber Area	89,126	4%
			Uneven-Aged Timber Area	199,541	8%
Eastside Management Area‖	161,810	6.5%	Eastside Management Area	149,971	6%
			Eastside Management Area – Riparian Reserve	11,838	<1%
			Totals	**2,478,856**	**-**

* The acreage of the different components of the Late-Successional Reserve in this table is presented for comparison to the information for the action alternatives. The different components describe areas that are included in the Late-Successional Reserve for different reasons, including analytical projections of areas that the BLM would identify in the future as part of the Late-Successional Reserve. These different components are not sub-allocations, in that they do not have differing management objectives or management direction. The only sub-allocations of the Late-Successional Reserve, as detailed in **Appendix B** – Management Objectives and Direction, are Late-Successional Reserve – Dry and Late-Successional Reserve – Moist.

† For the Proposed RMP, the BLM used updated detection rates to calculate acres of predicted marbled murrelet sites, which increased the acreage of predicted marbled murrelet sites compared to the alternatives (see the Forest Management and Wildlife sections of Chapter 3).
‡ The design of the Riparian Reserve – west of Highway 97 varies among three classes of subwatersheds. In addition, the Riparian Reserve – west of Highway 97 includes sub-allocations of Riparian Reserve – Moist and Riparian Reserve – Dry, which overlap the three classes of subwatershed. This table only presents the Riparian Reserve – west of Highway 97 by subwatershed class for simplicity of presentation.
§ District-Designated Reserves include several sub-allocations, as detailed in **Appendix B**, which are grouped together in this table.
|| The acreage for the Eastside Management Area in this table includes both forested and non-forested lands and Eastside Management Area – Riparian Reserve.
Existing Red Tree Vole Sites and Predicted Red Tree Vole Sites means those sites of the North Oregon Coast Distinct Population Segment of the red tree vole north of Highway 20.

Approximately 74 percent of the BLM land base in the PRMP planning area is in a reserve LUA. Note that not all areas adjacent to streams and other water bodies in the planning area are represented in the 635,717 acres shown for the Riparian Reserve LUA in **Table 3**. That figure does not include acres adjacent to streams and other water bodies in LUA categories that are deemed by the BLM to be more protective than Riparian Reserves. For example, acres adjacent to water bodies within the Congressionally Reserved LUA sub-categories Wilderness or designated Wild and Scenic Rivers are not included in the Riparian Reserve acre total. This hierarchy results in an undercounting of total acres adjacent to streams and other water bodies throughout the area of the PRMP, some of which would be managed more conservatively than the Riparian Reserve LUA.

For example, within the OC coho salmon ESU within the planning area, there are 341,958 acres of Riparian Reserve on BLM land. When Riparian Reserve widths are applied within the Congressional Reserves, District-Defined Reserves and Late-Successional Reserves within the ESU, an additional 92,657 acres adjacent to water bodies are identified.

Table 4 to Table 14 display acres and percentages by LUA by land ownership for each Evolutionarily Significant Unit (ESU) and Distinct Population Segment (DPS) of ESA-listed Pacific salmon species in the planning area, for McKenzie River basin bull trout, and for the combined Lost and Upper Klamath Recovery Units (RU) for Lost River and shortnose suckers. Note that the term “Land Cover District-Designated Reserve” is not a LUA sub-allocation. It is a label for non-forested areas such as the surface of water bodies and roads. Column 3 of each table displays the percent of the *entire* ESU, DPS or Recovery Unit that is represented by BLM acres for each LUA of the PRMP. Column 4 displays the percent of total PRMP BLM acres in the ESU, DPS or Recovery Unit *within the planning area boundary* that is represented by BLM acres for each LUA. BLM land ownership is a very small percentage of some species geographic areas that are only partially within the planning area. For example, BLM acres in the planning area within the entire Lower Columbia River Chinook salmon ESU is only 0.75 percent of the entire ESU.

The distribution of Southern DPS green sturgeon and Southern DPS Pacific eulachon is so limited within the planning area as to not allow for a meaningful presentation of LUA

acres. There is only 0.07 miles of sturgeon designated CH adjacent to BLM land. Because of the incompatibility of the line work for sturgeon designated CH with the NHD stream layer, the 0.07 miles may be overstated. There is only 0.12 miles of eulachon habitat adjacent to BLM land.

Table 4. Acres and percentages by PRMP land use allocation in the Lower Columbia River Chinook salmon ESU.

Land Use Allocation	Total Acres	Percent ESU Acres	Percent PRMP Acres
Total ESU acres	4,770,456	100.00%	-
Total PRMP BLM Acres	35,621	0.75%	100.0%
Congressionally Reserved	6,568	0.14%	18.4%
District-Designated Reserve	1,292	0.03%	3.6%
Harvest Land Base	13,732	0.29%	38.6%
Land Cover District-Designated Reserve	1,448	0.03%	4.1%
Late-Successional Reserve	2,605	0.05%	7.3%
Riparian Reserves	9,977	0.21%	28.0%

Table 5. Acres and percentages by PRMP land use allocation in the Lower Columbia River coho salmon ESU.

Land Use Allocation	Total Acres	Percent ESU Acres	Percent PRMP Acres
Total ESU acres	4,770 ,456	100.00%	-
Total PRMP BLM Acres	35,620	0.75%	100.0%
Congressionally Reserved	6,568	0.14%	18.4%
District-Designated Reserve	1,292	0.03%	3.6%
Harvest Land Base	13,732	0.29%	38.6%
Land Cover District-Designated Reserve	1,448	0.03%	4.1%
Late-Successional Reserve	2,605	0.05%	7.3%
Riparian Reserves	9,977	0.21%	28.0%

Table 6. Acres and percentages by PRMP land use allocation in the Lower Columbia River steelhead DPS.

Land Use Allocation	Total Acres	Percent ESU Acres	Percent PRMP Acres

Total ESU acres	3,682,397	100.00%	-
Total PRMP BLM Acres	28,615	0.78%	100.0%
Congressionally Reserved	6,568	0.18%	23.0%
District-Designated Reserve	1,292	0.04%	4.5%
Harvest Land Base	9,570	0.26%	33.4%
Land Cover District-Designated Reserve	1,289	0.04%	4.5%
Late-Successional Reserve	2,558	0.07%	8.9%
Riparian Reserves	7,339	0.20%	25.6%

Table 7. Acres and percentages by PRMP land use allocation in the Oregon Coast coho salmon ESU.

Land Use Allocation	Total Acres	Percent ESU Acres	Percent PRMP Acres
Total ESU acres	6,873,907	100.00%	-
Total PRMP BLM Acres	1,085,611	15.79%	100.0%
Congressionally Reserved	2,445	0.04%	0.2%
District-Designated Reserve	20,991	0.31%	1.9%
Harvest Land Base	142,602	2.07%	13.1%
Land Cover District-Designated Reserve	27,175	0.40%	2.5%
Late-Successional Reserve	550,442	8.01%	50.7%
Riparian Reserves	341,957	4.97%	31.5%

Table 8. Acres and percentages by PRMP land use allocation in the Southern Oregon Northern California Coasts coho salmon ESU.

Land Use Allocation	Total Acres	Percent ESU Acres	Percent PRMP Acres
Total ESU acres	11,452,007	100.00%	-
Total PRMP BLM Acres	729,566	6.37%	100.0%
Congressionally Reserved	19,748	0.17%	2.7%
District-Designated Reserve	25,757	0.22%	3.5%
Harvest Land Base	162,720	1.42%	22.3%
Land Cover District-Designated Reserve	114,815	1.00%	15.7%
Late-Successional Reserve	239,947	2.10%	32.9%
Riparian Reserves	166,583	1.45%	22.8%

Table 9. Acres and percentages by PRMP land use allocation in the Upper Willamette River Chinook salmon ESU.

Land Use Allocation	Total Acres	Percent ESU Acres	Percent PRMP Acres
Total ESU acres	4,344,499	100.00%	-
Total PRMP BLM Acres	234,485	5.40%	100.0%
Congressionally Reserved	7,217	0.17%	3.1%
District-Designated Reserve	7,746	0.18%	3.3%
Harvest Land Base	93,972	2.16%	40.1%
Land Cover District-Designated Reserve	12,573	0.29%	5.4%
Late-Successional Reserve	36,920	0.85%	15.7%
Riparian Reserves	76,057	1.75%	32.4%

Table 10. Acres and percentages by PRMP land use allocation in the Upper Willamette River steelhead DPS.

Land Use Allocation	Total Acres	Percent ESU Acres	Percent PRMP Acres
Total ESU acres	3,108,539	100.00%	-
Total PRMP BLM Acres	184,404	5.9%	100.0%
Congressionally Reserved	7,078	0.23%	3.8%
District-Designated Reserve	7,273	0.23%	3.9%
Harvest Land Base	65,147	2.10%	35.3%
Land Cover District-Designated Reserve	10,441	0.34%	5.7%
Late-Successional Reserve	27,539	0.89%	14.9%
Riparian Reserves	66,926	2.15%	36.3%

Table 11. Acres and percentages by PRMP land use allocation for bull trout in the McKenzie River basin.

Land Use Allocation	Total Acres	Percent Basin Acres	Percent PRMP Acres
Total McKenzie River Basin acres	856,409	100.00%	-
Total PRMP BLM Acres	51,805	6.05%	100.0%
District-Designated Reserve	734	0.09%	1.4%
Harvest Land Base	23,607	2.76%	45.6%
Land Cover District-Designated Reserve	1,656	0.19%	3.2%
Late-Successional Reserve	8,250	0.96%	15.9%
Riparian Reserves	17,559	2.05%	33.9%

Table 12. Acres and percentages by PRMP land use allocation for the Lost Recovery Unit for Lost River and shortnose suckers.

Land Use Allocation	Total Acres	Percent Recovery Unit Acres	Percent PRMP Acres
Total Recovery Unit acres	1,921,537	100.00%	-
Total PRMP BLM Acres	158,534	8.25%	100.00%
Eastside Management Area	149,971	7.52%	91.1%
Harvest Land Base	41,751	0.07%	0.9%
Land Cover District-Designated Reserve	8,674	0.05%	0.6%
Riparian Reserves	15,788	0.61%	7.3%

Table 13. Acres and percentages by PRMP land use allocation for the Upper Klamath Recovery Unit for Lost River and shortnose suckers.

Land Use Allocation	Total Acres	Percent Recovery Unit Acres	Percent PRMP Acres
Total Recovery Unit acres	2,940,423	100.00%	-
Total PRMP BLM Acres	71,292	2.4%	100.00%
Congressionally Reserved	2,633	0.09%	1.1%
District-Designated Reserve	1,046	0.04%	0.5%
Eastside Management Area	5,515	0.19%	65.3%
Harvest Land Base	40,336	1.37%	18.2%
Land Cover District-Designated Reserve	7,654	0.26%	3.8%
Late-Successional Reserve	9,961	0.34%	4.3%
Riparian Reserves	4,147	0.14%	6.9%

a. Congressionally Reserved and National Landscape Conservation System

Congressionally Reserved lands are those lands that Congress has designated and defined management through law, including designated Wilderness, Wilderness Study Areas and Wild and Scenic Rivers. The mandated management of these lands requires that the BLM reserve these lands from sustained-yield timber production. Congressionally Reserved lands total 40,505 acres; 1.6 percent of the BLM-administered lands in the planning area.

Under the PRMP, the BLM would recommend for inclusion in the National Wild and Scenic River System the eligible Wild and Scenic River segments with recreation identified as an Outstandingly Remarkable Value and the eligible river segments that the BLM found suitable during its administrative process (as outlined in BLM Manual 6400, USDI BLM 2012b).

Management Objectives

- Conserve, protect, and restore the identified outstanding cultural, ecological, and scientific values of the National Landscape Conservation System and other congressionally designated lands.
- Preserve the wilderness character of designated Wilderness Areas.
- Preserve wilderness characteristics in Wilderness Study Areas in accordance with non-impairment standards as defined under the management policy for Wilderness Study Areas (USDI BLM Manual 6330), until Congress either designates these lands as wilderness or releases them for other purposes.

b. District-Designated Reserve including Land Cover District-Designated Reserve

District-Designated Reserves include lands that are reserved from sustained-yield timber production for a variety of reasons, including:

- Areas that the BLM has constructed for specific purposes (such as roads, buildings, maintenance yards, and other facilities and infrastructure)
- Areas that the BLM has identified through the Timber Production Capability Classification system as unsuitable for sustained-yield timber production (e.g., rock outcrops)
- Areas of Critical Environmental Concern, including Research Natural Areas
- Areas of road surface or water surface
- Other reserves (e.g., special recreation management areas and areas protected for Bureau sensitive species)

Land Cover District-Designated Reserve is not a sub-LUA. It is a label for non-forested reserves such as the surface of water bodies and roads. District Designated Reserves total 223,142 acres; 9.0 percent of the BLM-administered lands in the planning area. The PRMP includes management for wilderness characteristics of all lands with wilderness characteristics that are outside of the Harvest Land Base.

Management Objectives

- Maintain the values and resources for which the BLM has reserved these areas from sustained-yield timber production.

c. Late-Successional Reserve

The Late-Successional Reserve (LSR) comprises 948,466 acres; 38.3 percent of the BLM-administered lands in the planning area. In the PRMP, the LSR includes, primarily, Structurally-Complex Forest, Large Block Forest Reserves (LSR – Moist and LSR – Dry), and much smaller acreages from existing occupied marbled murrelet sites and

existing sites of the North Oregon Coast DPS of the red tree vole north of Highway 20. In addition, the PRMP includes requirements for surveys for the marbled murrelet and the North Oregon Coast DPS of the red tree vole, as described below; newly discovered sites would be included in the Late-Successional Reserve. Thus, this description of the LSR includes predictions of the acreage of newly discovered marbled murrelet and red tree vole sites. Within the LSR, the BLM would not conduct timber salvage after disturbance, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.

Structurally-Complex Forest

The PRMP includes within the LSR all stands identified by existing, district-specific information on structurally-complex forests.[1]

Large Block Forest Reserves: Late-Successional Reserve - Moist and Late-Successional Reserve - Dry[2]

The PRMP includes within the LSR blocks of functional and potential northern spotted owl habitat, sufficient to meet block size and spacing requirements (Thomas *et al*. 1990, pp. 24, 28) in all provinces except the Coast Range province, where reserves include blocks of habitat without limitations for size and spacing. The PRMP includes additional areas of LSR in the Eugene and Roseburg Districts to facilitate east-west northern spotted owl movement and survival between the Coast Range and Cascade Mountains. In moist forests, the BLM would conduct restoration thinning to promote the development of structurally-complex forest, which may include commercial removal of cut trees. In dry forests, the BLM would conduct restoration activities including thinning and prescribed burning to promote the development of structurally-complex forest and to improve resilience to disturbance, which may include commercial removal of cut trees.

Management Objectives for LSR

- Maintain nesting-roosting habitat for the northern spotted owl and nesting habitat for the marbled murrelet.
- Promote the development of nesting-roosting habitat for the northern spotted owl in stands that do not currently support northern spotted owl nesting and roosting.
- Promote the development of nesting habitat for marbled murrelet in stands that do not currently meet nesting habitat criteria.
- Promote the development and maintenance of foraging habitat for the northern spotted owl, including creating and maintaining habitat to increase diversity and abundance of prey for the northern spotted owl.

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[1] The BLM has updated this information since the preparation of Alternative B in the Draft RMP/EIS, which used the district-specific information on structurally-complex forests available at that time.

[2] The Late-Successional Reserve – Dry and Riparian Reserve – Dry sub-allocations in the PRMP are delineated as those portions of the Late-Successional Reserve and Riparian Reserve, respectively, which are in dry and very dry forest types identified by potential vegetation types within the Klamath Falls Field Office, the Medford District, and the South River Field Office of the Roseburg District.

Management Objectives for LSR-Dry

- See LSR management objectives.
- Enable forests to: (1) recover from past management measures, (2) respond positively to climate-driven stresses, wildfire and other disturbance with resilience, (3) ensure positive or neutral ecological impacts from wildfire, and (4) contribute to northern spotted owl recovery.
- Reduce the risk of loss of key late-successional structure through the development of vertical and horizontal heterogeneity.
- Increase diversity of stocking levels and size classes within the stand and the landscape.

d. Riparian Reserve

The Riparian Reserve encompasses lands along streams and other water bodies under the PRMP. The design of the Riparian Reserve west of Highway 97 varies among three classes of sixth-field subwatersheds (Hydrologic Unit Code-12). A Hydrologic Unit Code is a U.S Geological Survey classification based on a hierarchy of nested watersheds. A sixth-field subwatershed is typically 10,000 to 40,000 acres in size.

The BLM evaluated the importance of sixth-field subwatersheds to the conservation and recovery of listed fish based on designated critical habitat (CH) and the presence of high intrinsic potential habitat (HIP) for salmon. For sixth-field subwatersheds on the east side of the Willamette River, the BLM included core-genetic and core-legacy populations in addition to designated CH. The "intrinsic potential" is the set of habitat features that most influence whether that habitat is likely to be used or selected (or not) by an individual fish species. "High intrinsic potential" streams are those streams with the habitat features that are known to be highly productive for an individual fish species (see BLM 2015b, pp. 2-3).

Class I sixth-field subwatersheds are those that include *both* designated CH and HIP streams. Class II sixth-field subwatersheds are those that include *either* CH or HIP streams. Class III sixth-field subwatersheds are those that include *neither* designated CH or HIP streams.

All Class I, II, and III subwatersheds have the same Riparian Reserve width on fish-bearing or perennial streams. The difference is that the Riparian Reserve width for intermittent, non-fish bearing streams is 50 feet for Class III subwatersheds, where Class I and Class II subwatersheds maintain a site potential tree height Riparian Reserve width.

The Riparian Reserve comprises 635,717 acres of the BLM lands west of HWY 97, which is approximately 25.6 percent of the BLM-administered lands in the planning area. Riparian Reserve distances by water feature for lands west of Highway 97 in moist and dry forest are presented in Table 14.

Table 14. Riparian reserve distances by water feature for moist and dry forest lands west of Highway 97.

Feature	Riparian Reserve Distance[1]
Fish-bearing streams and perennial streams	One site-potential tree height distance from the ordinary high water line, including the channel migration zone for low-gradient alluvial shifting channels, on each side of a stream
Intermittent, non-fish-bearing streams	Class I and II watersheds: One site-potential tree height distance from the ordinary high water line on each side of a stream
	Class III watersheds: 50’ feet from the ordinary high water line on each side of a stream
Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails	The extent of the unstable area. Where there is a stable area between such an unstable area and a stream, and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area.
Lakes, natural ponds > 1 acre, and wetlands > 1 acre	100’ extending from the ordinary high water line
Natural ponds < 1 acre and wetlands < 1 acre (including seeps and springs), and constructed water impoundments of any size	25’ extending from the ordinary high water line

[1]Reported distances are measured as slope distance.

Zone-specific management direction for streams in each subwatershed class for the Riparian Reserve – Moist is presented in **Table 15** to **Table 17**, which are Tables B-6, B-7 and B-8 in the FEIS. Zone-specific management direction for streams in each subwatershed class for the Riparian Reserve – Dry is presented in **Table 18** to **Table** 20, which are Tables B-10, B-11 and B-12 in the FEIS. Much of the zone-specific management direction for Riparian Reserve – Moist and Riparian Reserve – Dry is identical, but there are some differences. For the remaining management direction for the Riparian Reserve Land Use Allocation, please see Appendix A. **Figure 1**, **Figure 2** and **Figure 3** visually depict Riparian Reserve zone distances and zone-specific management direction for Class I, Class II and Class III subwatersheds, respectively.

Table 15. Zone-specific management direction for streams in Class I subwatersheds in the Riparian Reserve – Moist.

Fish-bearing streams and perennial streams
Inner Zone (0–120 feet)
Do not thin stands, except for— • SOD treatments and • Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-3** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
Intermittent, non-fish-bearing streams
Inner Zone (0–50 feet)
Do not thin stands, except for— • SOD treatments; and • Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Middle Zone (50–120 feet)
Thin stands as needed to ensure that stands are able to provide trees that would function as stable

wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Remove cut trees only as needed for safety or operational reasons, or to meet the tree-tipping management direction described above.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the harvest unit within the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-3** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

Table 16. Zone-specific management direction for streams in Class II subwatersheds in the Riparian Reserve – Moist.

Fish-bearing streams and perennial streams
Inner Zone (0–120 feet)
Do not thin stands, except for— • SOD treatments; and • Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally-complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-3** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within

the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
Intermittent, non-fish-bearing streams
Inner Zone (0–50 feet)
Do not thin stands, except for— • SOD treatments • Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (50 feet to one site-potential tree height)
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally-complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-3** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

Table 17. Zone-specific management direction for streams in Class III subwatersheds in the Riparian Reserve – Moist.

Fish-bearing streams and perennial streams
Inner Zone (0–120 feet)
Do not thin stands, except for— • SOD treatments; and • Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.

Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally-complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-3** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
Intermittent, non-fish-bearing streams (0-50 feet)
Do not thin stands, except for— • SOD treatments; and • Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.

Table 18. Zone-specific management direction for streams in Class I subwatersheds in the Riparian Reserve – Dry.

Fish-bearing streams and perennial streams
Inner Zone (0–120 feet)
Do not thin stands, except for— • Fuels treatments as needed to reduce the risk of stand-replacing crown fires. Do not conduct fuels treatments within 60 feet of fish-bearing or perennial streams. Retain at least 50 percent canopy cover per acre. Do not cut trees > 12” DBH; and • as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-

replacing crown fires. Retain at least 30 percent canopy cover and 60 trees per acre, expressed as an average across the treated portion of the Riparian Reserve. Make available for sale the merchantable timber from thinning and other silvicultural treatments. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-3** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Meet the snag creation amounts as an average at the scale of the portion of the harvest unit within the Riparian Reserve, but may not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Use trees from any species to meet snag creation levels. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
Intermittent, non-fish-bearing streams
Inner Zone (0–50 feet)
Do not thin stands, except as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Middle Zone (50–120 feet)
Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. Remove cut trees as needed for safety or operational reasons, to reduce the risk of stand-replacing, crown fires, or to meet the tree-tipping management direction described above. Merchantable timber from thinning, fuels reduction, and other silvicultural treatments that must be removed for safety or operational reasons, to reduce the risk of stand-replacing, crown fires, or to meet the tree-tipping management direction described above may be made available for sale.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-3** within one year of completion of yarding the timber in the timber sale. If trees are

not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation:

- Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.
- Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species.

Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

Table 19. Zone-specific management direction for streams in Class II subwatersheds in the Riparian Reserve – Dry.

Fish-bearing streams and perennial streams
Inner Zone (0–120 feet)
Do not thin stands, except for— • Fuels treatments as needed to reduce the risk of stand-replacing crown fires. Do not conduct fuels treatments within 60 feet of fish-bearing or perennial streams. Retain at least 50 percent canopy cover per acre. Do not cut trees > 12” DBH; and • as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-3** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
Intermittent, non-fish-bearing streams
Inner Zone (0–50 feet)
Do not thin stands, except for— • Fuels treatments as needed to reduce the risk of stand-replacing crown fires. Do not conduct fuels treatments within 60 feet of fish-bearing or perennial streams. Retain at least 50 percent canopy cover per acre. Do not cut trees > 12” DBH; and • as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (50 feet to one site-potential tree height)

Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-3** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

Table 20. Zone-specific management direction for streams in Class III subwatersheds in the Riparian Reserve – Dry.

Fish-bearing streams and perennial streams
Inner Zone (0–120 feet)
Do not thin stands, except as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-3** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag

creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
Intermittent, non-fish-bearing streams (0-50 feet)
Do not thin stands, except as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.

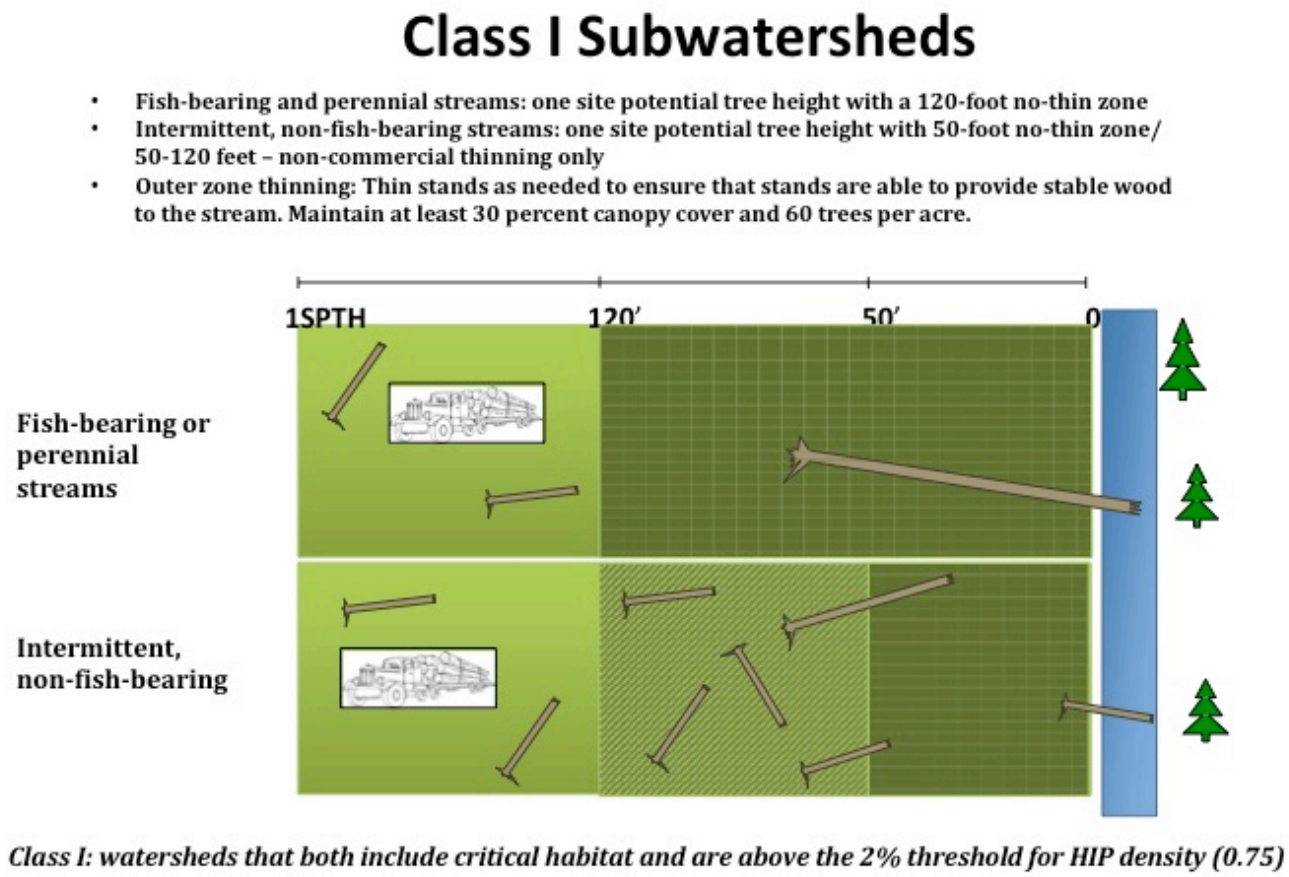
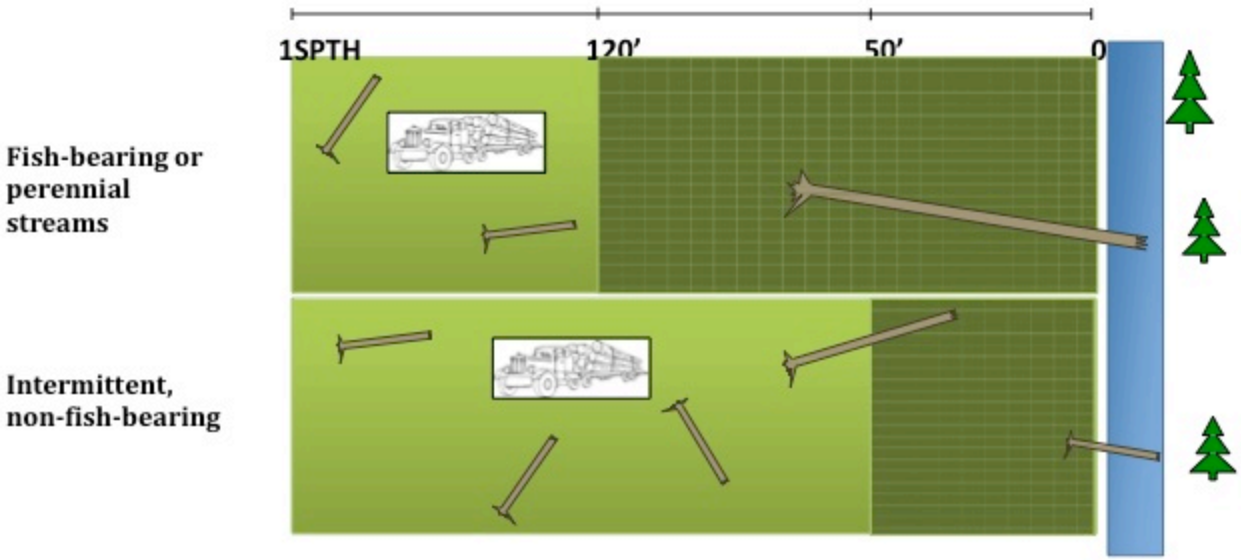


Figure 1. Class I subwatershed Riparian Reserve zone distances and zone-specific management direction.

Class II Subwatersheds

- Fish-bearing and perennial streams: one site potential tree height with a 120-foot no-thin zone
- Intermittent, non-fish-bearing streams: one site potential tree height with 50-foot no-thin zone
- Outer zone thinning: Apply thinning to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Maintain at least 30 percent canopy cover and 60 trees per acre.



Class II: watersheds that either include critical habitat or are above the 2% threshold for HIP density (0.75), and include Eastside tributaries with core-genetic and core legacy populations.

Figure 2. Class II subwatershed Riparian Reserve zone distances and zone-specific management direction.

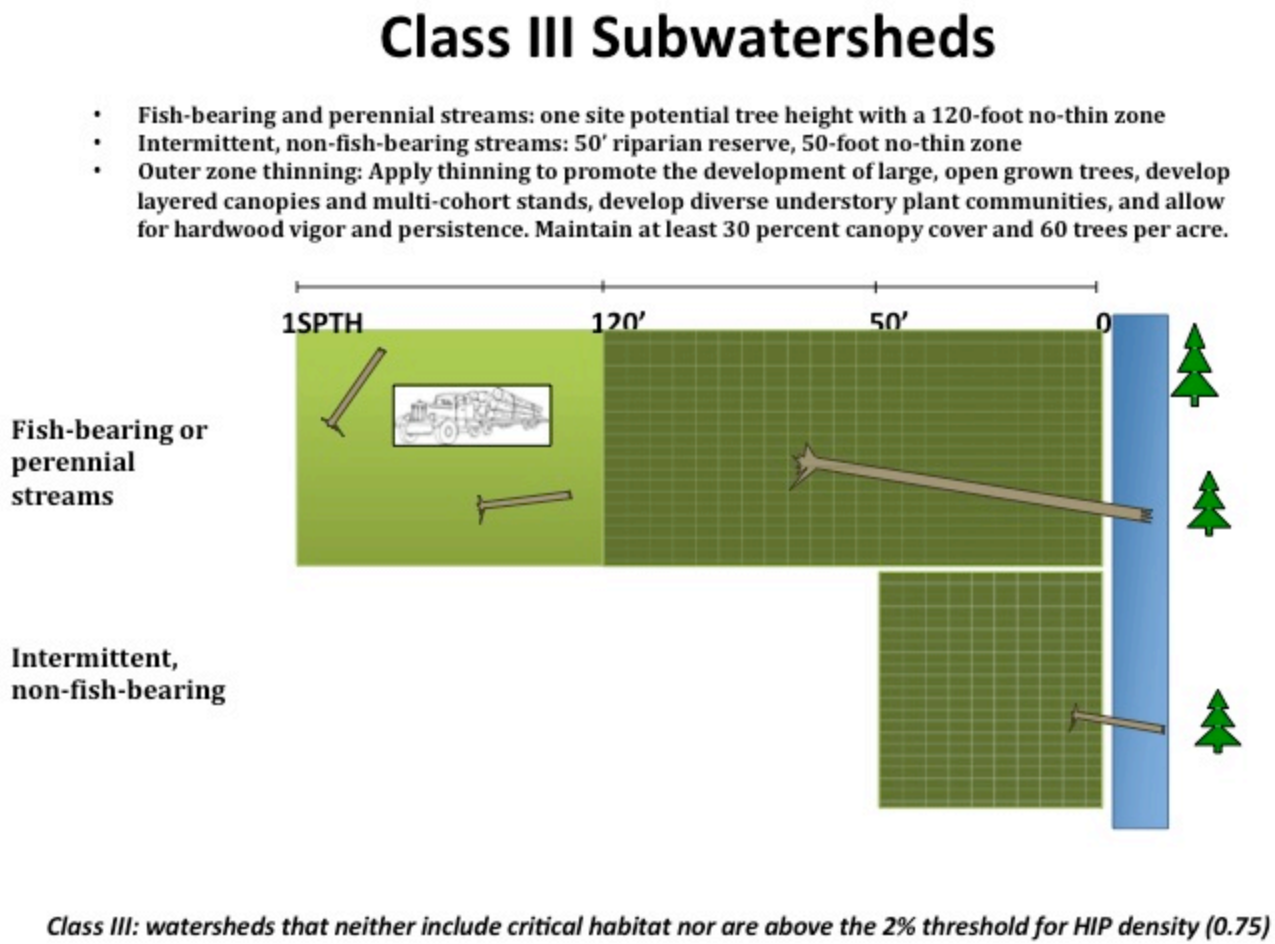


Figure 3. Class III subwatershed Riparian Reserve zone distances and zone-specific management direction.

Table 21 presents a count of Riparian Reserve Class I, II and III sixth-field subwatersheds by ESA-listed fish geographic area within the PRMP planning area. Note that these are not additive. The Lower Columbia River Chinook salmon ESU, the coho salmon ESU and steelhead DPS have some subwatersheds in common, as do the Upper Willamette River Chinook salmon ESU and steelhead DPS.

Table 21. Number of sixth-field subwatersheds with BLM land ownership by Riparian Reserve type, for salmon Evolutionarily Significant Units, steelhead Distinct Population Segments, Lost River and shortnose sucker Recovery Units and in the McKenzie River Basin bull trout analysis area within the PRMP Planning Area.

ESU/DPS/RU	HUC12 Subwatersheds by Riparian Reserve Type			
	Class I	Class II	Class III	Eastside Management Area
Lower Columbia River Chinook salmon	23	11	0	0
Lower Columbia River coho salmon	23	11	0	0
Lower Columbia River steelhead	20	8	0	0
Upper Willamette River Chinook salmon	57	54	11	0
Upper Willamette River steelhead	52	49	10	0
Oregon Coast coho salmon	233	19	10	0
Southern Oregon Northern California coho salmon	120	22	4	0
McKenzie Basin bull trout	3	8	0	0
Lost River Recovery Unit, Lost River & shortnose sucker[1]	0	1	1	37
Upper Klamath Recovery Unit, Lost River & shortnose sucker[1]	0	3	20	7

[1]Class II and Class III watersheds shown for the sucker recovery units are based upon HUC12s with BLM land ownership that are not in the Eastside Management Area.

Riparian Reserve distances by water feature for lands east of Highway 97 (Eastside Management Area) are presented in Table 22. The Riparian Reserve totals 11,838 acres, or approximately seven percent of the Eastside Management Area. Management objectives for the Riparian Reserve (Moist and Dry) west of Highway 97 and in the Eastside Management Area are presented below. For a complete list of management direction for each Riparian Reserve, please see Appendix A.

Table 22. Riparian Reserve distances by water feature for the Eastside Management Area (east of Highway 97).

Feature	Riparian Reserve Distance*
Fish-bearing streams and/or perennial streams	150 feet on each side of a stream channel from the ordinary high water line, including the channel migration zone for low-gradient alluvial shifting channels.
Non-fish bearing intermittent streams, all lakes, all natural ponds, constructed water impoundments >1 acre, constructed ponds >1 acre, and wetlands >1 acre	100 feet on each side of the water feature from the ordinary high water line.
Wetlands <1 acre, constructed water impoundments <1 acre, and constructed ponds <1 acre.	25 feet on each side of the water feature from the ordinary high water line.

* Reported distances are measured as slope distance

Management Objectives for Riparian Reserve west of Highway 97 - Moist

- Contribute to the conservation and recovery of listed fish species and their habitats and provide for conservation of special status fish and other special status riparian associated species.
- Maintain and restore the proper functioning condition of riparian areas, stream channels and wetlands by providing forest shade, sediment filtering, wood recruitment, stability of stream banks and channels, water storage and release, vegetation diversity, nutrient cycling and cool and moist microclimate.
- Maintain water quality and streamflows within the range of natural variability, to protect aquatic biodiversity, provide quality water for contact recreation and drinking water sources.
- Meet ODEQ water quality targets for 303(d) water bodies with approved Total Maximum Daily Loads (TMDLs).
- Maintain high quality water and contribute to the restoration of degraded water quality for 303(d) listed streams.
- Maintain high quality waters within ODEQ designated Source Water Protection watersheds.

Management Objectives for Riparian Reserve west of Highway 97 – Dry

- Contribute to the conservation and recovery of listed fish species and their habitats and provide for conservation of special status fish and other special status riparian associated species.
- Maintain and restore the proper functioning condition of riparian areas, stream channels and wetlands by providing forest shade, sediment filtering, wood recruitment, stability of stream banks and channels, water storage and release, vegetation diversity, nutrient cycling and cool and moist microclimate.

- Maintain water quality and streamflows within the range of natural variability, to protect aquatic biodiversity, provide quality water for contact recreation and drinking water sources.
- Meet ODEQ water quality targets for 303(d) water bodies with approved Total Maximum Daily Loads (TMDLs).
- Maintain high quality water and contribute to the restoration of degraded water quality for 303(d) listed streams.
- Maintain high quality waters within ODEQ designated Source Water Protection watersheds.

Management Objectives for Riparian Reserve in the Eastside Management Area

- Provide for conservation of special status fish and other special status riparian associated species.
- Provide for the riparian and aquatic conditions that supply stream channels with shade, sediment filtering, leaf litter and large wood sources, and stream bank stability.
- Maintain and restore water quality and hydrologic functions.
- Maintain and restore access to stream channels for all life stages of aquatic species.
- Maintain and restore the proper functioning condition and ecological site potential of riparian and wetland areas.

e. Harvest Land Base

The Harvest Land Base comprises 469,215 acres; 18.9 percent of the BLM-administered lands in the planning area. In the PRMP, the Harvest Land Base is comprised of the Uneven-aged Timber Area, Low Intensity Timber Area, and Moderate Intensity Timber Area.

The Uneven-aged Timber Area is located in:

- dry and very dry forest types identified by potential vegetation types in the Klamath Falls Field Office,
- dry forest types within northern spotted owl CH designated in the 2012 final rule (77 FR 71908) and very dry forest types in the Medford District, and
- very dry forest types in the South River Field Office.

The Low Intensity Timber Area is located in areas within the Harvest Land Base outside of the Uneven-aged Timber Area, in which the BLM identified that higher level of retention within regeneration harvest units would better integrate the management of multiple resources. Timber harvest in the Low Intensity Timber Area includes thinning and regeneration harvest with retention of 15 to 30 percent of the stand. In delineating these areas, the BLM included:

- northern spotted owl CH designated in the 2012 final rule (77 FR 71908) in the Harvest Land Base outside of the Uneven-aged Timber Area,
- dry forest types outside of designated northern spotted owl CH in the Harvest Land Base in the Medford District, and

- Special Recreation Management Areas that overlap the Harvest Land Base outside of the Uneven-aged Timber Area where increased tree retention in regeneration harvests would facilitate recreation management.

The Moderate Intensity Timber Area is located in the remaining portions of the Harvest Land Base. Timber harvest in the Moderate Intensity Timber Area includes thinning and regeneration harvest with retention of 5 to 15 percent of the stand.

The PRMP includes either natural tree regeneration or replanting after timber harvest in both the Low Intensity Timber Area and Moderate Intensity Timber Area.

Management Objectives for Harvest Land Base

- Manage forests to achieve continual timber production that can be sustained through a balance of growth and harvest.
- Offer for sale the declared Allowable Sale Quantity of timber.
- Recover economic value from timber harvested after disturbance, such as a fire, windstorm, disease, or insect infestations.
- In harvested or disturbed areas, ensure the establishment and survival of desirable trees appropriate to the site and enhance their growth.
- Enhance the economic value of timber in forest stands.

Management Objectives for Harvest Land Base – Low Intensity Timber Area

- See Harvest Land Base management objectives.
- Provide complex early successional ecosystems.
- Develop diverse late-successional ecosystems for a portion of the rotation.
- Provide a variety of forest structural stages distributed both spatially and temporally.

Management Objectives for Harvest Land Base – Moderate Intensity Timber Area

- See Harvest Land Base management objectives.
- Provide complex early successional ecosystems.
- Develop late-successional ecosystems for a portion of the rotation.
- Provide a variety of forest structural stages distributed both temporally and spatially.

Management Objectives for Harvest Land Base – Uneven-aged Timber Area

- See Harvest Land Base management objectives.
- Increase diversity of stocking levels and size classes within the stand and the landscape.

f. Eastside Management Area

The Eastside Management Area comprises 161,810 acres; 6.5 percent of the BLM-administered lands in the planning area. It consists of those public domain lands in the Klamath Falls Field Office east of Highway 97. This land use allocation only occurs within the Lost River sucker and shortnose sucker Recovery Units (RUs)

Management Objectives – Forested Lands

- Manage forested lands on a sustainable basis for multiple uses including wildlife habitat, recreational needs, riparian habitat, cultural resources, community stability, and commodity production, including commercial timber and other forest products.
- Promote development of fire-resilient forests.
- Offer for sale the probable sale quantity of 350 mbf of timber per year.

Management Objectives for Non-forested Lands

- Manage non-forested lands with the intent of maintaining or improving wildlife habitat and rangeland conditions based on ecological site parameters. Where conditions are currently late seral or potential natural community, maintain these conditions. Where conditions are early or mid seral, improve conditions towards late seral or potential natural community.
- Manage non-forested lands for multiple uses in addition to those listed above including: recreational needs, community stability, and commodity production. Commodities include firewood, logs, biomass, chips, and other products and byproducts from juniper woodlands and rangelands.
- Promote development of fire-resilient woodlands and rangelands.
- Provide for the conservation of Bureau Special Status Species.

Management Objectives for Eastside Management Area – Riparian Reserve

- Provide for conservation of Bureau Special Status fish and other Bureau Special Status riparian-associated species.
- Provide for the riparian and aquatic conditions that supply stream channels with shade, sediment filtering, leaf litter and large wood sources, and stream bank stability.
- Maintain and restore water quality and hydrologic functions.
- Maintain and restore access to stream channels for all life stages of aquatic species.
- Maintain and restore the proper functioning condition and ecological site potential of riparian and wetland areas.

Aquatic Conservation Measures

a. Riparian Reserve

Please see narrative above in section II.A.1.d. for the Riparian Reserve Land Use Allocation.

b. Watershed Restoration

Watershed restoration will be an integral part of a program to contribute to the conservation and recovery of listed fish and protect water quality. Important components of a watershed restoration program include control and prevention of road-related runoff and sediment production, restoration of access to stream channels, restoration of in-stream habitat complexity, and restoration of the condition of riparian vegetation.

Watershed restoration will include road treatments, such as obliteration, decommissioning, closure, or upgrading. Upgrading may involve practices such as removing soil from locations

where there is a high potential of triggering landslides, modifying road drainage systems to reduce the extent to which the road functions as an extension of the stream network, and reconstructing stream crossings to reduce the risk and consequences of road failure or washing out at the crossings.

Watershed restoration will include maintaining and restoring access to stream channels for all life stages of aquatic species. Specific actions will include replacing stream crossings that currently or potentially block or hinder fish passage with crossings that allow aquatic species to pass at each life stage and at a range of flows.

Watershed restoration will include in-stream restoration to create desired levels of channel complexity and improve fish habitat. Specific actions may include log and boulder placement in stream channels, tree tipping, and gravel enhancement to create spawning, rearing, and holding habitat for fish.

Watershed restoration will include silvicultural treatments of riparian forest stands, as needed to ensure that stands are able to provide trees that would function as stable wood in the stream and to increase diversity of riparian species and develop structurally complex stands. Watershed restoration will also include fuels reduction treatments in riparian forest stands, as needed to reduce the risk of stand-replacing, crown fires.

The BLM will evaluate restoration opportunities based on watershed-scale information on aquatic and riparian resources, considering ecological processes and limiting factors. The BLM will use the BLM Western Oregon Aquatic Restoration Strategy in determining priorities for watershed restoration. The BLM Western Oregon Aquatic Restoration Strategy presents a restoration strategy that uses a combination of habitat based intrinsic potential modeling and professional field knowledge to focus restoration efforts in areas deemed likely to have the highest production potential for fish species of interest and is incorporated here by reference (BLM 2015). The BLM may update the Western Oregon Aquatic Restoration Strategy periodically, and the BLM will continue to use the updated strategy to guide watershed restoration priorities.

c. Tiered Watershed Approach

The BLM evaluated the importance of watersheds to the conservation and recovery of ESA-listed Chinook salmon, coho salmon and steelhead based on the presence of designated CH and the density of streams with a high intrinsic potential (HIP). For watersheds on the east side of the Willamette River, the BLM included core-genetic and core-legacy populations in addition to designated CH.

The intrinsic potential (IP) analysis was performed for the 2008 WOPR planning effort. IP was calculated for each stream reach independently for juvenile steelhead and for coho salmon from stream attributes of mean annual stream flow, valley constraint, and channel gradient. These attributes were produced in conjunction with the digital stream network from 10-m digital elevation models (DEMs) (Miller et al. 2003). The stream network was output in an ArcView shape file format and then imported into ArcInfo (ESRI version 8.3) for all subsequent processing. Stream attribute values were translated into index scores for each species. The index scores were based on empirical evidence from published studies regarding the relationship between a stream attribute and juvenile fish use; this evidence is detailed below.

Following the most commonly applied approaches for modeling habitat suitability (Morrison et al. 1998, Vadas and Orth 2001), IP for each stream reach was calculated by multiplying the un-weighted species-specific index scores together and then taking the geometric mean of the product. This approach reflects the assumption that the three stream attributes are of approximately equal importance and only partially compensatory, and that the smallest index core has the greatest influence on the intrinsic potential. The index scores and IP can range from zero to one; larger values indicate a greater potential for providing high-quality rearing habitat. Stream reaches were classified with a high species-specific IP when the calculated value was > 0.75. IP is reported for a species only below naturally occurring barriers to migrating adults. We identified these barriers based on information from the Oregon Department of Fish and Wildlife that included a field determination of passability, barrier type, barrier height, and 1:100,000-scale maps of fish distribution.

Watersheds located west of Highway 97 in the PRMP planning area were evaluated at the HUC12 scale (commonly described as sixth-field sub-watersheds). For each subwatershed, the total miles of HIP streams (defined as having IP value of .75 or greater) for all three species was calculated using GIS. The number for each sub-watershed was divided by the total square miles in that watershed to create HIP mileage density. All subwatersheds were then ordered by HIP mileage density, and the cumulative percentage of total HIP mileage density was calculated for the ordered list.

The cumulative percentage for each sub-watershed in the ordered list was then used to sort each watershed into one of three classes of Riparian Reserves. The subwatersheds with the top 98% of total HIP mileage density *and* any designated CH became Class I. Class II watersheds *either* were in the top 98% of total HIP mileage density, *or* had designated CH, but did not have both. Class III watersheds are those that have no designated CH for the three Pacific salmon species and are in the lowest 2 percent HIP mileage density. Note that all subwatersheds in the PRMP planning area (not just those with BLM ownership) were included in the cumulative percentage calculation.

The three tiers of watersheds is a result of the differentiation into three Riparian Reserve classes The BLM recognizes that Class I and II watersheds are more important to the conservation and recovery of ESA-listed Pacific salmon than Class III watersheds.

The classes differ by the width of the Riparian Reserves for intermittent, non-fish-bearing streams. For Class I and II, it is one site-potential tree height distance on both sides of the stream. For Class III, it is 50 feet on both sides of the stream. Please refer to the description of the Riparian Reserve LUA in section II.A.d presented earlier in this BA for management direction regarding activities within specific zones of the Riparian Reserve Moist and Dry west of Highway 97.

d. Monitoring

Monitoring is an essential component of an RMP. Monitoring provides information to determine whether the BLM is following the RMP management direction (implementation monitoring) and to verify if the implementation of the RMP is achieving plan-level desired results (effectiveness

monitoring). The monitoring plan for the PRMP is in FEIS Appendix V (Appendix B of this document.

The monitoring plan for the PRMP focuses specifically on monitoring the implementation and effectiveness of the RMP and is not intended as an all-encompassing strategy that addresses all ongoing monitoring and research efforts. The monitoring plan does not attempt to address research-based questions. There are many ongoing research-based efforts in which the BLM participates that address evaluating whether the RMP is based on correct assumptions (validation monitoring).

The use of the monitoring plan by all BLM offices in the decision area would provide a basis for consistent and coordinated monitoring, and allow district information to be compiled and considered at the scale of the entire decision area. The BLM would evaluate the monitoring questions at each monitoring interval to ascertain if the questions, reporting, methods, sample size, or intervals need to be changed. The BLM would make such changes to the monitoring plan through plan maintenance.

Effectiveness Monitoring

The BLM would continue to rely on the existing interagency effectiveness monitoring modules to address key questions about whether the RMP is effectively meeting its objectives. The existing interagency effectiveness modules are aquatic and riparian ecosystems, late-successional and old growth, marbled murrelet, northern spotted owl, socio-economic, and tribal. Although there are differences in the objectives in the 1995 RMP and this PRMP, the key questions that the existing interagency effectiveness modules are designed to answer are still relevant to the objectives of the PRMP, as detailed below for the aquatic and riparian effectiveness monitoring program. See Appendix B for information on the other modules.

The aquatic and riparian effectiveness monitoring program (AREMP) assesses status and trends in watershed condition to answer the basic question:

- Is implementation of the RMP maintaining and restoring aquatic and riparian ecosystems to desired conditions on federal lands in the planning area?

This monitoring effort determines riparian watershed condition status for every 6th-field watershed (with >5% federal ownership along the stream length) based on upslope and riparian data derived from GIS layers and satellite imagery. In-channel attributes are also measured using a statistically valid survey design to assess aquatic watershed condition. Changes in riparian and aquatic conditions provide information for tracking status and trend based on management activities, natural disturbance and wildfire. More information on the aquatic and riparian ecosystems effectiveness monitoring is contained in the 20-year Monitoring Report (Miller et al. 2015), which is incorporated here by reference.

Implementation Monitoring

The implementation monitoring plan for the PRMP would assess the level of management activity and would examine if the BLM is implementing actions in accordance with management direction of the RMP.

The BLM would employ sampling or evaluation of a subset of implementation actions. The BLM has designed the monitoring plan for the PRMP to avoid prohibitive costs and effectively answer monitoring questions and reporting levels of activities. It is not necessary or desirable for the BLM to monitor implementation action of an RMP. The BLM would select projects to be monitored based on those that would yield a greater amount of information or be more beneficial. For example, a random sample may result in monitoring of a relatively small straightforward project that would yield limited information, whereas a more sophisticated or complex project might be available for monitoring that would yield more information or be more effective. The BLM would conduct sampling at the level of the entire administrative unit to which the resource management applies (e.g., Eugene District or Klamath Falls Field Office).

The BLM would report implementation monitoring results annually in a monitoring report, as part of the Annual Program Summary. The monitoring report would report, track, and assess the progress of plan implementation, state the findings and conclusions made through monitoring, and serve as a report to managers and the public. Monitoring reports would also include any discussions and analysis of non-compliance and recommendations for corrective action.

Some management direction in the PRMP is not measurable or quantifiable, or does not have a standard or threshold of acceptability, and therefore would not lend itself to being addressed through monitoring questions that are almost always dependent on a quantifiable basis of measurement. The level of activity for certain management direction that does not have standards or thresholds of acceptability would be monitored in the form of a program reporting item.

In some cases, where monitoring indicates very high compliance with the plan, the BLM would subsequently adjust the frequency or interval of monitoring for cost and time efficiency.

Monitoring of certain questions would not take place in the early years of implementation, because the BLM would not yet have completed projects and, therefore, would not be ready for monitoring. Although incomplete projects may be informally examined by managers to assess progress towards implementing management actions and achieving objectives, the evaluation of incomplete projects would not be part of formal plan monitoring. Not all programs or resources have monitoring questions. See Appendix B for monitoring questions, requirements and intervals for the Riparian Reserve LUA and for other PRMP LUAs and programs.

e. Watershed-Scale Information for Implementation Actions

The BLM will compile watershed-scale information on aquatic and riparian resources, including identifying resource conditions, watershed processes, risks to resources, and restoration opportunities, as needed for planning and analysis of implementation actions under the approved RMP. The BLM will compile watershed-scale information with the purpose of developing and documenting a scientifically-based understanding of the ecological structures, functions, processes, and interactions occurring within a watershed. The number and detail of these aspects considered will depend on the issues pertaining to a given watershed and the scope of proposed implementation actions.

This compilation of watershed-scale information does not constitute a separate or additional analysis beyond what the BLM would provide for NEPA or Endangered Species Act compliance for implementation actions. The BLM will focus on collecting and compiling information within the watershed that is essential for making sound management decisions. This watershed-scale

information will be relevant to analyzing the effects of implementation actions, determining monitoring and restoration needs for a watershed, and developing priorities for funding and implementing actions.

The BLM will use such watershed-scale information, where appropriate, to facilitate NEPA and Endangered Species Act compliance for specific projects. For example, such watershed-scale information will typically be relevant in the preparation of biological assessments for consultation with the National Marine Fisheries Service and U.S. Fish and Wildlife Service under Section 7(a)(2) of the ESA on the effects of implementation actions that may affect listed fish species or their designated CH.

B. "May Affect" BLM Resource Programs

The BLM RMPs provide general direction for the management of natural resources on federal lands. These plans do not approve the implementation of any specific project-level actions.

The plans are implemented on a project-by-project basis through a second-level, decision-making process. Project level planning will be completed prior to implementation of these projects. This will include analysis of the environmental consequences of specific proposed actions and Section 7 ESA consultation at the project scale if needed.

The BLM has reviewed the resource programs that it administers within the ESA action area. Those that "May Affect" one or more ESA-listed fish species and/or designated CH are described in this sub-section (II.B). Management Objectives are presented here for each "May Affect" program, and Management Direction is found in Appendix A. Note that in the Effects Analysis section (section V), programs with common causal mechanisms for effects are grouped together. Those that are "No Effect" and the rationale for that conclusion are described in sub-section II.C. "No Effect" programs will not be discussed further in this BA.

The BLM has reviewed the proximity of BLM land to designated CH for Southern DPS Pacific eulachon, the timing of the presence of the species in streams within the planning area, and environmental impacts associated with BLM programs implemented under the PRMP. Considering these factors, the BLM has determined that the implementation of actions under many BLM programs will have no effect to the species or its designated CH.

1. Cultural Resources

This program would occur within all ESUs/DPSs/RUs except for Southern DPS Pacific eulachon.

The BLM's management of cultural resources consists of applying protection and preservation measures in accordance with treaty trust responsibilities, federal law, and BLM policy. There are specific laws that deal with Native American religious freedom and graves protection.

Management concerns include compliance with new laws, guidelines, and directives to ensure that cultural resources and traditional uses are identified and evaluated prior to surface-disturbing activities, and that appropriate mitigation occurs to protect these resources.

Management activities for the Cultural Resources program include the inventory and recording of cultural resource sites. Limited site testing/salvage excavation may be conducted where

appropriate, and rehabilitation or stabilization techniques would be applied as needed. There are 2,470 known cultural resource sites in the decision area (DEIS Table 3-30).

Management Objectives

- Preserve and protect significant cultural resources and ensure that they are available for appropriate uses by present and future generations.
- Reduce imminent threats and resolve potential conflicts from natural or human-caused deterioration or potential conflict with other resources by ensuring that all authorizations for land and resource use will comply with Section 106 of the National Historic Preservation Act.

2. Fire and Fuels

This program would occur within all ESUs/DPSs/RUs except for Southern DPS Pacific eulachon.

The Fire and Fuels Program includes wildfire suppression actions, and activities associated with fuel treatments applied to stands of any age to reduce fuel hazards. Wildfire suppression includes activities such as hand-line construction, use of heavy equipment to create fire lines, back-burning, felling of snags, use of pump chances as water sources, and application of fire retardant and foam. Fuel treatments include such activities as tree cutting, brush cutting, pruning, reducing crown bulk density, treating activity fuels, biomass removal, and prescribed burning. Some of this would occur by hand, while others such as machine piling and mechanical mastication, would use heavy equipment.

Treatment types and acres of non-commercial natural hazardous fuels under the PRMP are projected to occur at rates similar to the past decade. Totals by category by District/Field Office for the decade 2003-2012 are displayed in Table 23.

Table 23. Non-commercial natural hazardous fuel treatment acres within the Planning Area, 2003-2012.

BLM District or Field office	Biomass Removal (Acres)	Hand Pile and Burn (Acres)	Machine Pile and Burn (Acres)	Mechanical Manual (Acres)	Mechanical Mastication (Acres)	Underburn or Broadcast Burn (Acres)	Total Acres
Coos Bay	1,161	595	63	122	1,680	1,092	4,713
Eugene	0	192	1	10,354	813	15	11,375
Klamath Falls	5,443	4,163	17,071	4,592	2,198	9,371	42,838
Medford	1,190	62,497	0	15,032	3,161	22,064	103,944
Roseburg	0	422	0	2,313	0	3,235	5,970
Salem	0	438	0	3,733	280	0	4,451

Grand Total Acres	173,291

Fuel reduction activity for the 10-year period from 2003-2012 was concentrated in the Klamath Falls Field Office and Medford District, in the Dry Forest type. The 173,291 total acres treated in the decade represents approximately 6.9 percent of the 2.5 million acres administered by the BLM in western Oregon, or about 0.7 percent on an annual basis. The proximity of past treatment areas to ESA-listed fish habitat is not known. The proximity of future fuel reduction projects to ESA-listed fish habitat is not currently known. However, if the fuel reduction activity of the past 10 years is indicative of future activity, the habitat for ESA-listed fish species that would have the greatest exposure to effects from fuels treatment activities would be that of shortnose suckers and Lost River suckers (Klamath Falls Field Office) (about 25% of the total activity of the time period 2003-2012) and SONCC coho salmon (Medford District Office) (about 60% of the total activity of the time period 2003-2012) .

A sub-set of Fuels treatment activities will follow the aquatic conservation measures (ACM) and project design criteria (PDC) in the BA for fish habitat restoration activities, also known as ARBA II (USDA FS *et al.* 2013). General ACM are described on ARBA II pages 21-26. Specific Project Design Criteria (PDC) are described on pages 57-59 for the category of Riparian Vegetation Treatment (controlled burning), and page 57 for Juniper Tree Removal. Activities will also incorporate appropriate BMPs and PRMP program direction.

Wildfire suppression activities may occur at any location on the landscape within the planning area from one year to the next. Activities are proportional to the size and number of wildfires. The proximity of wildfire suppression activities to ESA-listed fish is not predictable. Fuels reduction activities may occur within Riparian Reserves and may be proximal to ESA-listed fish habitat.

Management Objectives

- Respond to wildfires in a manner that provides for public and firefighter safety while meeting land management objectives by utilizing the full range of fire management options.
- Fire management strategies would be risk-based decisions that consider firefighter and public safety, values at risk, management objectives, and costs that are commensurate with the identified risk.
- Actively manage the land to restore and maintain resilience of ecosystems to wildfire and decrease the risk of uncharacteristic large high-intensity/high-severity wildfires.
- Manage fuels to reduce wildfire hazard, risk, and negative impacts to communities and infrastructure, landscapes, ecosystems, and highly valued resources.
- Manage fire, fuels, and wildfire response consistent with the National Cohesive Wildland Fire Management Strategy.
- Participate with communities bordering Federal lands in partnership with local, State, and Federal stakeholders to reduce the risks and threats from wildland fire.

3. Fisheries

This program would occur within all ESUs/DPSs/RUs except for Southern DPS Pacific eulachon. On-the-ground activities of the Fisheries program are restoration activities, such as the placement of large wood in stream channels and fish passage improvement projects.

Management Objectives

- Improve the distribution and quantity of high-quality fish habitat across the landscape for all life stages of ESA-listed, BLM special status species, and other fish species.
- Maintain and restore access to stream channels for all life stages of aquatic species.

4. Forest Management

This program would occur within all ESUs/DPSs/RUs, except for Pacific eulachon.

The Forest Management program includes all activities associated with timber harvest. Component actions include accessing sites, felling of trees, bucking into logs, yarding or skidding, timber haul, timber harvest site preparation, re-establishment of forest vegetation, planting, and intermediate silvicultural treatments (regeneration harvest, partial harvest, thinning), as well as road-related activities (construction, use, maintenance, and decommissioning). Road maintenance actions include surface maintenance (blading), surface replacement, drainage maintenance and repair, vegetation management (brushing, limbing, seeding and mulching along roadways), and maintenance, replacement and repair of structures such as culverts. Access roads may be decommissioned upon completion of the timber sale. Post-harvest silvicultural treatments include site preparation, planting, plantation maintenance and release (density management, pre-commercial thinning and control of competing vegetation), animal damage control and fertilization. In addition, the PRMP includes tree-tipping, which is the directional felling of trees towards streams. It occurs within Riparian Reserves.

PRMP Projected Harvest Acreages by Harvest Type

The BLM PRMP projects acres of timber harvest by harvest type, as an average of the first two decades. The harvest type definitions and associated management direction are presented below.

Restoration. Is the tipping or directional felling of trees in Riparian Reserves. Management direction describes tree-tipping:

- Tree Tipping: When conducting commercial thinning[3] in any portion of the Outer Zone in a stand in all watershed classes, fall or tip up to 15 square feet of basal area per acre of live trees, averaged across the Riparian Reserve portion of the stand. Leave felled or

[3] In the context of management direction for the Riparian Reserve, "commercial thinning" means stand thinning in which some or all of the cut trees are removed from the stand for timber. "Commercial thinning" in this context does not include individual tree falling or tipping or stand thinning in which all of the cut trees are left in the stand for restoration purposes, or fuels reduction treatments in which cut trees are burned, chipped, or otherwise disposed of without removal from the stand for timber. "Commercial thinning" may be implemented through a variety of mechanisms, including timber sale contracts and stewardship agreements or contracts.

tipped trees on site or yard, deck, and make felled or tipped trees available for fish habitat restoration. The felled or tipped trees can be of any size and come from any zone.

Salvage. Salvage harvest occurs after disturbance events to recover economic value. Management direction describes retention requirements:

- Implement timber salvage harvest after disturbance events to recover economic value and to minimize commercial loss or deterioration of damaged trees where the BLM determines that removal is economically viable.
  - In timber salvage harvest units, retain at least 15 percent (Low Intensity Timber Area [LITA] harvest land base sub-allocation) and at least 5 percent (Moderate Intensity Timber Area [MITA] and Uneven-Aged Timber Area [UTA] harvest land base sub-allocations) of pre-harvest stand basal area in live trees or snags in individual harvest units. Retain trees and snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.
  - After salvage harvest, use natural or artificial regeneration to regenerate a mixture of species appropriate to the site to a stand-level average of at least 130 trees per acre within 5 years of harvest.

Selection. Selection harvesting generally involves removing individual trees or groups of trees up to four acres in size and is used as part of an uneven-aged management regime, or to create uneven-aged stands. Selection harvesting occurs outside of the Riparian Reserve. Management direction pertinent to selection harvest in the UTA harvest land base sub-allocation is shown below:

- In stands ≥10 acres treated with selection harvest or commercial thinning,
  - Conduct harvest to result in stand average relative density between 20 percent and 45 percent after harvest.
  - Do not create group selection openings[4] more than 4 acres in size.
  - Do not create group selection openings on more than 30 percent of the stand area.
  - Leave untreated areas (skips) on at least 10 percent of the stand area.
- When regenerating group selection openings created from selection harvest or commercial thinning, use natural or artificial regeneration to regenerate a mixture of species appropriate to the site to an average density across the group selection openings of at least 150 trees per acre within 5 years of harvest.

Management direction pertinent to selection harvest in the LSR land use allocation is shown below:

- In stands ≥10 acres treated with selection harvest or commercial thinning,
  - Conduct harvest to result in stand average relative density percent between 20 percent and 45 percent after harvest.

[4] Group selection openings are defined as areas with ≤ 2 live trees ≥ 7” DBH per acre. Roads, landings, yarding corridors, and skid trails do not count as group selection openings.

- Do not create group selection openings[5] more than 4 acres in size.
- Do not create group selection openings on more than 25 percent of the stand area.
- Leave untreated skips on at least 10 percent of the stand area.

- In stands <10 acres treated with selection harvest or commercial thinning, do not create group selection openings more than 2.5 acres in size.
- When regenerating group selection openings created from selection harvest or commercial thinning, use natural or artificial regeneration to regenerate a mixture of species appropriate to the site to an average density across the group selection openings of at least 75 trees per acre within 5 years of harvest.

Thinning. Commercial thinning removes some of the trees in a stand. Management direction pertinent to commercial thinning in the Harvest Land Base LITA and MITA land use sub-allocations is shown below:

- Conduct commercial thinning for any of the following reasons:
  - Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.
  - Recover anticipated mortality.
  - Adjust stand composition or dominance.
  - Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.
  - Improve stand merchantability and value.
  - Increase or maintain vegetative species diversity.
  - Promote or enhance the development of structural complexity.
  - Create growing space for the creation or augmentation of Bureau Special Status plant populations.
  - Create growing space for hardwood and pine persistence and regeneration.
- Maintain stand densities through commercial thinning at levels above that needed to occupy the site, but below densities that will result in loss of stand vigor and health.
  - Conduct thinning to result in stand average relative density between 25 percent and 45 percent after harvest.
    - Implement unthinned areas (skips) and group selection openings[5] to provide increased structural complexity in the post-treatment stand. Do not exceed 10 percent of the thinned portion of the stand in group selection openings after harvest. Leave at least 5 percent of the thinned portion of stand area in untreated skips after harvest.

Management direction pertinent to commercial thinning in the Harvest Land Base UTA land use sub-allocation is shown below:

- In stands ≥10 acres treated with selection harvest or commercial thinning, harvest to result in stand average relative density between 20 percent and 45 percent after harvest.
  - Do not create group selection openings[6] more than 4 acres in size.

[5] Group selection openings are defined as areas with ≤ 2 live trees ≥ 7" DBH per acre. Roads, landings, yarding corridors, and skid trails do not count as group selection openings.

- Do not create group selection openings on more than 30 percent of the stand area.
- Leave untreated areas (skips) on at least 10 percent of the stand area.

Management direction pertinent to commercial thinning in the LSR land use allocation is shown below:

- In stands ≥10 acres treated with selection harvest or commercial thinning,
  - Apply harvest to result in stand average relative density percent between 20 percent and 45 percent after harvest.
  - Do not create group selection openings[7] more than 4 acres in size.
  - Do not create group selection openings on more than 25 percent of the stand area.
  - Leave untreated skips on at least 10 percent of the stand area.
- In stands <10 acres treated with selection harvest or commercial thinning, do not create group selection openings more than 2.5 acres in size.

Two-Age. This is a form of regeneration timber harvest with retention. It is the only form of PRMP regeneration timber harvest and would occur outside of the Riparian Reserve. Management direction pertinent to Two-Age in the Harvest Land Base LITA and MITA land use sub-allocations is shown below:

- Apply regeneration harvest for one or more of the following reasons:
  - To produce timber to contribute to the attainment of the declared Allowable Sale Quantity
  - To develop a desired age class distribution in the LITA/MITA in each sustained-yield unit
  - To manage insect and disease infestations
  - To convert stands capable of supporting conifer species that are currently growing primarily hardwoods or shrubs to a mix of conifer and hardwood species suitable to the site
  - To increase or maintain vegetative species diversity
  - To restore and maintain habitat for special status species
  - To create growing space for hardwood and pine species persistence and regeneration
  - To produce complex early-successional ecosystems
  - To reset stand development in overly dense stands that would not respond well to commercial thinning
- In regeneration harvest units, retain 15 to 30 percent (LITA) or 5 to 15 percent (MITA) of pre-harvest stand basal area in live trees in individual regeneration harvest units. Retain trees in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. Include among retained trees all trees that are ≥40" dbh and were established prior to 1850, except where removal is necessary for safety or operational reasons. Identify trees

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[6] Group selection openings are defined as areas with ≤ 2 live trees ≥ 7" DBH per acre. Roads, landings, yarding corridors, and skid trails do not count as group selection openings.
[7] Group selection openings are defined as areas with ≤ 2 live trees ≥ 7" DBH per acre. Roads, landings, yarding corridors, and skid trails do not count as group selection openings.

established prior to 1850 for retention based on a BLM evaluation of bark, limb, trunk, and crown characteristics.

- After regeneration harvest, use natural or artificial regeneration to regenerate a mixture of species appropriate to the site to a stand-level average of at least 130 trees per acre within 5 years of harvest.

Acreages of BLM projected timber harvest under the PRMP by year for each decade beginning in 2013, by harvest type, are presented for each ESA-listed Pacific salmon ESU and DPS, for bull trout in the McKenzie River basin, for the Lost River and shortnose sucker Lost Recovery Unit, and for the Lost River and shortnose sucker Upper Klamath Recovery unit in Table 24 to Table 33. Note that the acreages are not additive among the species. Several of the ESUs/DPSs share parts or all of the same geographic locations (e.g., Lower Columbia River Chinook salmon, coho salmon and steelhead).

The acreage estimates should not be used as targets. The estimated timber harvest is based upon one model run using the Woodstock model, and those estimates are only appropriate at the Sustained Yield Unit scale. It is used here to establish relative context for the amount of activity that could occur. Actual acres may be more or less, and there is no certainty that harvest may occur at any specific location in any particular year. Because site-specific schedules of activities have not been established, exact or precise levels of impact cannot be assigned.

Table 24. Acres of BLM timber harvest by decade, by harvest type under the PRMP within the Lower Columbia River Chinook salmon Evolutionarily Significant Unit.

Decade Ending	Acres by Decade by Timber Harvest Type					
	Restoration	Salvage	Selection	Thin	Two Age	Total Acres
2023	11	0	0	1,532	1,949	3,492
2033	1	0	0	2,129	1,519	3,648
2043	6	8	0	1,143	1,550	2,707
2053	12	0	0	976	1,257	2,245
2063	10	0	0	1,333	1,390	2,734
Total BLM acres in ESU = 36,146						

Table 25. Acres of BLM timber harvest by decade, by harvest type under the PRMP within the Lower Columbia River coho salmon Evolutionarily Significant Unit.

Decade Ending	Acres by Decade by Timber Harvest Type					
	Restoration	Salvage	Selection	Thin	Two Age	Total Acres
2023	11	0	0	1,532	1,949	3,492
2033	1	0	0	2,129	1,519	3,648
2043	6	8	0	1,143	1,550	2,707
2053	12	0	0	976	1,257	2,245
2063	10	0	0	1,333	1,390	2,734
Total BLM acres in ESU = 36,146						

Table 26. Acres of BLM timber harvest by decade, by harvest type under the PRMP within the Lower Columbia River steelhead Distinct Population Segment.

Decade Ending	Acres by Decade by Timber Harvest Type					
	Restoration	Salvage	Selection	Thin	Two Age	Total Acres
2023	3	0	0	1,377	1,115	2,496
2033	0	0	0	1,532	1,392	2,924
2043	1	8	0	1,107	945	2,061
2053	9	0	0	976	1,083	2,067
2063	10	0	0	1,186	716	1,913
Total BLM acres in ESU = 29,062						

Table 27. Acres of BLM timber harvest by decade, by harvest type under the PRMP within the McKenzie River basin bull trout evaluation area.

Decade Ending	Acres by Decade by Timber Harvest Type					
	Restoration	Salvage	Selection	Thin	Two Age	Total Acres
2023	42	0	0	2,167	4,750	6,959
2033	0	0	0	5,640	2,227	7,867
2043	42	0	0	1,549	4,459	6,051

2053	0	0	0	1,489	2,650	4,139
2063	0	0	0	2,730	2,107	4,837
Total BLM acres in McKenzie Basin = 51,805						

Table 28. Acres of BLM timber harvest by decade, by harvest type under the PRMP within the Oregon Coast coho salmon Evolutionarily Significant Unit.

Decade Ending	Acres by Decade by Timber Harvest Type					
	Restoration	Salvage	Selection	Thin	Two Age	Total Acres
2023	1,636	414	12,084	35,197	11,763	61,094
2033	1,546	2,044	13,109	35,013	10,040	61,753
2043	1,279	10	13,127	27,494	12,702	54,612
2053	1,339	0	13,964	27,609	9,995	52,906
2063	882	427	12,050	26,464	7,312	47,135
Total BLM acres in ESU = 1,091,866						

Table 29. Acres of BLM timber harvest by decade, by harvest type under the PRMP within the Southern Oregon / Northern California Coasts coho salmon Evolutionarily Significant Unit.

Decade Ending	Acres by Decade by Timber Harvest Type					
	Restoration	Salvage	Selection	Thin	Two Age	Total Acres
2023	427	1,826	38,061	2,663	2,898	45,875
2033	470	232	37,761	2,479	3,124	44,066
2043	449	3,390	42,253	3,988	2,608	52,688
2053	208	2,332	39,335	1,506	2,159	45,539
2063	210	4,677	40,511	2,054	1,468	48,918
Total BLM acres in ESU = 732,896						

Table 30. Acres of BLM timber harvest by decade, by harvest type under the PRMP within the Lost Recovery Unit for Lost River and shortnose suckers.

Decade Ending	Acres by Decade by Timber Harvest Type					
	Restoration	Salvage	Selection	Thin	Two Age	Total Acres
2023	0	0	22	0	0	22
2033	0	0	309	0	0	309
2043	0	0	422	0	0	422
2053	0	0	531	0	0	531
2063	0	0	105	0	0	105
Total BLM acres in Recovery Unit = 158,534						

Table 31. Acres of BLM timber harvest by decade, by harvest type under the PRMP within the Upper Klamath Recovery Unit for Lost River and shortnose suckers.

Decade Ending	Acres by Decade by Timber Harvest Type					
	Restoration	Salvage	Selection	Thin	Two Age	Total Acres
2023	0	0	7,149	24	653	7,826
2033	0	0	8,058	18	582	8,659
2043	0	0	8,162	78	775	9,347
2053	0	0	7,720	379	856	8,955
2063	0	0	6,637	131	559	7,328
Total BLM acres in Recovery Unit = 71,291						

Table 32. Acres of BLM timber harvest by decade, by harvest type under the PRMP within the Upper Willamette River Chinook salmon Evolutionarily Significant Unit.

Decade Ending	Acres by Decade by Timber Harvest Type					
	Restoration	Salvage	Selection	Thin	Two Age	Total Acres
2023	188	0	0	7,960	13,330	21,478
2033	137	0	0	17,531	8,691	26,358

2043	209	0	0	12,264	13,714	26,187
2053	147	0	0	9,305	14,000	23,452
2063	100	101	0	11,518	7,901	19,620
Total BLM acres in ESU = 236,726						

Table 33. Acres of BLM timber harvest by decade, by harvest type under the PRMP within the Upper Willamette River steelhead Distinct Population Segment.

Decade Ending	Acres by Decade by Timber Harvest Type					
	Restoration	Salvage	Selection	Thin	Two Age	Total Acres
2023	122	0	0	5,941	7,476	13,539
2033	122	0	0	11,710	6,179	18,011
2043	164	81	0	7,893	9,947	18,085
2053	137	0	0	5,627	8,226	13,990
2063	112	101	0	5,458	4,686	10,357
Total BLM acres in DPS = 186,059						

PRMP Projected Thinning Acreages within Riparian Reserve

The total amount of Riparian Reserve thinning since 1995 (initiation of the NWFP) on BLM land in the planning area is 17,461 acres. Most of that has taken place in the last 10 years. The PRMP projects 10,561 acres of Riparian Reserve thinning in the first decade, declining to 5,434 acres in the fifth decade.

Acreages of BLM projected thinning within the Riparian Reserve under the PRMP by year for each decade beginning in 2013 are presented for each ESA-listed Pacific salmon ESU and DPS, for bull trout in the McKenzie River basin, for the Lost River and shortnose sucker Lost Recovery Unit, and for the Lost River and shortnose sucker Upper Klamath Recovery unit in Table 34 to Table 43. These thinning acres are already included in the total thinning acres by ESA-listed fish geographic units presented above in Table 24 to Table 33. Note that the acreages are not additive among the species. Several of the ESUs/DPSs share parts or all of the same geographic locations (e.g., Lower Columbia River Chinook salmon, coho salmon and steelhead). The BLM used an assumption for vegetation modeling purposes that stands within Riparian Reserves that are less than 80 years of age would be eligible for thinning. The vast majority of stands thinned since 1995 within BLM Riparian Reserves have been 80 years of age or less, and it is anticipated that this trend would continue under the PRMP. However, it is not Management Direction that a stand within a Riparian Reserve that is greater than 80 years of age would not be thinned.

The acreage estimates should not be used as targets. The estimated timber harvest is based upon one model run using the Woodstock model, and those estimates are only appropriate at the Sustained Yield Unit scale. It is used here to establish relative context for the amount of activity that could occur. Actual acres may be more or less, and there is no certainty that harvest may occur at any specific location in any particular year. Because site-specific schedules of activities have not been established, exact or precise levels of impact cannot be assigned.

Only a small percentage of the total Riparian Reserve acres in any ESA-listed fish species geographic area would be thinned in a decade. The range is 0 to <2 percent with one exception. That exception is for the decade ending in 2023 for the McKenzie River basin bull trout analysis area, at 4.1 percent.

Table 34. Acres of PRMP Riparian Reserve thinning by decade within the Lower Columbia River Chinook salmon Evolutionarily Significant Unit.

Riparian Reserve Category	2023 (Acres)	2033 (Acres)	2043 (Acres)	2053 (Acres)	2063 (Acres)
Total Riparian Reserve	9,977	9,977	9,977	9,977	9,977
Not Eligible	2,708	2,708	2,708	2,708	2,708
Eligible	7,269	7,269	7,269	7,269	7,269
Not Thinned	7,101	7,132	7,201	7,205	7,210
Thinned	168	138	68	64	59
% of total R. Reserve Thinned	1.7%	1.4%	0.7%	0.6%	0.6%

Table 35. Acres of PRMP Riparian Reserve thinning by decade within the Lower Columbia River coho salmon Evolutionarily Significant Unit.

Riparian Reserve Category	2023 (Acres)	2033 (Acres)	2043 (Acres)	2053 (Acres)	2063 (Acres)
Total Riparian Reserve	**9,977**	**9,977**	**9,977**	**9,977**	**9,977**
Not Eligible	2,708	2,708	2,708	2,708	2,708
Eligible	7,269	7,269	7,269	7,269	7,269
Not Thinned	7,101	7,132	7,201	7,205	7,210
Thinned	168	138	68	64	59
% of total R. Reserve Thinned	1.7%	1.4%	0.7%	0.6%	0.6%

Table 36. Acres of PRMP Riparian Reserve thinning by decade within the Lower Columbia River steelhead Distinct Population Segment.

Riparian Reserve Category	2023 (Acres)	2033 (Acres)	2043 (Acres)	2053 (Acres)	2063 (Acres)
Total Riparian Reserve	**7,339**	**7,339**	**7,339**	**7,339**	**7,339**
Not Eligible	2,508	2,508	2,508	2,508	2,508
Eligible	4,831	4,831	4,831	4,831	4,831
Not Thinned	4,691	4,739	4,800	4,767	4,809
Thinned	140	92	31	64	22
% of total R. Reserve Thinned	1.9%	1.3%	0.4%	0.9%	0.3%

Table 37. Acres of PRMP Riparian Reserve thinning by decade within the McKenzie River basin bull trout evaluation area.

Riparian Reserve Category	2023 (Acres)	2033 (Acres)	2043 (Acres)	2053 (Acres)	2063 (Acres)
Total Riparian Reserve	**17,559**	**17,559**	**17,559**	**17,559**	**17,559**
Not Eligible	3,661	3,661	3,661	3,661	3,661
Eligible	13,898	13,898	13,898	13,898	13,898
Not Thinned	13,181	13,669	13,587	13,614	13,740
Thinned	717	228	311	283	158
% of total R. Reserve Thinned	4.1%	1.3%	1.8%	1.6%	0.9%

Table 38. Acres of PRMP Riparian Reserve thinning by decade within the Oregon Coast coho salmon Evolutionarily Significant Unit.

Riparian Reserve Category	2023 (Acres)	2033 (Acres)	2043 (Acres)	2053 (Acres)	2063 (Acres)
Total Riparian Reserve	**341,958**	**341,958**	**341,958**	**341,958**	**341,958**
Not Eligible	110,731	110,731	110,731	110,731	110,731
Eligible	231,227	231,227	231,227	231,227	231,227
Not Thinned	226,199	226,249	226,667	227,495	228,591
Thinned	5,029	4,979	4,560	3,732	2,636
% of total R. Reserve Thinned	1.5%	1.5%	1.3%	1.1%	0.8%

Table 39. Acres of PRMP Riparian Reserve thinning by decade within the Southern Oregon / Northern California Coasts coho salmon Evolutionarily Significant Unit.

Riparian Reserve Category	2023 (Acres)	2033 (Acres)	2043 (Acres)	2053 (Acres)	2063 (Acres)
Total Riparian Reserve	**166,583**	**166,583**	**166,583**	**166,583**	**166,583**
Not Eligible	110,781	110,781	110,781	110,781	110,781
Eligible	55,801	55,801	55,801	55,801	55,801
Not Thinned	54,771	54,673	54,767	55,136	55,270
Thinned	1,031	1,128	1,034	665	531
% of total R. Reserve Thinned	0.6%	0.7%	0.6%	0.4%	0.3%

Table 40. Acres of PRMP Riparian Reserve thinning by decade within the Lost Recovery Unit for Lost River and shortnose suckers.

Riparian Reserve Category	2023 (Acres)	2033 (Acres)	2043 (Acres)	2053 (Acres)	2063 (Acres)
Total Riparian Reserve	**11,641**	**11,641**	**11,641**	**11,641**	**11,641**
Not Eligible	11,627	11,627	11,627	11,627	11,627
Eligible	14	14	14	14	14
Not Thinned	14	14	14	14	14
Thinned	0	0	0	0	0
% of total R. Reserve Thinned	0%	0%	0%	0%	0%

Table 41. Acres of PRMP Riparian Reserve thinning by decade within the Upper Klamath Recovery Unit for Lost River and shortnose suckers.

Riparian Reserve Category	2023 (Acres)	2033 (Acres)	2043 (Acres)	2053 (Acres)	2063 (Acres)
Total Riparian Reserve	**4,147**	**4,147**	**4,147**	**4,147**	**4,147**
Not Eligible	3,310	3,310	3,310	3,310	3,310
Eligible	837	837	837	837	837
Not Thinned	837	837	834	835	837
Thinned	0	0	3	2	0
% of total R. Reserve Thinned	0%	0%	0.07%	0.05%	0%

Table 42. Acres of PRMP Riparian Reserve thinning by decade within the Upper Willamette River Chinook salmon Evolutionarily Significant Unit.

Riparian Reserve Category	2023 (Acres)	2033 (Acres)	2043 (Acres)	2053 (Acres)	2063 (Acres)
Total Riparian Reserve	**76,057**	**76,057**	**76,057**	**76,057**	**76,057**
Not Eligible	21,956	21,956	21,956	21,956	21,956
Eligible	54,102	54,102	54,102	54,102	54,102
Not Thinned	52,659	53,253	53,212	53,255	53,573
Thinned	1,442	849	890	847	22
% of total R. Reserve Thinned	1.7%	1.4%	0.7%	0.6%	0.6%

Table 43. Acres of PRMP Riparian Reserve thinning by decade within the Upper Willamette River steelhead Distinct Population Segment.

Riparian Reserve Category	2023 (Acres)	2033 (Acres)	2043 (Acres)	2053 (Acres)	2063 (Acres)
Total Riparian Reserve	**66,926**	**66,926**	**66,926**	**66,926**	**66,926**
Not Eligible	19,855	19,855	19,855	19,855	19,855
Eligible	47,072	47,072	47,072	47,072	47,072
Not Thinned	46,208	46,308	46,467	46,451	46,650
Thinned	863	764	605	621	422
% of total R. Reserve Thinned	1.7%	1.4%	0.7%	0.6%	0.6%

Projected New Road Construction, Road Renovation and Improvement, and Road Closures

New road construction under the PRMP would be primarily to access areas for timber harvest. Projections for miles of new road construction under the PRMP are based upon road ratios (feet of new road/MBF of timber). Road ratios vary between types of harvest. The BLM used ratios developed for the 2008 RMP/EIS for the regeneration harvest and uneven-aged management harvest, and road ratios developed from six years (FY2007-FY2012) of harvest volume sold data and timber sale contract data for the commercial thinning harvest. The BLM is unable to use the harvest volume/timber sale contract data source for regeneration harvest or

uneven-aged management harvest because the BLM has not implemented enough of these harvests in the recent past to provide new road construction data for either of these harvest types.

Uneven-aged management and commercial thinning harvest typically require more new road construction than regeneration harvest. The average road ratios (feet/Mbf) across the decision area for uneven-age management harvest are 20 percent higher than the road ratios for regeneration harvest, and the road ratios for commercial thinning harvest are 70 percent higher than for regeneration harvest. The Medford District is an exception to the rule for commercial thinning harvest, as these ratios are actually 30 percent lower than for regeneration harvest. The projected miles of new road construction in the first decade (ten years) of PRMP implementation, and of the existing road network are shown by BLM administrative unit in Table 44.

Table 44. Miles of new road construction by road surfacing and status in the first decade of PRMP implementation, and existing miles of road.

District/ Field Office	Temporary Rock (Miles)	Temporary Natural (Miles)	Permanent Rock (Miles)	Permanent Natural (Miles)	Total New (Miles)	Total Existing (Miles)
Coos Bay	3	17	16	13	49	1,896
Eugene	3	28	56	1	88	2,017
Klamath Falls	-	1	-	1	2	524
Medford	17	37	62	35	151	4,589
Roseburg	2	40	27	5	74	2,868
Salem	10	47	12	4	73	2,436
Totals	**35**	**170**	**173**	**59**	**437**	**14,330**

Because these are projections rather than a result of actual timber sale project design, it is not known where on the landscape these road miles would be placed. It is currently not known what proportion of the new road miles would be within Riparian Reserves, or hydrologically connected to streams. The road sediment analysis in the Forest Management effects analysis section of this BA (section V.4) determined that 36 percent of the existing road system occurs within a 200 foot sediment delivery distance to streams. For sediment modeling purposes, the proportions by road surface type within the 200 foot delivery distance and outside of that distance in the existing BLM road system, was applied to the total miles of new road to be constructed in the first decade under the PRMP. The result was approximately 66 miles of new road construction would occur within the 200 foot delivery distance. This 66 miles is spread across the entire planning area.

There are 21 PRMP road BMPs that would minimize connectivity of new roads with streams and specifically address surface drainage and cross-drains (BMPs R2, R3, R27 and R31 to R48). See Appendix C for a complete description of each BMP.

The BLM will accomplish both renovation and improvement of existing roads needed for timber sale use. Renovated and improved roads will support anticipated use, provide for safety, and protect adjacent lands and resources. Renovation consists of restoring a degraded road to its original design standard (e.g., replacing both worn out cross drain culverts and depleted rock surfacing). Improvement consists of upgrading the original design standard, e.g., adding cross drain culverts and rock surfacing to an existing natural surface road. The PRMP would renovate 4,295 miles of road and improve 246 miles of road in the first decade.

Approximately 80 percent of road renovation occurs on rock surface roads. Renovation of some roads will occur more than once in the first decade. Renovation tasks typically include roadside brushing, ditchline and culvert cleaning, culvert replacement, rock surface replacement, and pot hole patching on paved roads. Virtually all road improvement will consist of rocking natural surfaced roads

The BLM would accomplish both permanent and long-term road closures under the PRMP. Table 45 and Table 46 summarize estimated permanent and long-term road closures by surface type for the first decade.

Table 45. PRMP first decade permanent road closures.

District/Field Office	Rock (Miles)	Natural (Miles)	Totals (Miles)
Coos Bay	2	29	31
Eugene	4	38	42
Klamath Falls	-	-	-
Medford	1	7	8
Roseburg	-	10	10
Salem	1	1	2
Totals	**8**	**85**	**93**

Table 46. PRMP first decade long-term road closures.

District/Field Office	Rock (Miles)	Natural (Miles)	Totals (Miles)
Coos Bay	35	96	131
Eugene	49	4	53

Klamath Falls	-	9	9
Medford	-	10	10
Roseburg	7	75	82
Salem	27	61	88
Totals	**118**	**255**	**373**

Permanent road closures, aimed primarily at natural surface roads, would affect significantly less than 1 percent of the western Oregon road network in the first decade. Long-term road closures, implemented at a 2:1 ratio of natural surface type to rock surface type, would increase the percentage of the BLM road network in a long-term closure status from its current 6 percent to 8 percent by the end of the first decade.

Projected Miscellaneous Forest Management Treatment Acres per Decade

The projected miscellaneous treatment acres per decade for the Forest Management Program of the PRMP, as an average of the first two decades, is presented in Table 47. Miscellaneous Forest Management Treatment Acres per Decade (average of first two decades).

Table 47. Miscellaneous Forest Management Treatment Acres per Decade (average of first two decades).

Treatment Type	Proposed RMP (Acres)
Non-commercial Thinning	2,215
Under Burn	15,832
Hand Pile and Burn	32,232
Landing Pile and Burn	5,468
Machine Pile and Burn	11,274
Slash and Scatter	28,109
Mastication	4,056
Planting	52,833
Stand Maintenance and Protection	82,696
Pre-commercial Thinning	41,108
Fertilization	0
Pruning	3,910

Stand Conversion	106

Management Objectives

- Enhance the health, stability, growth, and vigor of forest stands.
- In harvested or disturbed areas, ensure the establishment and survival of desirable vegetation appropriate to the site.
- Facilitate safe and efficient forestry operations for the BLM, reciprocal right of way agreement holders, and permittees.

5. Hydrology

This program would occur within all ESUs/DPSs/RUs except for Southern DPS Pacific eulachon. On-the-ground activities of the Hydrology program are restoration activities.

Management Objective

- Maintain water quality within the range of natural variability that meets ODEQ water quality standards for drinking water, contact recreation, and aquatic biodiversity.

6. Invasive Species

This program would occur within all ESUs/DPSs/RUs except for Southern DPS Pacific eulachon. On-the-ground activities of the Invasive Species program are restoration activities, including treatment for Sudden Oak Death. A programmatic fish habitat restoration ESA consultation was concluded in 2013 that includes coverage for various methods of non-native invasive plant control (NMFS 2013, USFWS 2013). The biological opinions, commonly known as ARBO II, are still in effect and the PDCs and terms and conditions are being followed by the BLM. The description below of the non-native invasive plant control program is excerpted from the programmatic biological assessment for fish habitat restoration activities, known as ARBA II (USFS et al. 2013).

Non-native invasive plant control includes manual, mechanical, biological, and chemical methods to remove invasive non-native plants within Riparian Reserves and adjacent uplands. In monoculture areas (e.g., areas dominated by black berry or knotweed) heavy machinery can be used to help remove invasive plants. This activity is intended to improve the composition, structure, and abundance of native riparian plant communities important for bank stability, stream shading, large wood and other organic inputs into streams, all of which are important elements to fish habitat and water quality. Manual and hand-held equipment will be used to remove plants and disperse chemical treatments. Heavy equipment, such as bulldozers, can be used to remove invasive plants, primarily in areas with low slope values.

Manual treatments are those done with hand tools or hand held motorized equipment. These treatments typically involve a small group of people in a localized area. Vegetation disturbance varies from cutting or mowing to temporarily reduce the size and vigor of plants to removal of entire plants. Soil disturbance is minimized by managing group size and targeting individual plants.

Mechanical treatments involve the use of motorized equipment and vary in intensity and impact from mowing to total vegetation removal and soil turnover (plowing and seed bed preparation). Mechanical treatments reduce the number of people treating vegetation. Unintended impacts may vary from none to removal of non-target vegetation and soil compaction or erosion. Impacts could be lessened by minimizing the use of heavy equipment in riparian areas, avoiding treatments that create bare soil in large or extensive areas, reseeding and mulching following treatments, and avoiding work when soils are wet and subject to compaction.

Release of traditional host specific biological control agents (insects and pathogens) consists of one or two people depositing agents on target vegetation. This results in minimal impact to soils and vegetation from the actual release. Over time, successful biological control agents will reduce the size and vigor of host noxious weeds with minimal or no impact to other plant species. Targeted grazing to reduce size and vigor of invasive plants, may impact desirable vegetation and soils. Short duration, high density stocking is typically used for treatments 1 to 3 times per year. Targeted grazing would be timed to impact invasive species while minimizing undesirable impacts.

Invasive plants, including state-listed noxious weeds, are particularly aggressive and difficult to control and may require the use of herbicides for successful control and restoration of riparian and upland areas. Herbicide treatments vary in impact to vegetation from complete removal to reduced vigor of specific plants. Minimal impacts to soil from compaction and erosion are expected.

The ARBA II provides the following general guidance for chemical treatments:

(a) Use herbicides only in an integrated weed or vegetation management context where all treatments are considered and various methods are used individually or in concert to maximize the benefits while reducing undesirable effects.
(b) Carefully consider herbicide impacts to fish, wildlife, non-target native plants, and other resources when making herbicide choices.
(c) Treat only the minimum area necessary for effective control. Herbicides may be applied by selective, hand-held, backpack, or broadcast equipment in accordance with state and federal law and only by certified and licensed applicators to specifically target invasive plant species.
(d) Herbicide application rates will follow label direction, unless site-specific analysis determines a lower maximum rate is needed to reduce non-target impacts.
(e) A herbicide safety/spill response plan is required for all projects to reduce the likelihood of spills, misapplication, reduce potential for unsafe practices, and to take remedial actions in the event of spills. Spill plan contents will follow agency direction.
(f) Pesticide applicator reports must be completed within 24 hours of application.

The ARBA II BA states that the active ingredients are restricted to the following (some common trade names are shown in parentheses; use of trade names does not imply endorsement by the U.S. government). The BLM currently employs only glyphosate, 2,4-D, dicamba, and picloram within the planning area, but may use others on this list at a future time.

(a) aminopyralid (e.g., *terrestrial*: Milestone VM)
(b) chlorsulfuron (e.g., *terrestrial*: Telar, Glean, Corsair)

(c) clopyralid (e.g., *terrestrial*: Transline)
(d) dicamba (e.g., *terrestrial*: Vanquish, Banvel)
(e) diflufenzopyr + dicamba (e.g., *terrestrial*: Overdrive)
(f) glyphosate (e.g., *aquatic*: Aquamaster, AquaPro, Rodeo, Accord)
(g) imazapic (e.g., *terrestrial*: Plateau)
(h) imazapyr (e.g., *aquatic*: Habitat; *terrestrial*: Arsenal, Chopper)
(i) metsulfuron methyl (e.g., *terrestrial*: Escort)
(j) picloram (e.g., *terrestrial*: Tordon, Outpost 22K)
(k) sethoxydim (e.g., *terrestrial*: Poast, Vantage)
(l) sulfometuron methyl (e.g., *terrestrial*: Oust, Oust XP)
(m) triclopyr (e.g., *aquatic*: Garlon 3A, Tahoe 3A, Renovate 3, Element 3A; *terrestrial*: Garlon 4A, Tahoe 4E, Pathfinder II)
(n) 2,4-D (e.g., *aquatic*: 2,4-D Amine, Clean Amine; *terrestrial*: Weedone, Hi-Dep)

When recommended by the label, an approved aquatic surfactant would be used to improve uptake. When aquatic herbicides are required, the only surfactants and adjuvants permitted are those allowed for use on aquatic sites, as listed by the Washington State Department of Ecology: http://www.ecy.wa.gov/programs/wq/pesticides/regpesticides.html. (Oregon Department of Agriculture also often recommends this list for aquatic site applications). The surfactants R-11, Polyethoxylated tallow amine (POEA), and herbicides that contain POEA (e.g., Roundup) will not be used.

Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil. Herbicides will be mixed more than 150 feet from any natural waterbody to minimize the risk of an accidental discharge. Impervious material will be placed beneath mixing areas in such a manner as to contain any spills associated with mixing/refilling. Spray tanks shall be washed further than 300 feet away from surface water. All hauling and application equipment shall be free from leaks and operating as intended.

Herbicide drift and leaching will be minimized as follows:

(a) Do not spray when wind speeds exceed 10 miles per hour to reduce the likelihood of spray/dust drift. Winds of 2 mph or less are indicative of air inversions. The applicator must confirm the absence of an inversion before proceeding with the application whenever the wind speed is 2 mph or less.
(b) Be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind.
(c) Keep boom or spray as low as possible to reduce wind effects.
(d) Avoid or minimize drift by utilizing appropriate equipment and settings (e.g., nozzle selection, adjusting pressure, drift reduction agents, etc.). Select proper application equipment (e.g., spray equipment that produces 200-800 micron diameter droplets [Spray droplets of 100 microns or less are most prone to drift]).
(e) Follow herbicide label directions for maximum daytime temperature permitted (some types of herbicides volatilize in hot temperatures).
(f) Do not spray during periods of adverse weather conditions (snow or rain imminent, fog, etc.). Wind and other weather data will be monitored and reported for all pesticide applicator reports.

(g) Herbicides shall not be applied when the soil is saturated or when a precipitation event likely to produce direct runoff to fish-bearing waters from a treated site is forecasted by NOAA/NWS (National Weather Service) or other similar forecasting service within 48 hours following application. Soil-activated herbicides can be applied as long as label is followed. Do not conduct any applications during periods of heavy rainfall.

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The following no-application buffers, measured in feet and based on herbicide formula, stream type, and application method, will be observed during herbicide applications (Table 48). Herbicide applications based on a combination of approved herbicides will use the most conservative buffer for any herbicide included. Buffer widths are measured as map distance perpendicular to the bankfull for streams, the upland boundary for wetlands, or the upper bank for roadside ditches.

Table 48. No-application buffer width in feet for herbicide application, by stream type and application method.

Herbicide	Perennial Streams and Wetlands, and Intermittent Streams and Roadside Ditches with flowing or standing water present			Dry Intermittent Streams, Dry Intermittent Wetlands, Dry Roadside Ditches		
	Broadcast Spraying	Spot Spraying	Hand Selective	Broadcast Spraying	Spot Spraying	Hand Selective
Labeled for Aquatic Use						
aquatic glyphosate	100	waterline	waterline	50	0	0
aquatic imazapyr	100	waterline	waterline	50	0	0
aquatic triclopyr-TEA	**Not Allowed**	15	waterline	**Not Allowed**	0	0
aquatic 2,4-D (amine)	100	waterline	waterline	50	0	0
Low Risk to Aquatic Organisms						
Aminopyralid	100	waterline	waterline	50	0	0
Dicamba	100	15	15	50	0	0
Dicamba+diflufenzopyr	100	15	15	50	0	0
Imazapic	100	15	bankfull elevation	50	0	0

Clopyralid	100	15	bankfull elevation	50	0	0
metsulfuron-methyl	100	15	bankfull elevation	50	0	0
Moderate Risk to Aquatic Organisms						
Imazapyr	100	50	bankfull elevation	50	15	bankfull elevation
sulfometuron-methyl	100	50	5	50	15	bankfull elevation
Chlorsulfuron	100	50	bankfull elevation	50	15	bankfull elevation
High Risk to Aquatic Organisms						
Triclopyr-BEE	**Not Allowed**	150	150	**Not Allowed**	150	150
Picloram	100	50	50	100	50	50
Sethoxydim	100	50	50	100	50	50
2,4-D (ester)	100	50	50	100	50	50

Management Objectives

- Prevent the introduction of invasive species and the spread of existing invasive species infestations.
- Prevent the introduction and spread of sudden oak death (*Phytophthora ramorum*) infections.

7. Lands and Realty

This program would occur within all ESUs/DPSs/RUs except for Southern DPS Pacific eulachon.

The BLM acquires lands by congressionally mandated acts, purchase or land exchanges. Uses of the public lands can be authorized by the issuance of right-of-ways, permits or easements and in certain cases the BLM disposes of land by a sale or the disposal side of the land exchange. Under the 1995 RMPs, the BLM has acquired 8,962 acres of lands by purchase within the decision area and has made only limited use of land exchanges. The BLM has acquired 22,390 acres and disposed of 7,367 acres by exchange in the same time frame. Federal legislation, rather than discretionary agency action, directed most land exchanges and transfer activities within the

planning area. Under the 1995 RMPs, the BLM has sold 3,798 acres of Zone 3 lands. The BLM sold these lands primarily to resolve unintentional encroachment cases, where an individual had unintentionally built a development on BLM-administered lands.

Land Exchange and Disposal

Through RMP-level decisions, the BLM places the land it administers into one of the following three land tenure zones:

- Lands in Zone 1 are retained under BLM administration
- Lands in Zone 2 are available for exchange to enhance public resource values, improve management capabilities, or reduce the potential for land use conflict
- Lands in Zone 3 are available for disposal using appropriate disposal mechanisms

The BLM used the following criteria to determine land tenure zones:

- Zone 1 lands would include:
    - Designated and suitable Wild and Scenic River corridors
    - Wilderness Areas
    - Wilderness Study Areas
    - National Trail management corridors
    - District-Designated Reserve – Lands managed for their Wilderness Characteristics
    - Areas of Critical Environmental Concern (including Research Natural Areas and Outstanding Natural Areas)
    - Congressionally designated Outstanding Natural Areas
    - Lands acquired with Land and Water Conservation Funds
- Zone 2 lands would include all BLM-administered lands not listed in the descriptions of both Zone 1 and Zone 3 lands.
- Zone 3 lands would include:
    - Lands that are either not practical to manage, or are uneconomical to manage (because of their intermingled location and non-suitability for management by another Federal agency)
    - Survey hiatuses – an area between two surveys where the record describes them to have one or more common boundary lines with no omission
    - Unintentional encroachments – an unintended unlawful and adverse intrusion within the boundary of BLM property where the BLM has discretion to determine if suitable for disposal

Appendix J of the FEIS provides further details regarding land tenure adjustment criteria. An acquisition criterion relevant to the habitat of ESA-listed species is: “Secures Threatened or Endangered or Sensitive plant and animal species habitat.”

The PRMP proposes the following acres of land in each Land Tenure Zone (Table 49).

Table 49. Proposed land tenure zone acres for the PRMP.

Land Tenure Zone	Acres
Zone 1 – Lands Suitable for Retention	193,019
Zone 2 – Lands Suitable for Exchange	2,282,370
Zone 3 – Lands Suitable for Disposal	18,266

Approximately 92 percent of lands in the decision area are suitable for exchange. However, exchanging out of habitat (including CH) for ESA-listed species is conditioned by management direction for the program. It states: "The BLM may dispose of lands designated in Zones 2 and 3 that provide habitat for listed species, including CH, only following consultation with the Fish and Wildlife Service or National Marine Fisheries Service and upon a determination that such action is consistent with relevant law and maximizes public resource values."

The exchange process requires NEPA analysis. Appropriate specialists, including fish biologists, provide information regarding the natural resource values of the BLM parcel proposed for exchange.

Right of Ways

Through RMP-level decisions, the BLM may identify certain BLM-administered lands as Right-of-Way Avoidance or Exclusion Areas.

- Right-Of-Way Avoidance Areas – Areas with sensitive resource values where the BLM will strongly discourage right-of-ways and land use authorizations. The BLM will make authorizations in avoidance areas only when compatible with the purpose for which the area was designated and not be otherwise feasible outside the avoidance area.
- Right-Of-Way Exclusion Areas – The BLM would not grant future right-of-ways except when mandated by law.

The BLM used the following criteria to identify BLM-administered lands that it would identify as Right-Of-Way Avoidance Areas:

- Areas of Critical Environmental Concern (including Research Natural Areas and Outstanding Natural Areas);
- Recreation Management Areas (Special and Extensive);
- Designated and suitable Wild and Scenic Rivers classified as Scenic and Recreational; and
- Visual Resource Management Class II areas not included in right-of-way exclusion areas.

The BLM used the following criteria to identify BLM-administered lands that it would identify as Right-Of-Way Exclusion Areas:

- Lands designated as Wilderness;
- District-Designated Reserve – Lands Managed for their Wilderness Characteristics;
- Wilderness Study Areas;
- Designated and suitable Wild and Scenic Rivers classified as Wild; and
- Visual Resource Management Class I areas.

The checkerboard land ownership pattern of the O&C lands generates most of the need to cross public land to provide access to individuals and to utilities to intermingled private lands. The BLM generally does not know the location and nature of such proposals until the Bureau receives an application. Some of the criteria above for identifying Right-of-Way Avoidance and Exclusion Areas, such as Wild and Scenic River designation or suitability, overlap with ESA-listed fish species occupancy / designated CH. Where the overlap occurs, it would limit or eliminate potential impacts to ESA-listed fish and their habitat from granting a right-of-way in those locations. The PRMP identifies 326,510 acres of Right-Of-Way Avoidance Areas and 92,066 acres of Right-Of-Way Exclusion Areas.

The granting of a right-of-way requires NEPA analysis, and ESA consultation if the BLM determines it would be “May Affect” to ESA-listed species or designated CH. Appropriate specialists, including fish biologists, provide information regarding the natural resource values of the BLM land under consideration. Each grant includes terms and conditions. The BLM identifies the road route and road construction standards to minimize environmental impacts as analyzed from the alternatives of the NEPA analysis.

Currently, most discretionary right-of-ways the BLM grants over BLM-administered land in western Oregon are for access roads. In most cases, other linear right-of-ways (for such uses as domestic or irrigation waterlines, or utility lines for servicing residences) are authorized within or adjacent to existing road-clearing limits.

BLM-administered land is generally available for needed right-of-ways where consistent with local public resource values. Under the 1995 RMPs the BLM has authorized numerous types of right-of-ways, including right-of-ways for county roads, private access roads, power transmission lines, communication sites and bicycle paths. New right-of-way proposals across public lands are likely to continue in the future.

Of the current 6,254 authorized right-of-ways, 78 percent are for roads. There are 83 communication sites on BLM-administered land within the planning area.

Management Objectives

- Make land tenure adjustments to facilitate the management of resources and enhance public resource values.
- Provide legal access to BLM-administered lands and facilities to support resource management programs.
- Provide needed right-of-ways, permits, leases, and easements over BLM-administered lands in a manner that is consistent with State and Federal laws.

- Protect lands that have important resource values or substantial levels of investment by withdrawing them, where necessary, from the implementation of nondiscretionary public land and mineral laws.

8. Livestock Grazing

This program would occur within the following ESUs/DPSs/RUs: Oregon Coast coho salmon, SONCC coho salmon, shortnose sucker, and Lost River sucker.

Livestock grazing on BLM land is managed to meet the *Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the States of Oregon and Washington* (USDI BLM 1997). The majority of BLM-administered lands within the decision area are outside of established livestock grazing districts, and, where it takes place, Section 15 of the Taylor Grazing Act permits grazing on this land through leases. These allotments are comprised of private land intermingled with BLM-administered lands. The private land typically provides the majority of livestock grazing acres. The BLM gives preference for leases to the owner of the private land nearby and adjoining those BLM-administered lands. The BLM permits most leases for 10 years, though that is not required. As these leases expire, proposed renewals would require new NEPA analysis and ESA consultation where those activities may affect ESA-listed species.

The Coos Bay District, Klamath Falls Field Office, and Medford District administer livestock grazing in the decision area. The livestock grazing statistics by District or Field Office are shown in Table 50. An Animal Unit Month (AUM) is the amount of forage needed to feed a cow, one domestic horse or five sheep for one month. Note that the PRMP would eliminate all allotments administered in the Coos Bay District (OC coho salmon ESU). However, livestock grazing would continue to occur at one location under an existing Cooperative Management Agreement (CMA).

Table 50. Livestock grazing statistics by District or Field Office.

District/Field Office	**Allotments Available for Grazing**		**BLM Acres within Allotments**		**Active AUMs**	
	No Action	PRMP	No Action	PRMP	No Action	PRMP
Coos Bay	4	0	544	0	120	0
Klamath Falls	95	94	203,582	203,377	13,219	13,199
Medford	91	46	285,920	156,926	11,886	9,372
Totals	**190**	**140**	**490,046**	**360,303**	**25,225**	**22,571**

The BLM would adjust grazing levels and management practices when needed to meet or make progress toward meeting the standards for rangeland health. Under the PRMP, public land available for livestock grazing would decrease from 490,046 acres to 360,303 acres, a 26.5 percent reduction. Most of the decrease would occur on the Medford District in the SONCC coho salmon ESU; approximately a 45 percent decrease. This change would occur through the BLM making currently vacant allotments unavailable for grazing.

Under the PRMP, there would be 26 BLM allotments available for grazing in the decision area that have streams or reservoirs containing designated CH for ESA-listed fish species that are within or form a boundary of an allotment (Table 51).

Table 51. Livestock grazing allotments by District or Field Office that contain or are bordered by a water body that has designated CH for ESA-listed fish species.

District/Field Office	ESA-listed Fish Species	Number of Allotments	Miles of Designated CH	Acres of Designated CH
Coos Bay	OC coho salmon	1	0.02	NA
Klamath Falls	shortnose sucker	4	7.5	147.1
Medford	SONCC coho salmon	21	64.7	4,705.5[1]

[1]Riparian areas 300 feet on each side of the stream from the normal high water line were included as designated CH for SONCC coho salmon. Since the mean width of these streams to the high water mark is unknown, this value represents a minimum value based upon a 600 ft. width across the 64.7 miles of designated CH.

As described above, grazing at the Coos Bay District location is done under a CMA with adjacent private landowners. The location is New River and a Floras Lake outlet stream. The entirety of designated CH for OC coho salmon is fenced out, except for a few water gaps.

The Klamath Falls Resource Area grazing allotments include tributaries to Gerber and Dry Prairie Reservoirs, and border Dry Prairie Reservoir itself. Several tributaries are used for spawning and rearing by shortnose sucker. Note that the Klamath River borders BLM grazing allotments managed by the Klamath Falls Field Office within the planning area. The Klamath River is occupied by shortnose sucker and Lost River sucker. However, because of steep terrain, it is extremely unlikely that cattle access it. The potential for effects to PCE of designated CH in the Klamath River is discussed in detail in the effects to PCEs of designated CH section for the two sucker species.

The Medford District grazing allotments are located on various tributaries of the Rogue River. The tributaries are used as spawning and rearing habitat by SONCC coho salmon.

Management Objectives

- Provide for livestock grazing consistent with other resource objectives while maintaining or improving the health of the public rangelands.
- Prevent livestock from causing trampling disturbance to fish spawning beds where ESA-listed or Bureau Sensitive species occur.

9. Minerals

This program would occur within all ESUs/DPSs/RUs.

The BLM administers the mineral estate on nearly 40 million acres of BLM, U.S. Forest Service, and other Federally-administered and Indian Trust lands in Oregon. Within the decision area, the BLM manages approximately 2.5 million acres of Federal surface ownership and an additional 68,600 acres of Federal minerals with private surface ownership (Table 52).

For the planning area, the Oregon Department of Geology and Mineral Industries (DOGAMI) database (MILO) shows that the vast majority of mineral resources used in Oregon are common rock for aggregate used in construction and road surfacing (http://www.oregongeology.org/sub/milo/index.htm). The MILO database shows that there are over 5,500 quarry sites for stone/aggregate and an estimated 300 occurrences for other mineral commodities such as clay, limestone, pumice, and silica sand scattered throughout the planning area. There are 150 occurrences for coal in the planning area with most sites in coastal areas concentrated in the Coos Bay area. In addition, the database shows 3,300 metal occurrences (gold, silver, copper, nickel, chromite, and other minerals) in the planning area with nearly all being located in southwest Oregon.

Table 52. Acres of surface and mineral estate by BLM administrative unit.

District/Field Office	Federal Surface and Mineral Estate (Acres)[1]	Federal Minerals and Private Surface (Acres)[1]
Coos Bay	329,600	12,200
Eugene	317,400	1,300
Klamath Falls	212,000	21,000
Medford	866,300	4,700
Roseburg	425,600	1,700
Salem	398,100	27,800
Totals	**2,549,000**	**68,700**

[1] 2008 data from the Western Oregon Plan Revision EIS and district-specific information.

Note that all mineral activity on BLM land must meet state and federal laws and regulations, including compliance with the ESA and the Clean Water Act (CWA).

Salable Minerals

Salable minerals include common variety quarry rock used in construction and road surfacing, sand and gravel, clay, and volcanic pumice and cinders. The regulations found in 43 CFR 3600 guide the exploration, development, and disposal of mineral material resources and the protection of resources and the environment. Mineral materials are sold at fair market value to

the public and offered by free use permits to government entities or non-profit organizations.

The BLM will not dispose of mineral materials if the BLM determines that the aggregate damage to public lands and resources would exceed the public benefit that BLM expects from the proposed disposal. Salable mineral disposals require NEPA analysis and consultation to the extent required under section 7(a)(2) of the ESA. Restrictions developed through these analyses may include development, design, or source locations changes, mitigation measures and seasonal constraints.

The BLM's primary salable mineral material within the decision area is quarry rock. The majority of this quarry rock is crushed to create aggregate for road surfacing. Other uses of quarry rock include rip-rap for fish enhancement projects, jetty and boat ramps, and reclamation projects.

The total number of sales or permits for all salable mineral material in the decision area ranged from 41 to 92 by year from 2007 to 2013. The cubic yards of mineral material produced ranged from 5,100 to 46,310 by year from 2007 to 2113. Mineral material sales data from 2007-2013 show that sales and permits (BLM use is tracked by permits) in the decision area are both numerous and of low volume, with nearly 500 disposals during this seven-year period averaging about 400 cubic yards each.

There are 602 developed BLM quarry sites in the decision area. The majority of these quarries are used for in-place quarry rock, although a few sites are for pumice, sand, gravel, or dimension stone. Many of these sites were developed before the 1990s and are used sporadically. The footprint, or area of disturbance, of quarry sites is variable and ranges from about 0.01-5 acres. A typical quarry is about 0.5 acre in size. The BLM estimates that approximately 25-33 percent of the developed rock quarries are near depletion with just a few thousand cubic yards of rock remaining. At some sites, continued removal could require expansion of the existing footprint.

The BLM locates rock quarries based on the suitability of the available rock to meet the required specifications. However, access, proximity to area of use, and environmental considerations are also important factors in determining where to develop a quarry. Figure 4 shows the spatial distribution of quarry sites in the decision area. There are 602 BLM rock quarries in the planning area (

Table 53).

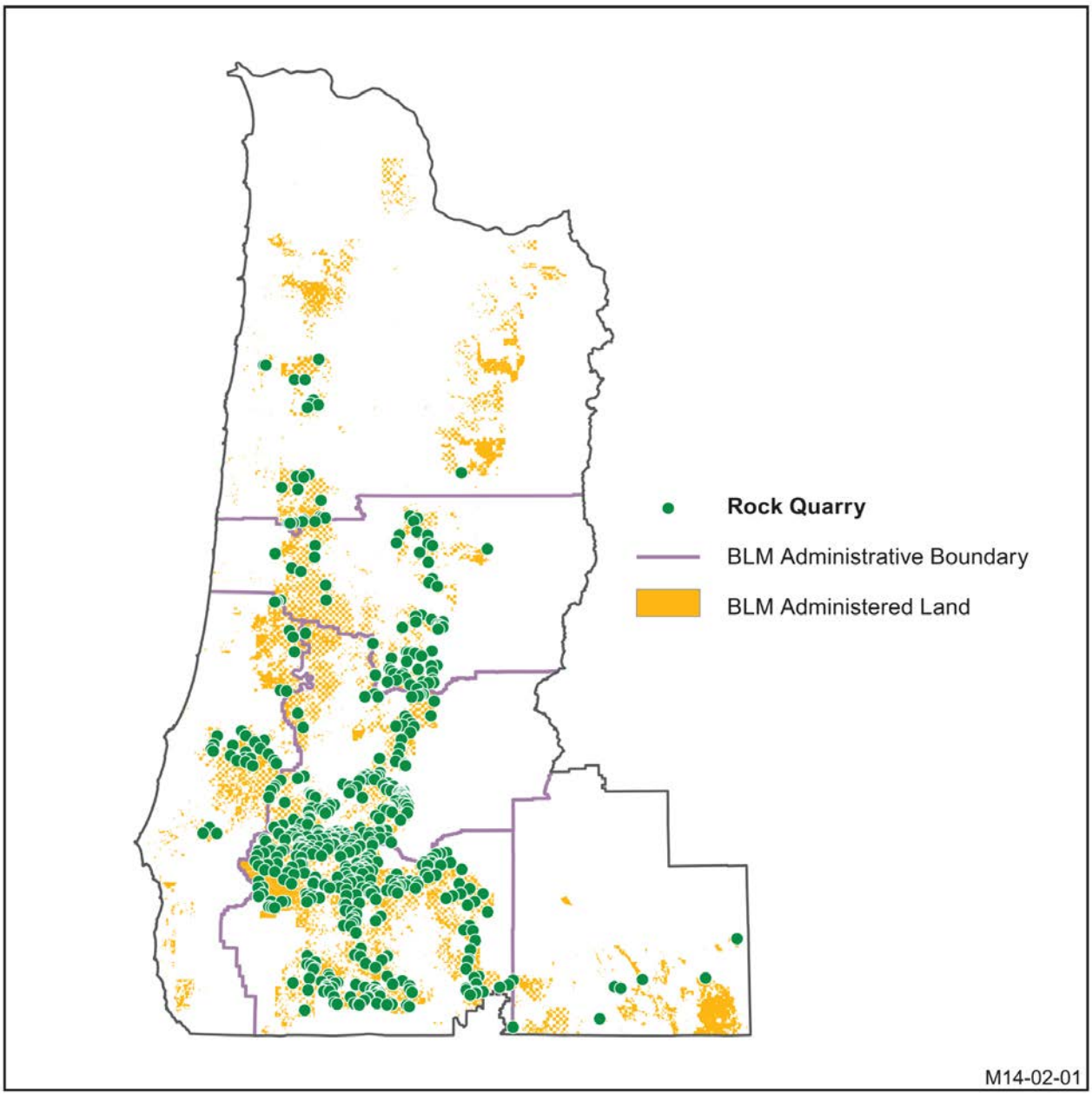


Figure 4. Spatial distribution of BLM rock quarry sites in the decision area from 2013 office inventories.

Table 53. Rock quarry sites by BLM administrative unit in the planning area.

District/Field Office	Number of Quarry Sites
Coos Bay	31
Eugene	87
Klamath Falls	13
Medford	250
Roseburg	203
Salem	18
Totals	**602**

Figure 4 and Table 53 indicate that the number of rock quarry sites are most concentrated within the SONCC coho salmon ESU, the Upper Willamette Chinook salmon ESU and steelhead DPS, and the OC coho salmon ESU.

The BLM does not have a complete inventory of potential rock quarry sites in the decision area. However, there is ongoing interest in BLM quarries, with 40 to 90 sales a year. All of the salable activity described above takes place on BLM-administered lands that are open to salable mineral entry. There are areas currently closed to salable mineral development. Closed nondiscretionary lands, which total 31,530 acres, would remain closed under the PRMP. The majority of those acres (24,600) are located on the Medford District. Legal mandates establish non-discretionary closures while a discretionary closure is the result of an agency management decision.

Trends in salable mineral material developments for rock quarries and development guidance can be found in FEIS Appendix L.

The PRMP would petition to close 249,241 acres to salable entry (Table 54). The acres closed to salable minerals represents about 10.1 percent of the BLM lands in the decision area. The BLM proposes to close some lands managed for their wilderness characteristics, some eligible Wild and Scenic River (WSR) segments, some Areas of Critical Environmental Concern (ACECs), and some Recreation Management Areas (RMAs) to salable mineral development. Where this coincides with the distribution of ESA-listed fish and/or designated CH, it would be a beneficial effect. FEIS Appendix L lists each ACEC, RMA, lands managed for wilderness characteristics, and eligible Wild and Scenic River closed to salable entry through this RMP revision.

Table 54. Acres the BLM would recommend closed to salable mineral entry under the PRMP and closed nondiscretionary acres.

Land Category	PRMP Acres
ACEC, RMA, Lands Managed for their Wilderness Characteristics, Eligible Wild and Scenic Rivers	217,711
Closed Non-discretionary[1]	31,530
Totals	**249,241**

[1]Legal mandates establish non-discretionary closures, while a discretionary closure is the result of an agency management decision.

Fifteen rock quarries would be closed to mineral development: 6 in ACEC, 3 in RMA and 6 in lands managed for wilderness characteristics. This may necessitate the development of new quarries elsewhere to offset the loss. FEIS Appendix L contains the developed rock quarries by district and name within each ACEC, RMA, lands managed for wilderness characteristics and eligible WSRs closed to salable mineral development under the PRMP.

The FEIS (Table L-1) identifies the estimated number of new quarries that could be developed or the existing sites that would require expansion for development over a 10-year period. It is reformatted here as Table 55.

Table 55. Salable mineral development ten-year scenario for new or expanded (beyond existing footprint). The BLM assumes 0.5 acres per quarry.

District/Field Office	Number of Quarries	Total Acres
Coos Bay	7	3.5
Eugene	4	2
Klamath Falls	2	1
Medford	9	4.5
Roseburg	6	3
Salem	9	4.5
Totals	**37**	**18.5**

Locatable Minerals

Locatable minerals include the metals gold, silver, copper, lead, zinc, nickel, and chromite and certain non-metallic minerals determined to be uncommon, such as fluorspar and certain varieties of limestone. The Mining Law of 1872, as amended, gives citizens the right to prospect, explore, and develop locatable minerals on lands open to mineral entry. BLM regulations at 43

CFR 3700 and 3800 establish procedures for locating mining claims, and the surface management and occupancy of mining claims. Regulations include preventing unnecessary or undue degradation, compliance with Federal and State laws, and performance standards. Surface Management Regulations from 43 CFR 3809 include that a Plan of Operations must be submitted for any operations causing surface disturbance greater than casual use in designated ACECs, areas in the National Wild and Scenic Rivers System, and areas designated as closed to public motorized travel use (as defined in 43 CFR 8340.0-5). A Plan of Operations is subject to NEPA.

A withdrawal from locatable mineral entry removes lands from the location of new mining claims and places certain requirements on existing mining claims for development of the minerals. These requirements include that after the date on which the lands are withdrawn, the BLM will not approve a Plan of Operations or allow notice-level operations to proceed until the BLM has prepared a mineral examination report to determine mining claim validity. Congress can designate withdrawals, or the BLM can initiate a withdrawal. Withdrawal decisions are signed by the Secretary of Interior. This RMP revision does not withdraw lands from locatable mineral entry, but recommends lands for withdrawal.

The planning area contains over 3,300 occurrences of locatable mineral resources and has a long history of mineral development (DOGAMI MILO). Mining claim records show that about 39,500 claims have been located on public lands in the planning area since BLM recording requirements began with the passage of FLPMA. The 1,045 active mining claims in the decision area attest to the ongoing interest in locatable minerals. Table 56 shows the number of active mining claims, Notices, and pending or authorized Plans of Operation in the decision area by administrative unit. Figure 5 shows the general locations of active mining claims in the decision area.

Table 56. 2013 Active mining claims and 2015 Authorized Notices, and pending or authorized Plans of Operation in the decision area.

District/Field Office	Active Mining Claims	Notices Authorized	Plans of Operation - Pending or Authorized
Coos Bay	38	1	-
Eugene	36	1	-
Klamath Falls	1	-	-
Medford	840	21	8
Roseburg	123	-	1
Salem	7	1	-
Totals	**1,045**	**24**	**8**

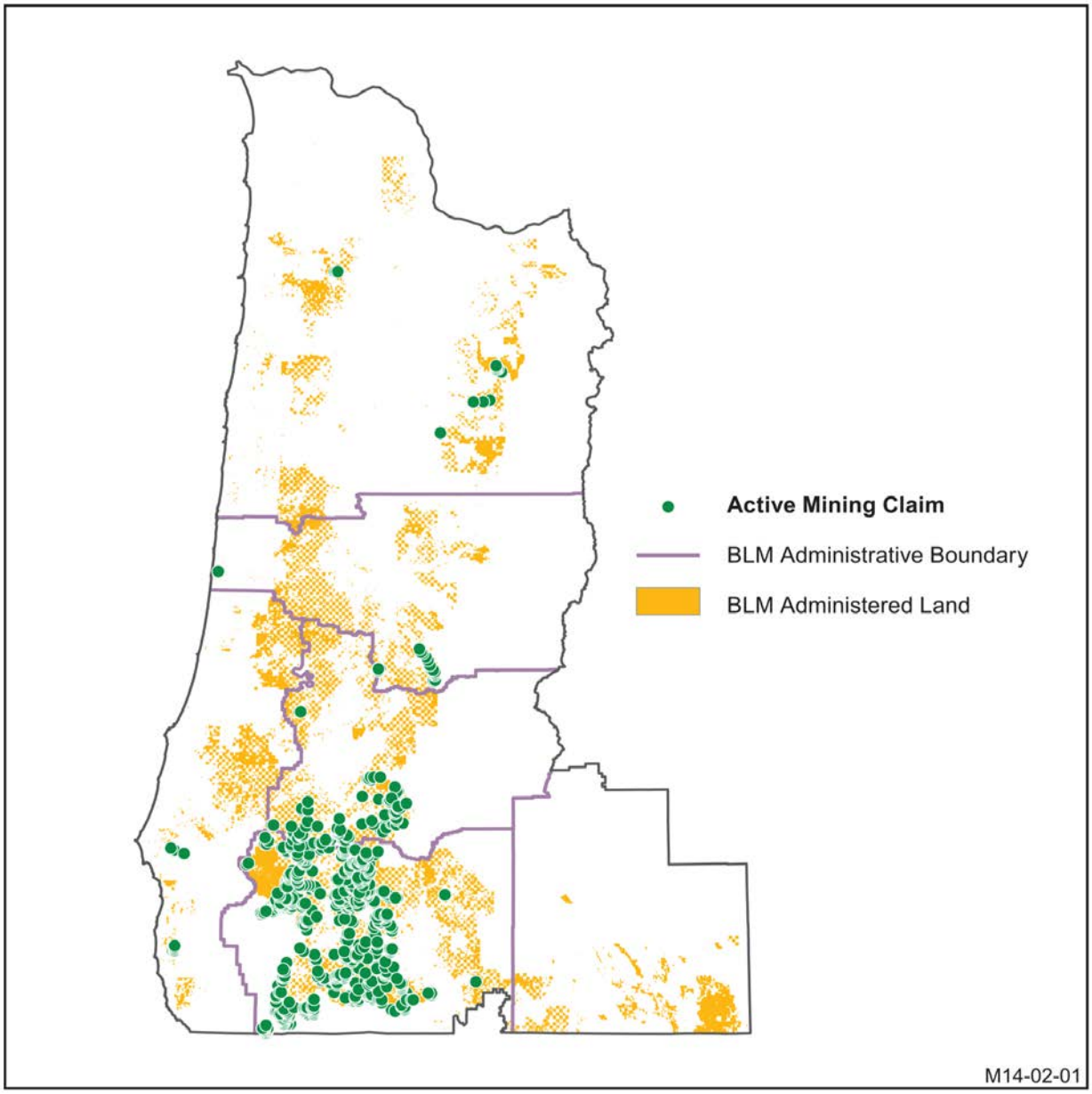


Figure 5. Locations of active mining claims in the decision area in 2013.

The large majority of active mining claims in the decision area are in the Rogue River basin (SONCC coho salmon ESU) and the Umpqua River basin (OC coho salmon ESU). There are no mining claims in the Lost River sucker or shortnose sucker RUs in the decision area, and none that would affect bull trout in the McKenzie River basin.

The PRMP identifies a total of 208,912 acres of land in the categories of ACEC, RMA, Lands managed for Wilderness Characteristics and eligible Wild and Scenic Rivers to be petitioned for withdrawal from locatable mineral entry (Table 57). This would be in addition to 98,400 acres previously withdrawn. Should lands recommended for withdrawal be successful, a total of about 12.4 percent of the land in the decision area would be withdrawn from locatable mineral entry.

This would have a beneficial effect to ESA-listed fish species and designated CH where the withdrawals coincide.

Table 57. Acres the BLM would recommend for withdrawal from locatable mineral entry under the PRMP and previously withdrawn acres.

Land Category	PRMP Acres
ACEC, RMA, Lands Managed for their Wilderness Characteristics, Eligible Wild and Scenic Rivers	208,912
Previously Withdrawn	98,400
Totals	**307,312**

Mining is regulated by the Surface Management Regulations (43 CFR 3809) and Use and Occupancy Under the Mining Laws (43 CFR 3715). It is the responsibility of the mining claimant/operator to prevent "unnecessary or undue degradation," perform all necessary reclamation work, and comply with relevant Federal and State regulations. Operations ordinarily resulting in only negligible disturbance as defined in 43 CFR 3809.5 are considered to be casual use and no notification to the BLM is required. All activities exceeding casual use must file a notice or plan of operations.

Locatable mineral actions require NEPA and ESA consultation to the extent required under section 7(a)(2) of the ESA, or just ESA consultation (e.g., certain suction dredging and certain Notice level activity) dependent upon the type of activity. Management direction relevant to locatable mineral activity with respect to ESA-listed fish and designated CH includes:

- Prior to beginning any suction dredging activity within lands or waters that contain Federally proposed or listed threatened or endangered species or their proposed or designated CH, the operator must contact the BLM in order for the BLM to determine if the proposed use is classified as casual use, or requires a notice or a plan of operations. It is the operator's burden to determine the location of their activity relative to the location of lands or waters that contain Federally proposed or listed threatened or endangered species or their proposed or designated CH.
    - Suction dredging activity proposed within lands or waters that contain Federally proposed or listed threatened or endangered species or their proposed or designated CH, regardless of the level of disturbance, must not begin until BLM has completed consultation to the extent required under section 7(a)(2) of the ESA.
- For notice-level mining proposals that are located within lands or waters known to contain Federally proposed or listed threatened or endangered species or their proposed or designated CH, the notice will be complete only after the BLM has reviewed the notice and completed consultation to the extent required under section 7(a)(2) of the ESA.
- Plans of operation located within lands or waters known to contain Federally proposed or listed threatened or endangered species or their proposed or designated CH continue to be governed by the standards in 43 CFR 3809 et seq.

The estimated number of new and renewed notices of operation under the PRMP over a 10-year period are shown in Table 58. The estimated number of new plans of operation under the PRMP over a 10-year period are shown in Table 59.

Table 58. Locatable mineral ten-year scenario for new and renewed notices of operation. The BLM assumes 0.25 acres per notice.

District/Field Office	Number of New and Renewed Notices	Total Acres
Coos Bay	4	1
Eugene	4	1
Klamath Falls	0	0
Medford	70	17
Roseburg	4	1
Salem	4	1
Totals	**86**	**21**

Table 59. Locatable mineral development ten-year scenario for plans of operation. The BLM assumes 3 acres per plan of operation.

District/Field Office	Number of New Plans of Operation	Total Acres
Coos Bay	1	3
Eugene	1	3
Klamath Falls	0	0
Medford	20	60
Roseburg	1	3
Salem	1	3
Totals	**24**	**72**

Note that the state of Oregon will begin a moratorium on instream (suction dredge) and upland motorized placer mining in Oregon on January 2, 2016 that will continue until January 2, 2021 (ODEQ 2015). According to an ODEQ news release dated July 16, 2015, the prohibition will be:

- In all streams above the lowest extent of spawning habitat in rivers and tributaries containing Essential Salmonid Habitat or naturally reproducing populations of bull trout.
- In upland areas within 100 yards of these streams if the mining results in the removal or disturbance of vegetation in a manner that may affect water quality.

This prohibition will include all habitat occupied by ESA-listed salmonids in the decision area.

Leasable Minerals

Energy leasable minerals include coal, oil shale, oil and gas, and geothermal. Sodium (salt), potassium (potash), trona and phosphate are also available for development through the leasing program. The PRMP identifies 211,638 acres of land that would be subject to the following fluid leasable minerals restrictions: no surface occupancy, conditional surface use and timing limitations. This would be for land in the categories of ACEC, RMA, Lands managed for Wilderness Characteristics and eligible Wild and Scenic Rivers.

Management direction relevant to leasable mineral activity in the categories of oil, gas or coal bed natural gas resources, with respect to ESA-listed fish and designated CH includes:

- Apply site-specific stipulations as needed to protect Federally-listed threatened and endangered species and their CHs.

There are several levels of NEPA and potentially ESA review for leases. There is a “Pre-lease” NEPA evaluation (broad-scaled including Master Leasing Plans for general areas) and a lease-specific NEPA review. These NEPA reviews consider stipulations attached or to be attached to the lease itself. After the lease, with appropriate stipulations, is awarded through bid, any ground-disturbing or development activity (Application for Permit to Drill [APD] for petroleum and a Geothermal Drilling Permit [GDP] for geothermal) undergoes a third NEPA evaluation, resulting in Conditions of Approval (COAs) requirements for development of the permit. Consultation may take place to the extent required under section 7(a)(2) of the ESA.

The DEIS describes the current situation with respect to development of the Coos Basin Coal bed Natural Gas Play. Natural gas prices currently are not favorable for development. The current holder has decided to abandon permanently all but five wells. However, it is plausible that within the life of the RMP the historical price levels could be reached, making development once more marketable.

Management Objectives

- Manage the development of leasable (including traditional and non-traditional hydrocarbon resources) minerals, locatable mineral entry, and salable mineral material disposal in an orderly and efficient manner.
- Maintain availability of mineral material sites needed for development and maintenance of access roads for forest management, timber harvest, local communities, rights-of-way for energy production and transmission, and for other uses.

10. Paleontological Resources

This program would occur within all ESUs/DPSs/RUs except for Southern DPS Pacific eulachon.

Paleontological resources include the fossil remains of plants and animals, as well as traces such as tracks, claw marks and skin impressions. Management activities for Paleontological Resources include the inventory and recording of sites.

Public Law 111-011, Title VI, Subtitle D, known by its popular name as the Paleontological Resources Preservation Act (PRPA, the Act, 16 U.S.C. 470aaa *et seq*.) was passed in March 2009. It regulates the collection of scientifically important fossil specimens, including trace fossils. Qualified paleontologists and academic institutions can obtain permits from the BLM for collecting.

BLM information memorandum No. 2012-140 (6/19/2012) explains that casual collecting of reasonable amounts of common invertebrate and plant fossils from public lands for personal use does not require a permit. It further explains the provisions in 43 CFR 8365.1-5 regarding the reasonable amounts of specimens that can be collected. Specimens are small samples that are easily carried and transportable by hand. Specimens can only be collected from the surface or with the use of non-powered hand-tools. Casual collecting activities may not cause disturbance to the surface that would have impacts on other natural or cultural resources. Ulrich (Ulrich pers. com. 2015) explained that the collection of common fossils for personal use is opportunistic in nature. For example, people may notice a fossil in a bare soil area, such as a road cutbank or a streambank, and collect it.

There are only 47 known paleontological localities (sites) in the decision area (FEIS Table 3-30).

Management Objectives

- Protect and preserve significant localities from natural or human-caused deterioration or potential conflict with other resources.
- Provide appropriate scientific, educational, and recreational use, such as research and interpretive opportunities, for paleontological resources.

11. Recreation and Visitors Services

This program would occur within all ESUs/DPSs/RUs.

The BLM's Recreation and Visitor Services Program provides a diverse array of recreation opportunities. The FEIS identifies the top 13 recreation experiences by number of participants in the planning area (shown from high to low below). The range of annual participants in 2012 was from about 2.6 million for wildlife viewing to 6,900 for snowmobile and other motorized winter activities:

- Wildlife Viewing, Interpretation, and Nature Study
- Driving for Pleasure (along designated BLM roadways)
- Camping and Picnicking

- Non-motorized Travel (hiking, biking, and horseback riding)
- Hunting (big game, upland game, and migratory game birds)
- Motorized Off-Highway Vehicle Travel
- Fishing
- Specialized Non-motorized Activities and Events
- Swimming and Other Water-Based Activities
- Motorized Boating
- Non-motorized Winter Activities
- Snowmobile and other Motorized Winter Activities

The FEIS projects increases in participants for each activity type from 2012 to 2060. The average annual rate of increase ranges from 0.4 percent (hunting) to 1.4 percent (non-motorized winter activities). The BLM provides campgrounds, day use areas, boat ramps, a public motorized travel system, trail system and hiking trails to facilitate several activity types. In addition, the BLM issues special use permits for commercial, competitive, educational and organized group recreational activities. Table 60presents a count of BLM recreational sites within a site-potential tree distance (216 feet) of streams occupied by ESA-listed fish or with designated CH in the planning area.

Table 60. Number of recreation facilities by type within a site-potential tree distance of occupied habitat or designated CH for ESA-listed fish species in the planning area.

ESA-listed Fish Species	Recreation Facility Type	Count
Lower Columbia River Chinook salmon	Campground	1
	Day Use Area	1
Lower Columbia River coho salmon	Campground	1
	Day Use Area	1
Lower Columbia River steelhead	Campground	1
	Day Use Area	1
Oregon Coast coho salmon	Campground	21
	Day Use Area	16
	Nature Study	1
	Water/River Use Area	2
Southern Oregon / Northern California Coasts coho salmon	Campground	5
	Day Use Area	2
Upper Willamette River Chinook salmon	Campground	2
	Day Use Area	3
	Water/River Use Area	2
Upper Willamette River steelhead	Campground	3
	Day Use Area	2
McKenzie River Basin bull trout	Water/River Use Area	4
Lost River sucker Lost River & Upper Klamath Recovery Units	Campground	3
	Water/River Use Area	1
Shortnose sucker Lost River & Upper Klamath Recovery Units	Campground	7
	Day Use Area	2
	Water/River Use Area	4

Management Objectives

- Provide a diversity of quality recreational opportunities.
- Meet legal requirements for visitor health and safety and mitigate resource user conflicts.
- Mitigate recreational impacts on natural and cultural resources. In land use allocations where management of other resources is dominant, provide recreational opportunities where they can be managed consistent with the management of these other resources.
- Develop new recreation opportunities (e.g., trails, trailheads, restrooms) to address recreation activity demand created by growing communities, activity groups, or recreation-tourism if:
    - Recreation development is consistent with interdisciplinary land use plan objectives; and
    - The BLM has secured commitments from partners (e.g., a cooperative management agreement, adopt-a-trail agreement, and a memorandum of understanding).

12. Soil Resources

This program would occur within all ESUs/DPSs/RUs except for Southern DPS Pacific eulachon. On-the-ground activities of the Soils program are restoration activities, such as sub-soiling to reduce soil compaction.

Management Objectives

- Maintain or enhance the inherent soil functions of management ecosystems (e.g., ability of soil to take in water, store water, regulate outputs for vegetative growth and stream flow, and resist erosion or compaction).
- Provide landscapes that stay within natural soil stability failure rates during and after management activities.

13. Special Forest Products

This program would occur within all ESUs/DPSs/RUs except for Southern DPS Pacific eulachon.

Special forest products (SFP) is a term used to describe some of the vegetative material found on BLM land that can be harvested for recreation, personal use, or as a source of income. They include grasses, seeds, roots, bark, berries, mosses, greenery (e.g., boughs, leaves, vine maple, fern fronds, salal, and huckleberry), edible mushrooms, tree seedlings, transplants, poles, posts, shake and shingle bolts, and firewood. Trees or logs that contain saw timber are not considered SFP.

Commercial, personal, and incidental uses are distinct categories for public users on BLM-administered lands, although the boundaries between personal and incidental use blend. Commercial use of SFP requires a permit and harvesters generally search for and harvest high value products from patches in a systematic and thorough method for high resale value. Individuals who harvest or collect SFP for their own personal use tend to harvest smaller quantities, searching less systematically and less thoroughly and at a smaller spatial scale. Some personal use SFP also require permits, such as Christmas trees and firewood. Incidental use

includes collection and gathering of berries and mushrooms for immediate use and firewood for campfires.

Permits for commercial use and some types of personal use for SFP may include restrictions to help meet ecological and renewable resource standards and to protect other sensitive resource values. Permits may restrict the type of species, quantity harvested, harvest or collection method, location, access and season.

There are no specific management objectives for the SFP program.

14. Sustainable Energy

This program would occur within all ESUs/DPSs/RUs except for Southern DPS Pacific eulachon.

The three components of the PRMP Sustainable Energy Program are biomass, wind and geothermal. Biomass in the form of slash would be available for the purpose of generating energy under the PRMP. Slash is wood residue such as tree-tops, limbs, cull material and broken pieces from harvested merchantable timber. It can also include non-merchantable hardwoods and sub-merchantable wood material removed from fire-prone stands. Slash is an outcome of the Forest Management program.

A second issue addressed in the FEIS is how energy transmission Right-of-Way (ROW) avoidance and exclusion areas affect the potential siting of wind energy developments and sustainable energy corridor designations. The PRMP identifies 564,591 acres of land with designations resulting in avoidance or exclusion from siting wind energy developments and energy transmission ROW. This does not result in any causal mechanisms to affect any fish habitat characteristics or PCE of CH, nor are there any mechanisms to directly impact individual fish.

The third issue addressed in the FEIS is how the PRMP would affect the development of geothermal energy resources. Geothermal energy is managed as a fluid mineral by the BLM, and there is no current geothermal development occurring on BLM-administered lands within the planning area. Under the PRMP, leasable stipulations such as no surface occupancy would negatively affect, though not entirely preclude, the potential for geothermal development on BLM-administered lands. The PRMP leasable stipulations do not result in any causal mechanisms to affect any fish habitat characteristics or PCE of CH, nor are there any mechanisms to directly impact individual fish.

Management Objectives

- Develop sustainable energy resources to the maximum extent possible without precluding other land uses.

15. Trails and Travel Management

This program would occur within all ESUs/DPSs/RUs except for Southern DPS Pacific eulachon.

This program includes three components: The road system; public motorized access designations; and the trail system. The construction of new roads, the maintenance of existing

roads, and the closure of roads under the PRMP are largely connected to the Forest Management program. Because of that nexus, projected new road construction and road closure that would occur under the PRMP addressed in the Forest Management program section (section 4 above in the proposed action description). The description of the proposed action in this section is focused on the other two components of the Trails and Travel Management program: public motorized travel designations and the trail system.

Public motorized access designations

The definitions for public motorized access designations are as follows:

- Open: Areas where the BLM does not limit public motorized travel activities since there are no issues regarding resources, visitor conflicts, or public safety to warrant limiting cross-country travel.
- Limited: Areas where the BLM has restricted public motorized travel activities in order to meet recreational and resource management objectives[8]
    - *Limited to designated roads and trails* means that transportation management planning has taken place and roads and trails for public motorized travel use have been designated
    - *Limited to existing roads and trails* means all routes that physically exist within the planning area, both BLM and user created
- Closed: Areas that the BLM has closed to all public motorized vehicle activities to protect resources, ensure visitor safety, or reduce visitor conflicts.

The BLM is deferring implementation-level Travel Management Planning during the current RMPs for Western Oregon planning effort. Implementation-level travel management planning is the process of establishing a final travel and transportation network that includes route-specific designations within the broader land use planning level area designations.

Future implementation-level travel planning will follow a site-specific process for selecting a final road and trail network. The BLM will make final route designations for the decision area in a comprehensive, interdisciplinary Travel and Transportation Management Plan to be completed within five years after the completion of the western Oregon RMPs. The BLM estimates that there are approximately 1,000 miles of non-designated user created routes within the decision area. The BLM will develop proposed future route designations through public scoping and NEPA analysis, utilizing the draft route inventories to evaluate amendments to the existing travel network during an implementation-level travel management plan.

Route-specific decisions in a travel management plan will support RMP goals, objectives, and management actions, and the designation criteria in 43 CFR 8342. In addition to the

[8] Restrictions may include the number or types of vehicles, the time or season of use, permitted or licensed use only, or limiting use to existing or designated roads and trails.

minimization criteria contained in 43 CFR 8342, the BLM will consider the following criteria during implementation level travel management planning.

- Upon the completion of implementation level travel management plans individual routes within public motorized access areas designated as “limited to existing” will transition to “limited to designated.”

- Temporary closures will be considered in accordance with 43 CFR subpart 8364 (Closures and Restrictions); 43 CFR subpart 8351 (Designated National Area); 43 CFR subpart 6302 (Use of Wilderness Areas, Prohibited Acts, and Penalties); 43 CFR subpart 8341 (Conditions of Use).

- Temporary closure or restriction orders under these authorities will be enacted at the discretion of the authorized officer to resolve management conflicts and protect persons, property, and public lands and resources. Where an authorized officer determines that off-highway vehicles are causing or will cause considerable adverse effects upon soil, vegetation, wildlife, wildlife habitat, cultural resources, historical resources, threatened or endangered species, wilderness suitability, other authorized uses, or other resources, the affected areas shall be immediately closed to the type(s) of vehicle causing the adverse effect until the adverse effects are eliminated and measures implemented to prevent recurrence. (43 CFR 8341.2) A closure or restriction order shall be considered only after other management strategies and alternatives have been explored. The duration of temporary closure or restriction orders shall be limited to 24 months or less; however, certain situations may require longer closures and/or iterative temporary closures. This may include closure of routes or areas.

- The BLM will consider public land roads or trails determined to cause considerable adverse effects or to continue a nuisance or threat to public safety for relocation or closure and rehabilitation after appropriate coordination with applicable agencies and partners.

- Areas designated as “Closed” will not be available for new public motorized access designation or construction without an RMP amendment changing the area designation.

- Routes that are duplicative, parallel, or redundant will be considered for closure. Eliminate parallel roads travelling to the same destination when the destination can be accessed from the same direction and topography and user experience.

- A timeline to complete travel planning efforts will be identified, prioritized and updated annually in all relevant planning areas to accelerate the accomplishment of: data collection, route evaluation and selection, and on the ground implementation efforts including signing, monitoring and rehabilitation.

- Consultation with interested user groups, Federal, State, county and local agencies, local landowners, and other parties in a manner that provides an opportunity for the public to provide input and have its views given consideration. Consequently, a public outreach plan to fully engage all interested stakeholders will be incorporated into future implementation level travel management plans.

- All routes will undergo a route evaluation to determine its purpose and need and the potential resource and/or user conflicts from motorized travel. Where resource and/or user conflicts outweigh the purpose and need for the route, the route will be considered for closure or considered for relocation outside of sensitive habitat.
- Consider limiting over snow vehicles (OSV) designed for use over snow and that run on tracks and/or skis, while in use over snow to designated routes or consider seasonal closures on routes in sensitive areas.
- Routes not required for public access or recreation with a current administrative/agency purpose or need will be evaluated for administrative access only.
- Consider prioritizing restoration of routes not designated in a Travel Management Plan.
- Consider using seed mixes or transplant techniques that will maintain or enhance habitat when rehabilitating linear disturbances.

The PRMP would eliminate the acres currently in the *Open* designation (Table 61).

Table 61. PRMP and No Action public motorized access designations.

Trails and Travel Management Designations	No Action (Acres)	PRMP (Acres)
Closed to public motorized Use	84,589	156,036
Limited to Designated Routes	1,119,686	11,508
Limited to Existing Routes	1,037,026	2,311,312
Open to Cross-country Travel	330,394	0

Areas closed to public motorized access use under the PRMP include: Some Recreation Management Areas; ACEC; and, Protected Lands with Wilderness Characteristics.

For areas classified as *limited*, the BLM would designate the types or modes of travel, such as pedestrian, equestrian, bicycle, motorized, etc.; limitations on time or season of use; limitations to certain types of vehicles (e.g., public motorized travel, motorcycles, and all-terrain vehicles); limitations on BLM administrative use only; or other types of limitations.

The BLM applied designation criteria in 43 CFR 8342 when designating lands as *open*, *limited*, or *closed* to public motorized travel activities. All designations are based on the protection of the resources of the public lands, the promotion of the safety of all the users of the public lands, and the minimization of conflicts among various uses of the public lands. These designations are in accordance with the following criteria:

1. Areas and trails shall be located to minimize damage to soil, watershed, vegetation, air, or other resources of the public lands, and to prevent impairment of wilderness suitability.

2. Areas and trails shall be located to minimize harassment of wildlife or significant disruption of wildlife habitats. *Special attention will be given to protect endangered or threatened species and their habitats.* (emphasis added)

3. Areas and trails shall be located to minimize conflicts between of-road vehicle use and other existing or proposed recreational uses of the same or neighboring public lands, and to ensure the compatibility of such uses with existing conditions in populated areas, taking into account noise and other factors.

4. Areas and trails shall not be located in officially designated wilderness areas or primitive areas. Areas and trails shall be located in natural areas only if the authorized officer determines that off-road vehicle use in such locations will not adversely affect their natural, esthetic, scenic, or other values for which such areas are established.

The RMPs that the BLM will adopt at the end of this RMP revision process will include indicators that guide future plan maintenance, amendments, or revisions related to public motorized access area designations or the approved road and trail system within "Limited to Existing" areas. Future conditions may require the designation or construction of new routes or closure of routes to better address resources and resource use conflicts. NEPA compliance and ESA consultation (if may affect) would be required for actual route designations within "Limited to Existing" areas. Plan maintenance would be accomplished through additional analysis and implementation-level travel planning (e.g., activity level planning). Two of the factors that would be considered in future analysis are relevant to reducing effects to ESA-listed fish and designated CH:

- Measures needed to meet the objectives stated in the Western Oregon RMP (e.g., cultural resources, soil resources, special status species, and recreation).

- Public land roads or trails determined to cause considerable adverse effects or to continue a nuisance or threat to public safety would be considered for relocation or closure and rehabilitation after appropriate coordination with applicable agencies and partners.

Although the BLM has some site-specific and anecdotal information about illegal public motorized travel activities, the BLM does not have a basis for predicting the location or effects of any widespread or systematic illegal public motorized travel activities. In addition, much of the decision area has physical limitations to potential illegal public motorized travel activities such as dense vegetation, steep slopes, and locked gates. Terrain, vegetation, and a greater amount of open spaces in most of the interior/south can lead to degradation and erosion in a greater proportion than most of the coastal/north where vegetation is more dense and terrain is more steep. However, at this scale of analysis, the BLM does not have a basis for characterizing current illegal public motorized travel activities or forecasting potential illegal public motorized travel activities in the future under any of the alternatives and the Proposed RMP. Therefore, in this analysis, the BLM assumed that members of the public participating in motorized travel recreation typically operate vehicles consistent with BLM decisions about public motorized travel opportunities.

The BLM has done a geospatial analysis of trails allowing motorized use. Within the 2,487,106 acres where public motorized travel use is currently designated in western Oregon, there are no crossings of streams with designated CH for any ESA-listed fish species. There appears to be one

public motorized travel crossing on a stream occupied by ESA-listed Upper Willamette River steelhead. The motorized use trail ends just beyond the crossing. The stream is Mohawk Creek, a tributary to Shotgun Creek in the McKenzie River basin.

Hiking Trails

The BLM manages 63 individual trails and trail systems that total over 395 miles in the Western Oregon decision area. Trail-based recreation opportunities within the decision area include trail systems for motorized and non-motorized users, providing a range of available activities across various recreation settings. Popular activities include hiking, mountain biking, horseback riding, and public motorized travel use.

Management Objectives

- Maintain a comprehensive travel network that best meets the full range of public use, resource management, and administrative access needs.
- Protect fragile and unique resource values from damage by public motorized vehicle use.
- Provide public motorized vehicle use opportunities where appropriate.

16. Wildlife

This program would occur within all ESUs/DPSs/RUs except for Southern DPS Pacific eulachon. On-the-ground activities of the Wildlife program are habitat restoration activities.

Management Objectives

- Conserve and recover species that are ESA-listed, proposed, or candidates, and the ecosystems on which they depend.
- Implement conservation measures that reduce or eliminate threats to Bureau Sensitive species to minimize the likelihood of and need for the ESA-listing of these species.
- Conserve or create habitat for species addressed by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act and the ecosystems on which they depend.

17. Wild Horses

This program would only occur in the shortnose sucker and Lost River sucker Upper Klamath RU.

The Pokegama Herd Management Area (HMA) is the only HMA within the planning area (Figure 6). It encompasses a total of 85,022 acres in Oregon and California and includes private, state, and Federal lands. About 83 percent of the HMA (70,550 acres) is within the planning area, and about 23 percent of the HMA is on BLM-administered lands managed by the Klamath Falls Field Office. The remainder of the HMA within the planning area is on private land.

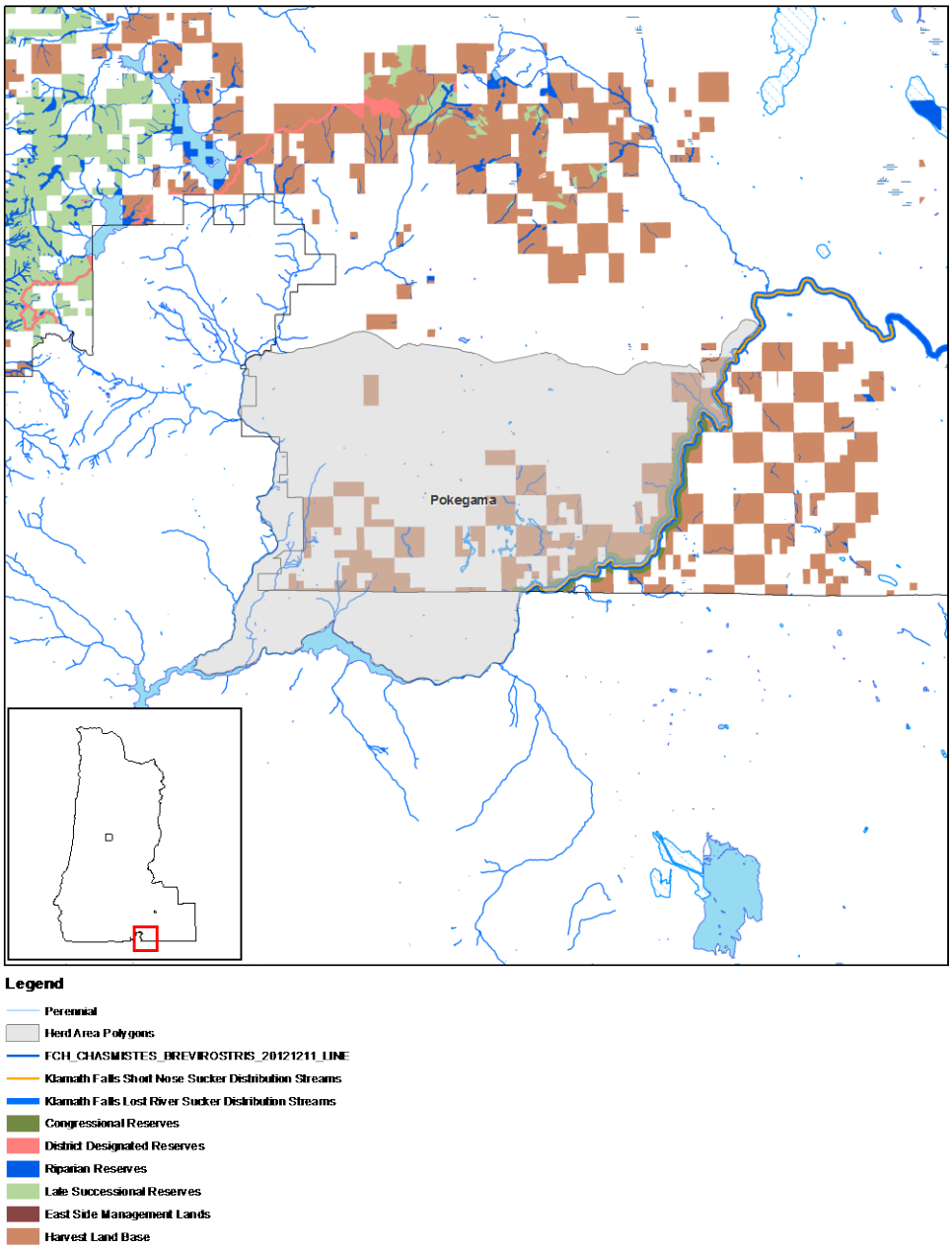


Figure 6. Pokegama Herd Management Area.

The Pokegama herd primarily occupies the private land within the HMA. Private landowners allow wild horses on their lands, if the herd size is maintained within the established appropriate management level, and the horses do not range outside the HMA.

The Pokegama herd is currently within the appropriate management level of 30 to 50 horses, based on the HMA management plan. Since designation of the HMA in 1971, census counts of the Pokegama wild horse population have ranged from 25 in 1972 to 55 in 2000. The 2012 census counted 24 horses, although the BLM estimates the current herd size is 30 to 40 horses. The BLM completed captures in 1996 and 2000, removing 20 and 18 horses, respectively.

The portion of the HMA within the planning area lies within the boundaries of the Dixie and Edge Creek livestock grazing allotments. There is abundant forage and available water within the two allotments in the HMA.

Management Objective

- Manage and maintain a healthy population of wild and free-roaming horses in the Pokegama Herd Management Area of the Klamath Falls Field Office.

C. "No Effect" BLM Resource Programs

The PRMP categories listed below are designations rather than programs with management activities. These designations generally prohibit certain activities from occurring to protect resource values. Actions that may take place within lands with these designations, and their natural resource impacts and effects to ESA-listed species or designated CH are attributed to specific management programs. For example, if noxious weeds were to be treated within an Area of Critical Environmental Concern (ACEC), the effects are attributed to the Invasive Species program. The list of designations is:

- Areas of Critical Environmental Concern
- District-Designated Reserrve – Lands Managed for their Wilderness Characteristics
- National Trails System
- Wild and Scenic Rivers

In addition to designations, there are management programs that have no causal mechanism for an ESA effect or which have no BLM management discretion. Designations and programs with these characteristics are described in this section. The rationale for an ESA effect determination of "*No Effect*" for each designation or program is presented.

1. Air Quality

Management of air quality involves planning and decisions required to meet ambient air quality standards of the Clean Air Act. Typically, it is the management of smoke. There are no causal mechanisms to affect any fish habitat characteristics or PCE of CH, nor are there any mechanisms to directly impact individual fish. Consequently, the ESA effect determination for ESA-listed fish species and their respective designated CH is *"No Effect."*

2. Areas of Critical Environmental Concern

This category is a designation. The decision to manage all ACECs to protect the values for which they were designated does not have any causal mechanisms to affect any fish habitat characteristics or PCE of CH, nor are there any mechanisms to directly impact individual fish. Consequently, the ESA effect determination for ESA-listed fish species and their respective designated CH, is *"No Effect."*

3. District-Designated Reserve – Lands Managed for their Wilderness Characteristics

This category is a designation. The decision to protect lands with wilderness characteristics that are outside of the Harvest Land Base and are compatible with existing and potentially non-compatible recreation uses (motorized and mechanized uses) does not have any causal mechanisms to affect any fish habitat characteristics or PCE of CH, nor are there any mechanisms to directly impact individual fish. Consequently, the ESA effect determination for ESA-listed fish species and their respective designated CH, is *"No Effect."*

4. National Trails System

Congress designated three classifications of trails for public use under separate criteria established in the National Trails System Act of 1968, Sec. 3(a). They are National Recreation Trail, National Scenic Trail and National Historic Trail. The only management actions under the PRMP for the National Trails System program are the designation of National Trail Management Corridors (NTMC) for two specific trails described below. A National Trail Management Corridor includes public land area of sufficient width to encompass National Trail System resources, qualities, values, and associated settings. .

The PRMP would establish a one mile NTMC (one half mile on each side) of the Pacific Crest National Scenic Trail (PCT), on portions of the trail that are on BLM land. There are approximately 17.0 miles of the PCT on BLM land within the planning area. The PCT is located primarily on or near ridge-tops. A GIS analysis determined that the portions of the PCT NTMC that are on BLM land in the planning area are >5 miles distant from SONCC coho salmon designated CH and known distribution, and >14 miles away from Lost River and shortnose sucker designated CH and known distribution. Consequently, the BLM believes the designation of the PCT NTMC would have no effect on any ESA-listed fish species or designated CH in the planning area.

The PRMP would establish a 50 foot wide NTMC on either side of the centerline of the Applegate Trail Route for a total width of 100 feet. The Applegate Trail Route will be evaluated by the National Park Service in a feasibility study to determine whether it should be added to the California National Historic Trail. A GIS analysis determined that there is very little intersection of the 100 foot NTMC with streams having designated CH or known distribution of ESA-listed fish species on the 10.2 miles of the Applegate Trail Route that occurs on BLM lands. For OC coho salmon, approximately 0.23 miles of stream with designated CH and 0.11 miles of stream with known distribution overlaps the 100 foot NTMC on the trail on BLM land. For Lost River and shortnose sucker, there is only 0.01 miles of designated CH and stream with known distribution that overlaps the 100 foot NTMC on the trail on BLM land.

The 50 foot width of the NTMC on either side of the trail where it intersects streams is within the Riparian Reserve land use allocation, primarily within the inner zone. It would not be more protective than the designation of Riparian Reserve under the PRMP. Consequently, the BLM believes that the designation of the 100 foot wide buffer on BLM portions of the Applegate Trail Route would have no effect on any ESA-listed fish species or designated CH in the planning area.

There are four National Recreation Trails within the planning area. They are managed solely for the recreational use of the designated trail. No additional management beyond the trail management (i.e., for scenic or historical values) is proposed in the PRMP. Overall, the actions proposed in the PRMP for trails in the National Trail System results in a no effect determination to ESA-listed fish species and designated CH.

Note that the ESA effects of the use and maintenance of all trails, including those in the National Trail System, are evaluated in the effects of the Trails and Travel Management Program later in this document.

5. Rare Plants and Fungi

Actions under this resource program typically involve surveys with little to no ground disturbance. There are no causal mechanisms to affect any fish habitat characteristics or PCE of CH, nor are there any mechanisms to directly impact individual fish. Consequently, the ESA effect determination for ESA-listed fish species and their respective designated CH, is *"No Effect."*

6. Tribal Interests

The BLM has no discretion regarding Native American uses. Therefore it is not subject to ESA consultation. Other tribal interests addressed in the PRMP relate to effects to fish species and fish passage, deer and elk, culturally important plants, religious and culturally important sites, the visibility of the historic Siletz reservation boundary, historic trail routes, effects to neighboring Tribally-managed lands, and socioeconomic effects to Tribal communities. These topics and their effects to fish and their habitat are either addressed in this BA for other PRMP management programs (for example, Fisheries and Invasive Plants), or have no causal mechanisms to affect any fish habitat characteristics or PCE of CH, nor are there any mechanisms to directly impact individual fish. Consequently, the ESA effect determination for ESA-listed fish species and their respective designated CH, is *"No Effect."*

7. Visual Resources

The management program does not result in ground-disturbing activities. There are no causal mechanisms to affect any fish habitat characteristics or PCE of CH, nor are there any mechanisms to directly impact individual fish. Consequently, the ESA effect determination for ESA-listed fish species and their respective designated CH, is *"No Effect."*

8. Wild and Scenic Rivers

The BLM administers nine designated Wild and Scenic Rivers (WSR) within the planning area. They will continue to be administered as WSR with no change in management under the PRMP. Since their management does not change, there would be no effect to ESA-listed fish species and their designated CH.

Under the 1995 RMPs, the BLM recommended 13 suitable river segments for inclusion in the WSR National System. The BLM currently manages these segments under interim protection until Congress designates the river segments or releases them for other uses. The BLM revalidated these findings of suitability for these 13 river segments during this planning process.

The interim protection would continue under the PRMP. Since their management does not change, there would be no effect to ESA-listed fish species and their designated CH.

Under the 1995 RMPs, the BLM found 51 river segments eligible for WSR status. These segments are currently managed under interim protection until the BLM makes land use plan decisions regarding their suitability. As part of the current planning effort, the BLM evaluated these 51 eligible segments for suitability. The BLM identified six segments that meet the suitability criteria for recommendation for potential inclusion in the National System. Upon implementation of the PRMP, the BLM would recommend to Congress that a total of nineteen rivers (thirteen eligible rivers found suitable during the 1995 assessments and six eligible rivers found suitable through the current assessment) be included in the WSR National System.

The recommendation to Congress that the nineteen segments be included in the WSR National System is an administrative process. It does not result in any on-the-ground changes to management for the nineteen segments and therefore does not result in an effect to ESA-listed fish species or their designated CH. Based upon the fact that there are 13 river segments recommended for inclusion under the 1995 RMPs that have not been acted upon by Congress (a >20 year period), there is no reasonable certainty that any of the six segments proposed under the RMP would be included in the WSR National System.

Implementing the PRMP would not recommend 43 river segments for inclusion in the WSR National System, and the BLM would not continue to manage for WSR Outstandingly Remarkable Values (ORV) on those river segments. The FEIS analyzed the effects to the ORVs of eligible segments that would not be recommended for inclusion in the WSR National System. The FEIS evaluated effects from riparian management under the PRMP to eligible segments for which fish was an ORV. The FEIS concludes that management under the PRMP would result in no effect to fish ORVs for the 41 currently eligible river segments with fish as an ORV. The other two river segments that would not be recommended for inclusion in the WSR National System, that do not have fish as an ORV, have Cultural, Ecology, Scenery and Recreation as ORVs, either solely or in combination. Consequently, the BLM believes that not continuing to manage eligible river segments under the PRMP would not result in an effect ESA-listed fish species or to designated CH.

Given the information presented above, the ESA effect determination for ESA-listed fish species and their respective designated CH for the WSR program, is *"No Effect."*

D. ESA Action Area

The ESA defines the ESA action area as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action [50 CFR § 402.02]. The ESA action area considered in this BA is that portion of the area covered by the six RMPs (the planning area) that is coincident with the distribution of fish species listed under the Federal ESA and their designated CH. For simplicity of analysis, the ESA action area includes all lands within the planning area boundary (Figure 7). It is possible that ESA effects to listed fish species or to designated CH can extend beyond the planning area boundary. This may occur when an action occurs on BLM land near the planning area boundary and the effects are transmitted downstream beyond the planning area boundary.

The BLM's current RMPs provide the procedures and requirements for the management of approximately 2.5 million acres of federal land within the planning area, The planning area is primarily located west of the Cascades Mountain Range in Oregon, but also includes some land within the Klamath River basin administered by the BLM Klamath Falls Resource Area. These BLM-administered lands are widely scattered and represent only about 11% of the planning area. Of the approximately 2.5 million acres that are administered by the BLM, approximately 2.1 million acres are managed primarily under the O&C Act and are commonly referred to as the O&C lands. The remaining acres are public domain (about 384,000 acres) and acquired lands (about 9,000 acres) that are managed primarily under the FLPMA.

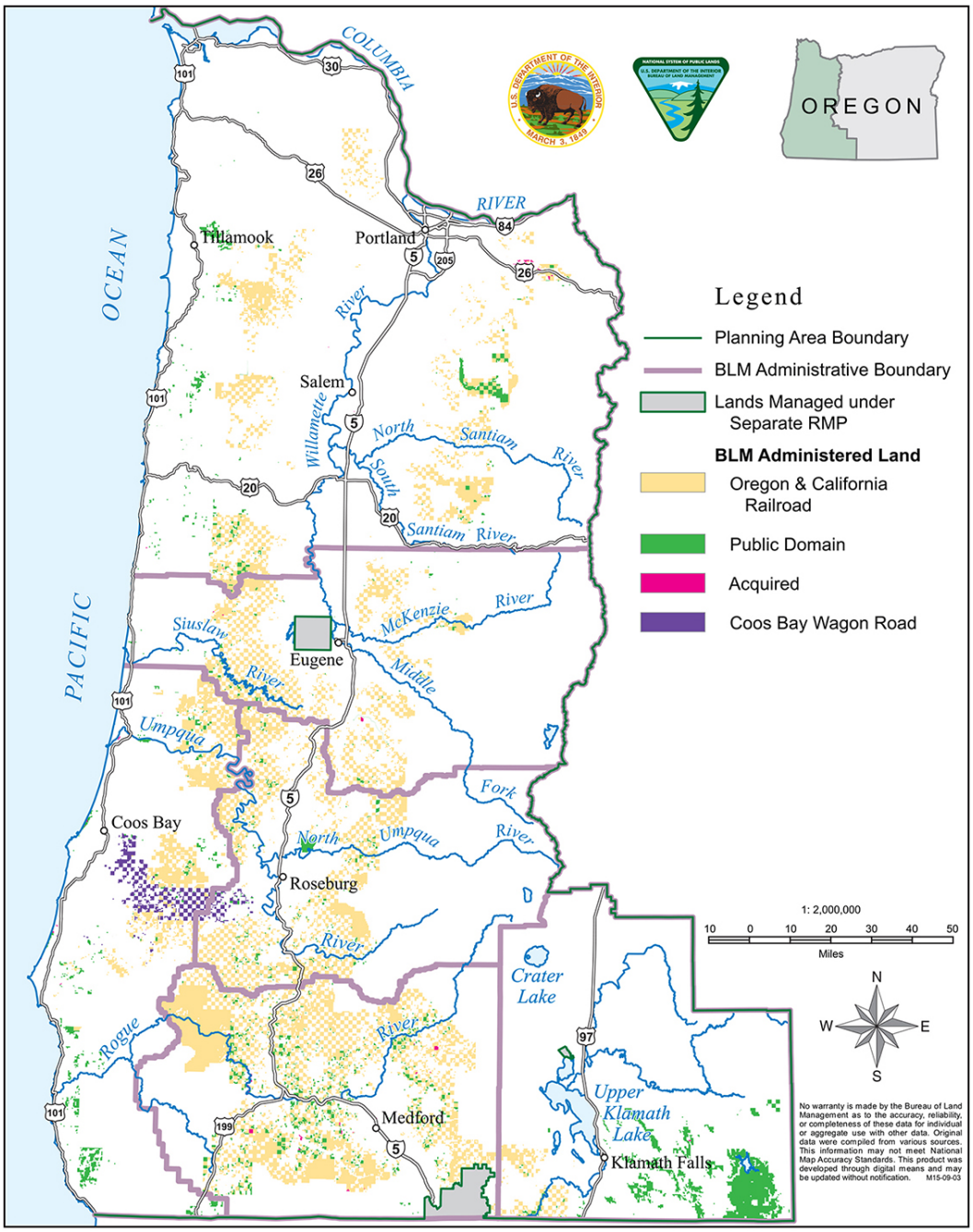


Figure 7. BLM land ownership within the ESA action area and planning area boundary.

III. Status of ESA-Listed Fish Species and Designated Critical Habitat Within the Plan Area

A. Fish species under the jurisdiction of the NMFS

Population units can be viewed as a hierarchy of levels of complexity and geographic scope. The highest level in the hierarchy of population units for Pacific salmon on the Oregon coast is the Evolutionarily Significant Unit (ESU) (Waples 1995) for Chinook and coho salmon, and the Distinct Population Segment (DPS) for steelhead.

The narrative that follows is from NMFS (2015). For Pacific salmon, steelhead, and certain other species, the NMFS commonly uses the four "viable salmonid population" (VSP) criteria (McElhany *et al.* 2000) to assess the viability of the populations that, together, constitute the species. These four criteria (spatial structure, diversity, abundance, and productivity) encompass the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. When these parameters are collectively at appropriate levels, they maintain a population's capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment.

"Spatial structure" refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population's spatial structure depends on habitat quality and spatial configuration, and the dynamics and dispersal characteristics of individuals in the population.

"Diversity" refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation in single genes to complex life history traits (McElhany *et al.* 2000).

"Abundance" generally refers to the number of naturally-produced adults (*i.e.*, the progeny of naturally-spawning parents) in the natural environment (*e.g.*, on spawning grounds).

"Productivity," as applied to viability factors, refers to the entire life cycle (*i.e.*, the number of naturally-spawning adults produced per parent). When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is declining. McElhany *et al.* (2000) use the terms "population growth rate" and "productivity" interchangeably when referring to production over the entire life cycle. They also refer to "trend in abundance," which is the manifestation of the long-term population growth rate.

For species with multiple populations, once the biological status of a species' populations has been determined, NMFS assesses the status of the entire species using criteria for groups of populations, as described in recovery plans and guidance documents from technical recovery teams. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close to allow functioning as metapopulations (McElhany *et al.* 2000).

The summaries that follow describe the status of the nine ESA-listed species, and their designated CH, that occur within the geographic area of this proposed action and are considered in this BA. More detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and CH designations published in the Federal Register (Table 1, Table 2).

The status of species and CH sections for salmon and steelhead are organized by recovery domains (Table 62) to better integrate into this consultation information in final and draft recovery plans on the conservation status of the ESA-listed species and their CH. Recovery domains are the geographically-based areas within which recovery plans are prepared.

Table 62. Recovery domains identified by NMFS and their ESA-listed salmon and steelhead species within the geographic area of the proposed action.

Recovery Domain	Species
Willamette-Lower Columbia (WLC)	LCR Chinook salmon UWR Chinook salmon LCR coho salmon LCR steelhead UWR steelhead
Oregon Coast (OC)	OC coho salmon
Southern Oregon/Northern California Coast (SONCC)	SONCC coho salmon

For each recovery domain, a technical review team (TRT) that NMFS appointed has developed, or is developing, criteria necessary to identify independent populations within each species, recommended viability criteria for those species, and descriptions of factors that limit species survival. Viability criteria are prescriptions of the biological conditions for populations, biogeographic strata, and evolutionarily significant units (ESU) that, if met, would indicate that an ESU will have a negligible risk of extinction over a 100-year time frame.[9]

Although the TRTs operated from the common set of biological principals described in McElhany *et al.* (2000), they worked semi-independently from each other and developed criteria suitable to the species and conditions found in their specific recovery domains. All of the criteria have qualitative as well as quantitative aspects. The diversity of salmonid species and populations makes it impossible to set narrow quantitative guidelines that will fit all populations in all situations. For this and other reasons, viability criteria vary among species, mainly in the number and type of metrics and the scales at which the metrics apply (*i.e.*, population, major population group (MPG), or ESU) (Busch *et al.* 2008).

[9] For Pacific salmon, NMFS uses its 1991 ESU policy, which states that a population or group of populations will be considered a DPS if it is an ESU. An ESU represents a DPS of Pacific salmon under the ESA that 1) is substantially reproductively isolated from conspecific populations and 2) represents an important component of the evolutionary legacy of the species. The species *O. mykiss* is under the joint jurisdiction of NMFS and the U.S. Fish and Wildlife Service (USFWS), so in making its January 2006 ESA listing determinations, NMFS elected to use the 1996 joint USFWS-NMFS DPS policy for this species.

Most TRTs included in their viability criteria a combined risk rating for abundance and productivity (A/P) and either an integrated spatial structure and diversity (SS/D) risk rating (*e.g.*, Interior Columbia TRT) or separate risk ratings for spatial structure and diversity (*e.g.*, Willamette/Lower Columbia TRT).

The boundaries of each population were defined using a combination of genetic information, geography, life-history traits, morphological traits, and population dynamics that indicate the extent of reproductive isolation among spawning groups. The overall viability of a species is a function of the VSP attributes of its constituent populations. Until a viability analysis of a species is completed, the VSP guidelines recommend that all populations should be managed to retain the potential to achieve viable status to ensure a rapid start along the road to recovery, and that no significant parts of the species are lost before a full recovery plan is implemented (McElhany *et al.* 2000).

Viability status or probability of population persistence is described below for each of the populations considered in this opinion. Although southern green sturgeon and the southern distinct population segment of eulachon (hereafter, "eulachon") are part of more than one recovery domain structure, they are presented below for convenience as part of the Willamette Lower Columbia recovery domain.

Willamette-Lower Columbia Recovery Domain. Species in the Willamette-Lower Columbia (WLC) Recovery Domain include LCR Chinook salmon, UWR Chinook salmon, CR chum salmon, LCR coho salmon, LCR steelhead, UWR steelhead, southern green sturgeon, and eulachon. The WLC Technical Recovery Team (WLC-TRT) identified 107 demographically independent populations of Pacific salmon and steelhead (Myers *et al.* 2006). These populations were further aggregated into strata, groupings above the population level that are connected by some degree of migration, based on ecological subregions. All 107 populations use parts of the mainstem of the Columbia River and the Columbia River estuary for migration, rearing, and smoltification.

Persistence probabilities, which are provided here for Lower Columbia River salmon and steelhead, are the complement of a population's extinction risk (*i.e.*, persistence probability = 1 – extinction risk) (NMFS 2013a). Overall viability risk scores (high to low) and population persistence scores for species in this domain are based on combined ratings for the A&P and SS/D metrics (Table 63) (McElhany *et al.* 2006).

Table 63. Population persistence categories and probabilities from McElhany *et al.* (2006). A low or negligible risk of extinction is considered "viable" (Ford 2011). For population persistence categories, 4 = very low (VL), 3 = low (L), 2 = moderate (M), 1 = high (H), and 0 = very high (VH) in Oregon populations, and "extirpated or nearly so" (E) in Washington populations (Ford 2011).

Population Persistence Category	Probability of population persistence in 100 years	Probability of population extinction in 100 years	Description
0	0-40%	60-100%	Either extinct or "high" risk of extinction
1	40-75%	25-60%	Relatively "high" risk of extinction in 100 years
2	75-95%	5-25%	"Moderate" risk of extinction in 100 years
3	95-99%	1-5%	"Low" (negligible) risk of extinction in 100 years
4	>99%	<1%	"Very low" risk of extinction in 100 years

Oregon Coast Recovery Domain. The OC recovery domain includes OC coho salmon, southern green sturgeon, and eulachon, covering Oregon coastal streams south of the Columbia River and north of Cape Blanco. Streams and rivers in this area drain west into the Pacific Ocean, and vary in length from < 1 mile to more than 210 miles in length.

Southern Oregon and Northern California Coast Recovery Domain. The SONCC recovery domain includes coho salmon, green sturgeon, and eulachon. The SONCC recovery domain extends from Cape Blanco, Oregon, to Punta Gorda, California. This area includes many small-to-moderate-sized coastal basins, where high quality habitat occurs in the lower reaches of each basin, and three large basins (Rogue, Klamath and Eel) where high quality habitat is in the lower reaches, little habitat is provided by the middle reaches, and the largest amount of habitat is in the upper reaches.

1. Status of the Species

Lower Columbia River Chinook Salmon

Recovery plan targets for this species are tailored for each life history type, and within each type, specific population targets are identified (NMFS 2013a). For spring Chinook salmon, all populations are affected by aspects of habitat loss and degradation. Four of the nine populations require significant reductions in every threat category. Protection and improvement of tributary and estuarine habitat are specifically noted.

For fall Chinook salmon, recovery requires restoration of the Coast and Cascade strata to high probability of persistence, to be achieved primarily by ensuring habitat protection and restoration. Very large improvements are needed for most fall Chinook salmon populations to improve their probability of persistence.

For late fall Chinook salmon, recovery requires maintenance of the North Fork Lewis and Sandy populations which are comparatively healthy, together with improving the probability of persistence of the Sandy population from its current status of "high" to "very high." Improving

the status of the Sandy population depends largely on harvest and hatchery changes. Habitat improvements to the Columbia River estuary and tributary spawning areas are also necessary.

Spatial Structure and Diversity. This species includes all naturally-spawned populations of Chinook salmon in the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River; the Willamette River to Willamette Falls, Oregon, exclusive of spring-run Chinook salmon in the Clackamas River; and progeny of 15 artificial propagation programs (USDC 2014). LCR Chinook populations exhibit three different life history types base on return timing and other features: fall-run (or "tules"), late-fall-run (or "brights"), and spring-run.

The WLC-TRT identified 32 historical populations of LCR Chinook salmon—seven in the coastal subregion, six in the Columbia Gorge, and 19 in the Cascade Range (Myers *et al.* 2006) (Table 64). Spatial structure has been substantially reduced in several populations. Low abundance, past broodstock transfers and other legacy hatchery effects, and ongoing hatchery straying may have reduced genetic diversity within and among LCR Chinook salmon populations. Hatchery-origin fish spawning naturally may also have reduced population productivity (Lower Columbia Fish Recovery Board 2010; ODFW 2010; NMFS 2013a). Out of the 32 populations that make up this ESU, only the two late-fall runs, the North Fork Lewis and Sandy, are considered viable. Most populations (23 out of 32) have a very low probability of persistence over the next 100 years (and some are extirpated or nearly so) (Lower Columbia Fish Recovery Board 2010; ODFW 2010; Ford 2011; NMFS 2013a). Five of the six strata fall significantly short of the WLC-TRT criteria for viability; one stratum, Cascade late-fall, meets the WLC TRT criteria (NMFS 2013a).

Table 64. LCR Chinook salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A&P, spatial structure, and diversity) used to determine overall net persistence probability of the population (NMFS 2013a). Persistence probability ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH).

Stratum		Spawning Population (Watershed)	A&P	Spatial Structure	Diversity	Overall Persistence Probability
Ecological Subregion	Run Timing					
Cascade Range	Spring	Upper Cowlitz River (WA)	VL	L	M	VL
		Cispus River (WA)	VL	L	M	VL
		Tilton River (WA)	VL	VL	VL	VL
		Toutle River (WA)	VL	H	L	VL
		Kalama River (WA)	VL	H	L	VL
		North Fork Lewis (WA)	VL	L	M	VL
		Sandy River (OR)	M	M	M	M
	Fall	Lower Cowlitz River (WA)	VL	H	M	VL
		Upper Cowlitz River (WA)	VL	VL	M	VL
		Toutle River (WA)	VL	H	M	VL
		Coweeman River (WA)	L	H	H	L
		Kalama River (WA)	VL	H	M	VL
		Lewis River (WA)	VL	H	H	VL
		Salmon Creek (WA)	VL	H	M	VL
		Clackamas River (OR)	VL	VH	L	VL
		Sandy River (OR)	VL	M	L	VL
		Washougal River (WA)	VL	H	M	VL
	Late Fall	North Fork Lewis (WA)	VH	H	H	VH
		Sandy River (OR)	VH	M	M	VH
Columbia Gorge	Spring	White Salmon River (WA)	VL	VL	VL	VL
		Hood River (OR)	VL	VH	VL	VL
	Fall	Lower Gorge (WA & OR)	VL	M	L	VL
		Upper Gorge (WA & OR)	VL	M	L	VL
		White Salmon River (WA)	VL	L	L	VL
		Hood River (OR)	VL	VH	L	VL
Coast Range	Fall	Young Bay (OR)	L	VH	L	L
		Grays/Chinook rivers (WA)	VL	H	VL	VL
		Big Creek (OR)	VL	H	L	VL
		Elochoman/Skamokawa creeks (WA)	VL	H	L	VL
		Clatskanie River (OR)	VL	VH	L	VL
		Mill, Germany, and Abernathy creeks (WA)	VL	H	L	VL
		Scappoose River (OR)	L	H	L	L

Abundance and Productivity. A&P ratings for LCR Chinook salmon populations are currently "low" to "very low" for most populations, except for spring Chinook salmon in the Sandy River, which are "moderate" and late-fall Chinook salmon in North Fork Lewis River and Sandy River, which are "very high" (NMFS 2013a). Low abundance of natural-origin spawners (100 fish or fewer) has increased genetic and demographic risks. Other LCR Chinook salmon populations have higher total abundance, but several of these also have high proportions of hatchery-origin spawners. Particularly for tule fall Chinook salmon populations, poor data quality prevents precise quantification of population abundance and productivity; data quality

has been poor because of inadequate spawning surveys and the presence of unmarked hatchery-origin spawners (Ford 2011).

Limiting Factors. Limiting factors for all Lower Columbia River species are shown in Table 65.

Table 65. Limiting factors for Lower Columbia River species by life history type within species *NMFS 2013a). Some limiting factors vary by stratum and population; for additional information see NMFS (2013a), particularly Appendices A, B, C, and H.

Limiting Factor	Spring Chinook Salmon	Fall Chinook Salmon	Late Fall Chinook Salmon	Chum Salmon	Coho Salmon	Winter Steelhead	Summer Steelhead
Tributary Habitat							
Habitat Quantity (Small Dams)					√		
Riparian Condition	√	√		√	√	√	√
Channel Structure and Form	√	√	√	√	√	√	√
Side Channel and Wetland Conditions	√	√	√	√	√	√	√
Floodplain Conditions	√	√	√	√	√	√	√
Sediment Conditions	√	√	√	√	√	√	√
Water Quality (Temperature)	√	√	√	√	√	√	√
Water Quantity (Flow)	√	√	√	√	√	√	√
Toxic Contaminants						√	√
Estuary Habitat							
Toxic Contaminants		√	√	√	√	√	√
Food (Shift from Macro- to Microdetrital-Based)		√	√	√	√	√	√
Estuary Condition	√	√	√	√	√	√	√
Channel Structure and Form	√	√	√	√	√	√	√
Sediment Conditions	√	√	√	√	√	√	√

Water Quality (Temperature)	√	√	√	√	√	√	√
Water Quantity (Flow)	√	√	√	√	√	√	√
Hydropower Factors							
Habitat Quantity (Access) – Bonneville Dam	√	√	√	√	√	√	√
Habitat Quantity (Inundation) – Bonneville Dam	√	√			√	√	√
Habitat Quantity (Access) – Tributary dams	√	√	√		√	√	√
Water Quantity (Flow) – Mainstem Dams				√			
Harvest Factors							
Direct Mortality	√	√	√		√	√	√
Hatchery Factors							
Food (Competition)	√	√	√		√	√	√
Population Diversity (Interbreeding)	√	√	√	√	√	√	√
Predation Factors							
Direct Mortality (Land Use)	√	√	√	√	√	√	√
Direct Mortality (Dams)	√	√		√	√	√	√

Lower Columbia River Coho Salmon

This species is included in the Lower Columbia River recovery plan (NMFS 2013a). Specific recovery goals are to improve all four viability parameters to the point that the Coast, Cascade, and Gorge strata achieve high probability of persistence. Protection of existing high functioning habitat and restoration of tributary habitat are noted needs, along with reduction of hatchery and harvest impacts. Large improvements are needed in the persistence probability of most populations of this ESU.

Spatial Structure and Diversity. This species includes all naturally-spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood rivers; in the Willamette River to Willamette Falls, Oregon; and progeny of 21 artificial propagation programs (USDC 2014). Spatial diversity is rated "moderate" to "very high" for all the populations, except the North Fork Lewis River, which has a "low" rating for spatial structure.

Out of the 24 populations that make up this ESU (Table 66), 21 have a "very low" probability of persisting for the next 100 years, and none of them are considered viable (Lower Columbia Fish Recovery Board 2010; ODFW 2010; Ford 2011; NMFS 2013a).

Table 66. LCR coho salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A&P, spatial structure, and diversity) used to determine current overall net persistence probability of the population (NMFS 2013a). Persistence probability ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH).

Ecological Subregions	Population (Watershed)	A&P	Spatial Structure	Diversity	Overall Persistence Probability
Coast Range	Young's Bay (OR)	VL	VH	VL	VL
	Grays/Chinook rivers (WA)	VL	H	VL	VL
	Big Creek (OR)	VL	H	L	VL
	Elochoman/Skamokawa creeks (WA)	VL	H	VL	VL
	Clatskanie River (OR)	L	VH	M	L
	Mill, Germany, and Abernathy creeks (WA)	VL	H	L	VL
	Scappoose River (OR)	M	H	M	M
Cascade Range	Lower Cowlitz River (WA)	VL	M	M	VL
	Upper Cowlitz River (WA)	VL	M	L	VL
	Cispus River (WA)	VL	M	L	VL
	Tilton River (WA)	VL	M	L	VL
	South Fork Toutle River (WA)	VL	H	M	VL
	North Fork Toutle River (WA)	VL	M	L	VL
	Coweeman River (WA)	VL	H	M	VL
	Kalama River (WA)	VL	H	L	VL
	North Fork Lewis River (WA)	VL	L	L	VL
	East Fork Lewis River (WA)	VL	H	M	VL
	Salmon Creek (WA)	VL	M	VL	VL
	Clackamas River (OR)	M	VH	H	M
	Sandy River (OR)	VL	H	M	VL
	Washougal River (WA)	VL	H	L	VL
Columbia Gorge	Lower Gorge Tributaries (WA & OR)	VL	M	VL	VL
	Upper Gorge/White Salmon (WA)	VL	M	VL	VL
	Upper Gorge Tributaries/Hood (OR)	VL	VH	L	VL

Abundance and Productivity. In Oregon, the Clatskanie Creek and Clackamas River populations have "low" and "moderate" persistence probability ratings for A&P, while the rest are rated "very low." All of the Washington populations have "very low" A&P ratings. The persistence probability for diversity is "high" in the Clackamas population, "moderate" in the Clatskanie, Scappoose, Lower Cowlitz, South Fork Toutle, Coweeman, East Fork Lewis, and Sandy populations, and "low" to "very low" in the rest (NMFS 2013a). Uncertainty is high because of a lack of adult spawner surveys. Smolt traps indicate some natural production in Washington populations, though given the high fraction of hatchery origin spawners suspected to occur in these populations it is not clear that any are self-sustaining (Ford 2011; NMFS 2011a; NMFS 2013a).

Limiting Factors. Limiting factors for this species are given in Table 65 above.

Lower Columbia River Steelhead

This species is included in the Lower Columbia River recovery plan (NMFS 2013a). For this species, threats in all categories must be reduced, but the most crucial elements are protecting favorable tributary habitat and restoring habitat in the Upper Cowlitz, Cispus, North Fork Toutle, Kalama and Sandy subbasins (for winter steelhead), and the East Fork Lewis, and Hood, subbasins (for summer steelhead). Protection and improvement is also need among the South Fork Toutle and Clackamas winter steelhead populations.

Spatial Structure and Diversity. Four strata and 23 historical populations of LCR steelhead occur within the DPS: 17 winter-run populations and six summer-run populations, within the Cascade and Gorge ecological subregions (Table 67).[10] The DPS also includes the progeny of seven artificial propagation programs (USDC 2014). Summer steelhead return to freshwater long before spawning. Winter steelhead, in contrast, return from the ocean much closer to maturity and spawn within a few weeks. Summer steelhead spawning areas in the Lower Columbia River are found above waterfalls and other features that create seasonal barriers to migration. Where no temporal barriers exist, the winter-run life history dominates.

[10] The White Salmon and Little White Salmon steelhead populations are part of the Middle Columbia steelhead DPS and are addressed in a separate recovery plan, the Middle Columbia River Steelhead Distinct Population Segment ESA Recovery Plan (NMFS 2009).

Table 67. LCR steelhead strata, ecological subregions, run timing, populations, and scores for the key elements (A&P, spatial structure, and diversity) used to determine current overall net persistence probability of the population (NMFS 2013a). Risk ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH).

Stratum		Population (Watershed)	A&P	Spatial Structure	Diversity	Overall Persistence Probability
Ecological Subregion	Run Timing					
Cascade Range	Summer	Kalama River (WA)	H	VH	M	M
		North Fork Lewis River (WA)	VL	VL	VL	VL
		East Fork Lewis River (WA)	VL	VH	M	VL
		Washougal River (WA)	M	VH	M	M
	Winter	Lower Cowlitz River (WA)	L	M	M	L
		Upper Cowlitz River (WA)	VL	M	M	VL
		Cispus River (WA)	VL	M	M	VL
		Tilton river (WA)	VL	M	M	VL
		South Fork Toutle River (WA)	M	VH	H	M
		North Fork Toutle River (WA)	VL	H	H	VL
		Coweeman River (WA)	L	VH	VH	L
		Kalama River (WA)	L	VH	H	L
		North Fork Lewis River (WA)	VL	M	M	VL
		East Fork Lewis River (WA)	M	VH	M	M
		Salmon Creek (WA)	VL	H	M	VL
		Clackamas River (OR)	M	VH	M	M
		Sandy River (OR)	L	M	M	L
		Washougal River (WA)	L	VH	M	L
Columbia Gorge	Summer	Wind River (WA)	VH	VH	H	H
		Hood River (OR)	VL	VH	L	VL
	Winter	Lower Gorge (WA & OR)	L	VH	M	L
		Upper Gorge (OR & WA)	L	M	M	L
		Hood River (OR)	M	VH	M	M

It is likely that genetic and life history diversity has been reduced as a result of pervasive hatchery effects and population bottlenecks. Spatial structure remains relatively high for most populations. Out of the 23 populations, 16 are considered to have a “low” or “very low” probability of persisting over the next 100 years, and six populations have a “moderate” probability of persistence (Lower Columbia Fish Recovery Board 2010; ODFW 2010; Ford 2011; NMFS 2013a). All four strata in the DPS fall short of the WLC-TRT criteria for viability (NMFS 2013a).

Baseline persistence probabilities were estimated to be “low” or “very low” for three out of the six summer steelhead populations that are part of the LCR DPS, moderate for two, and high for one, the Wind, which is considered viable. Thirteen of the 17 LCR winter steelhead populations have “low” or “very low” baseline probabilities of persistence, and the remaining four are at “moderate” probability of persistence (Table 67) (Lower Columbia Fish Recovery Board 2010; ODFW 2010; NMFS 2013a).

Abundance and Productivity. The “low” to “very low” baseline persistence probabilities of most Lower Columbia River steelhead populations reflect low abundance and productivity (NMFS 2013a). All of the populations increased in abundance during the early 2000s, generally

peaking in 2004. Most populations have since declined back to levels within one standard deviation of the long-term mean. Exceptions are the Washougal summer-run and North Fork Toutle winter-run, which are still higher than the long-term average, and the Sandy, which is lower. In general, the populations have not shown any sustained, dramatic changes in abundance or fraction of hatchery origin spawners since the 2005 status review (Ford 2011). Although current LCR steelhead populations are depressed compared to historical levels and long-term trends show declines, many populations are substantially healthier than their salmon counterparts, typically because of better habitat conditions in core steelhead production areas (Lower Columbia Fish Recovery Board 2010; NMFS 2013a).

Limiting Factors. Limiting factors for this species are given in Table 65 above.

Upper Willamette River Chinook Salmon

A recovery plan is available for this species (ODFW and NMFS 2011).

Spatial Structure and Diversity. This species includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River; in the Willamette River and its tributaries above Willamette Falls, Oregon; and progeny of six artificial propagation programs (USDC 2014). All seven historical populations of UWR Chinook salmon identified by the WLC-TRT occur within the action area and are contained within a single ecological subregion, the western Cascade Range (Table 68). The McKenzie River population has a “low” risk of extinction and the Clackamas population has a “moderate” risk. (Ford 2011). Data collected since the 2005 status review has confirmed a high fraction of hatchery origin fish in all of the populations of this species (even the Clackamas and McKenzie rivers have hatchery fractions above WLC-TRT viability thresholds). All of the UWR Chinook salmon populations have “moderate” or “high” risk ratings for diversity. Clackamas River Chinook salmon have a “low” risk rating for spatial structure (Ford 2011).

Table 68. Scores for the key elements (A&P, diversity, and spatial structure) used to determine current overall viability risk for UWR Chinook salmon (ODFW and NMFS 2011). All populations are in the Western Cascade Range ecological subregion. Risk ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH).

Population (Watershed)	A&P	Diversity	Spatial Structure	Overall Extinction Risk
Clackamas River	M	M	L	M
Molalla River	VH	H	H	VH
North Santiam River	VH	H	H	VH
South Santiam River	VH	M	M	VH
Calapooia River	VH	H	VH	VH
McKenzie River	VL	M	M	L
Middle Fork Willamette River	VH	H	H	VH

Abundance and Productivity. The Clackamas and McKenzie river populations currently have the best risk ratings for A&P, spatial structure, and diversity. Data collected since the BRT status update in 2005 highlighted the substantial risks associated with pre-spawning mortality. Although recovery plans are targeting key limiting factors for future actions, there have been no significant on-the-groundactions since the last status review to resolve the lack of access to historical habitat above dams nor have there been substantial actions removing hatchery fish from the spawning grounds (Ford 2011).

Limiting Factors. Limiting factors for this species include (ODFW and NMFS 2011):

- Degraded freshwater habitat, including floodplain connectivity and function, channel structure and complexity, riparian areas, and large wood recruitment
- Degraded water quality including elevated water temperature and toxins
- Increased disease incidence
- Altered stream flows
- Reduced access to spawning and rearing habitats
- Altered food web due to reduced inputs of microdetritus
- Predation by native and non-native species, including hatchery fish
- Competition related to introduced races of salmon and steelhead
- Altered population traits due to fisheries and by-catch

Upper Willamette River Steelhead

A recovery plan is available for this species (ODFW and NMFS 2011).

Spatial Structure and Diversity. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in the Willamette River, Oregon, and its tributaries upstream from Willamette Falls to and including the Calapooia River (USDC 2014). One stratum and four extant populations of UWR steelhead occur within the DPS (Table 69). Historical observations, hatchery records, and genetics suggest that the presence of UWR steelhead in many tributaries on the west side of the upper basin is the result of recent introductions. Nevertheless, the WLC-TRT recognized that although west side UWR steelhead does not represent a historical population, those tributaries may provide juvenile rearing habitat or may be temporarily (for one or more generations) colonized during periods of high abundance. Hatchery summer-run steelhead that are released in the subbasins are from an out-of-basin stock, and are not part of the DPS, nor are, stocked summer steelhead that have become established in the McKenzie River (ODFW and NMFS 2011).

Table 69. Scores for the key elements(A&P, diversity, and spatial structure) used to determine current overall viability risk for UWR steelhead (ODFW and NMFS 2011). All populations are in the Western Cascade Range ecological subregion. Risk ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH).

Population (Watershed)	A&P	Diversity	Spatial Structure	Overall Extinction Risk
Molalla River	VL	M	M	L
North Santiam River	VL	M	H	L
South Santiam River	VL	M	M	L
Calapooia River	M	M	VH	M

Abundance and Productivity. Since the last status review in 2005, UWR steelhead initially increased in abundance but subsequently declined and current abundance is at the levels observed in the mid-1990s when the DPS was first listed. The DPS appears to be at lower risk than the UWR Chinook salmon ESU, but continues to demonstrate the overall low abundance pattern that was of concern during the last status review. The elimination of winter-run hatchery release in the basin reduces hatchery threats, but non-native summer steelhead hatchery releases are still a concern for species diversity. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting Factors. Limiting factors for this species include (ODFW and NMFS 2011):

- Degraded freshwater habitat, including floodplain connectivity and function, channel structure and complexity, riparian areas, and large wood recruitment
- Degraded water quality including elevated water temperature and toxins
- Increased disease incidence
- Altered stream flows
- Reduced access to spawning and rearing habitats
- Altered food web due to reduced inputs of microdetritus
- Predation by native and non-native species, including hatchery fish
- Competition related to introduced races of salmon and steelhead
- Altered population traits due to fisheries and by-catch

Oregon Coast Coho Salmon

The NMFS is developing a recovery plan for this species.

Spatial Structure and Diversity**.** This species includes populations of coho salmon in Oregon coastal streams south of the Columbia River and north of Cape Blanco. The Cow Creek Hatchery Program (South Umpqua population) is included as part of the ESU because the original brood stock was founded from the local, natural origin population and natural origin coho salmon have been incorporated into the brood stock on a regular basis. The OC-TRT identified 56 populations, including 21 independent and 35 dependent populations in five biogeographic strata (Table 70) (Lawson *et al.* 2007). Independent populations are populations that historically would have had a high likelihood of persisting in isolation from neighboring populations for 100 years and are rated as functionally independent or potentially independent. Dependent populations (D) are populations that historically would not have had a high likelihood

of persisting in isolation for 100 years. These populations relied upon periodic immigration from other populations to maintain their abundance (McElhany *et al.* 2000; Lawson *et al.* 2007).

Table 70. OC coho salmon populations. Population types include functionally independent (FI), potentially independent (PI) and dependent populations (D) (McElhany *et al.* 200; Lawson *et al.* 2007).

Stratum	Population	Type	Stratum	Population	Type
North Coast	Necanicum River	PI	Mid-Coast (cont.)	Alsea River	FI
	Ecola Creek	D		Big Creek (Alsea)	D
	Arch Cape Creek	D		Vingie Creek	D
	Short Sands Creek	D		Yachats River	D
	Nehalem River	FI		Cummins Creek	D
	Spring Creek	D		Bob Creek	D
	Watseco Creek	D		Tenmile Creek	D
	Tillamook Bay	FI		Rock Creek	D
	Netarts Bay	D		Big Creek (Siuslaw)	D
	Rover Creek	D		China Creek	D
	Sand Creek	D		Cape Creek	D
	Nestucca River	FI		Berry Creek	D
	Neskowin Creek	D		Siuslaw River	FI
Mid-Coast	Salmon River	PI	Lakes	Siltcoos Lake	PI
	Devils Lake	D		Sutton Creek	D
	Siletz River	FI		Tahkenitch Lake	PI
	Schoolhouse Creek	D		Tenmile Lakes	PI
	Fogarty Creek	D	Umpqua	Lower Umpqua River	FI
	Depoe Bay	D		Middle Umpqua River	FI
	Rocky Creek	D		North Umpqua River	FI
	Spencer Creek	D		South Umpqua River	FI
	Wade Creek	D	Mid-South Coast	Threemile Creek	D
	Coal Creek	D		Coos River	FI
	Moolack Creek	D		Coquille River	FI
	Big Creek (Yaquina)	D		Johnson Creek	D
	Yaquina River	FI		Twomile Creek	D
	Theil Creek	D		Floras Creek	PI
	Beaver Creek	PI		Sixes River	PI

A 2010 BRT noted significant improvements in hatchery and harvest practices have been made (Stout *et al.* 2012). However, harvest and hatchery reductions have changed the population dynamics of the ESU. Current concerns for spatial structure focus on the Umpqua River. Of the four populations in the Umpqua stratum, the North Umpqua and South Umpqua were of particular concern. The North Umpqua is controlled by Winchester Dam and has historically been dominated by hatchery fish. Hatchery influence has recently been reduced, but the natural productivity of this population remains to be demonstrated. The South Umpqua is a large, warm system with degraded habitat. Spawner distribution appears to be seriously restricted in this population, and it is probably the most vulnerable of any population in this ESU to increased temperatures.

Current status of diversity shows improvement through the waning effects of hatchery fish on populations of OC coho salmon. In addition, recent efforts in several coastal estuaries to restore

lost wetlands should be beneficial. However, diversity is lower than it was historically because of the loss of both freshwater and tidal habitat loss coupled with the restriction of diversity from very low returns over the past 20 years.

Abundance and Productivity. It has not been demonstrated that productivity during periods of poor marine survival is now adequate to sustain the ESU. Recent increases in adult escapement do not provide strong evidence that the century-long downward trend has changed. The ability of the OC coho salmon ESU to survive another prolonged period of poor marine survival remains in question. Wainwright (2008) determined that the weakest strata of OC coho salmon were in the North Coast and Mid-Coast of Oregon, which had only "low" certainty of being persistent. The strongest strata were the Lakes and Mid-South Coast, which had "high" certainty of being persistent. To increase certainty that the ESU as a whole is persistent, they recommended that restoration work should focus on those populations with low persistence, particularly those in the North Coast, Mid-Coast, and Umpqua strata.

Limiting Factors. Information about limiting factors at the species scale can be gleaned from the discussion of factors for decline and threats in Stout *et al.* (2012). Also, the state of Oregon provided "population bottlenecks" (*i.e.*, limiting factors at the population scale) in its coastal coho assessment (State of Oregon 2005). Based on these two sources, limiting factors for this species include:

- Degraded stream complexity
- Reduced recruitment of wood to streams
- Increased fine substrate sediment
- Loss of beaver dams
- Increased water temperature
- Reduced stream flow
- Human disturbance of the landscape
- Loss of wetlands and estuarine habitat
- Fish passage barriers
- Effects of global climate change
- Periodic reduction in marine productivity
- Hatchery effects
- Effects from exotic fish species

Southern Oregon Northern California Coho Salmon

A recovery plan is available for this species (NMFS 2014).

Spatial Structure and Diversity. This species includes all naturally-spawned populations of coho salmon in coastal streams from the Elk River near Cape Blanco, Oregon, through and including the Mattole River near Punta Gorda, California, and progeny of three artificial propagation programs (NMFS 2014). Williams *et al.* (2006) designated 45 populations of coho salmon in the SONCC coho salmon ESU as dependent or independent based on their historical population size. Independent populations are populations that historically would have had a high likelihood of persisting in isolation from neighboring populations for 100 years and are rated as functionally independent or potentially independent. Dependent populations historically would

not have had a high likelihood of persisting in isolation for 100 years. These populations relied upon periodic immigration from other populations to maintain their abundance. Two populations are both small enough and isolated enough that they are only intermittently present (McElhany *et al.* 2000; Williams *et al.* 2006a; NMFS 2014). These populations were further grouped into seven diversity strata based on the geographical arrangement of the populations and basin-scale genetic, environmental, and ecological characteristics (Table 71).

Table 71. Independent and dependent SONCC coho salmon populations by stratum and role of each population in recovery (Williams et al. 2006a). Ephemeral populations per NMFS (2014b) not listed.

Diversity Stratum	Independent Population	Population Role
Northern Coastal Basins	Elk River	Independent - Core
	Brush Creek	Dependent
	Mussel Creek	Dependent
	Lower Rogue River	Independent - Non-Core 1
	Hunter Creek	Dependent
	Pistol River	Dependent
	Chetco River	Independent - Core
	Winchuck River	Independent - Non-Core 1
Interior Rogue River	Illinois River	Independent - Core
	Middle Rogue and Applegate rivers	Independent - Non-Core 1
	Upper Rogue River	Independent - Core
Central Coastal Basins	Smith River	Independent - Core
	Elk Creek	Dependent
	Wilson Creek	Dependent
	Lower Klamath River	Independent - Core
	Redwood Creek	Independent - Core
	Maple Creek/Big Lagoon	Independent - Non-Core 2
	Little River	Independent - Non-Core1
	Strawberry Creek	Dependent
	Norton/Widow White Creek	Dependent
	Mad River	Independent - Non-Core 1
Interior Klamath River	Middle Klamath River	Independent - Non-Core 1
	Upper Klamath River	Independent - Core
	Salmon River	Independent - Non-Core 1
	Scott River	Independent - Core
	Shasta River	Independent - Core
Interior Trinity River	Lower Trinity River	Independent - Core
	Upper Trinity River	Independent - Core
	South Fork Trinity River	Independent - Non-Core 1
Southern Coastal Basins	Humboldt Bay tributaries	Independent - Core
	Lower Eel and Van Duzen rivers	Independent - Core
	Guthrie Creek	Dependent
	Bear River	Independent - Non-Core 2
	Mattole River	Independent - Non-Core 1

Diversity Stratum	Independent Population	Population Role
Interior Eel River	South Fork Eel River	Independent - Core
	Mainstem Eel River	Independent - Core
	Middle Fork Eel River	Independent - Non-Core 2
	North Fork Eel River	Independent - Non-Core 2
	Middle Mainstem Eel River	Independent - Core
	Upper Mainstem Eel River	Independent - Non-Core 2

NMFS (2014b) determined the role each of the independent populations will serve in recovery (Table 72). Independent populations likely to respond to recovery actions and achieve a low risk of extinction most quickly are designated “Core” populations. The NMFS based this designation on current condition, geographic location in the ESU, a low risk threshold compared to the number of spawners needed for the entire stratum, and other factors. Independent populations with little to no documentation of coho salmon presence in the last century, and poor prospects for recovery were designated as non-core 2. All other independent populations are designated non-core 1. With improved data from 2006, NMFS (2014b) determined five of the 45 populations are ephemeral.

Table 72. Biological recovery objectives and criteria to measure whether recovery objectives are met for SONCC coho salmon (NMFS 2014).

VSP Parameter	Population Role	Biological Recovery Objective	Biological Recovery Criteria[1]
Abundance	Core	Achieve a low risk of extinction	The geometric mean of wild adults over 12 years meets or exceeds the "low risk threshold" of spawners for each core population[2]
	Non-Core 1	Achieve a moderate or low risk of extinction	The annual number of wild adults is greater than or equal to four spawners per IP-km for each non-core population[2]
Productivity	Core and Non-Core 1	Population growth rate is not negative	Slope of regression of the geometric mean of wild adults over the time series ≥ zero[2]
Spatial Structure	Core and Non-Core 1	Ensure populations are widely distributed	Annual within-population distribution ≥ 80%[4] of habitat[3,4] (outside of a temperature mask[5])
	Non-Core 2 and Dependent	Achieve inter- and intra-stratum connectivity	≥ 80% of accessible habitat[3] is occupied in years[6] following spawning of cohorts that experienced high marine survival[7]
Diversity	Core and Non-Core 1	Achieve low or moderate hatchery impacts on wild fish	Proportion of hatchery-origin adults (pHOS) < 0.05
	Core and Non-Core 1	Achieve life-history diversity	Variation is present in migration timing, age structure, size, and behavior. The variation in these parameters,[8] is retained.

[1]All applicable criteria must be met for each population in order for the ESU to be viable.
[2]Assess for at least 12 years, striving for a coefficient of variation (CV) of 15% or less at the population level (Crawford and Rumsey 2011).
[3]Based on available rearing habitat within the watershed (Wainwright *et al.* 2008). For purposes of these biological recovery criteria, "available" means accessible. 70% of habitat occupied relates to a truth value of approximately 0.60, providing a "high" certainty that juveniles occupy a high proportion of the available rearing habitat (Wainwright *et al.* 2008).
[4]The average for each of the three year classes over the 12 year period used for delisting evaluation must each meet this criterion. Strive to detect a 15% change in distribution with 80% certainty (Crawford and Rumsey 2011).
[5]Williams *et al.* (2008) identified a threshold air temperature, above which juvenile coho salmon generally do not occur, and identified areas with air temperatures over this threshold. These areas are considered to be within the temperature mask.
[6]If young-of-year are sampled, sampling would occur the spring following spawning of the cohorts experiencing high marine survival. If juveniles are sampled, sampling would occur approximately 1.5 years after spawning of the cohorts experiencing high marine survival, but before juveniles outmigrate to the estuary and ocean.
[7]High marine survival is defined as 10.2% for wild fish and 8% for hatchery fish (Sharr *et al.* 2000). If marine survival is not high, then this criterion does not apply.
[8]This variation is documented in the population profiles in Volume II of the recovery plan (NMFS 2014).

Abundance and Productivity. Although long-term data on abundance of SONCC coho salmon are scarce, available evidence from shorter-term research and monitoring efforts indicates that the population abundance of most independent populations is below the depensation threshold, and therefore SONCC coho salmon are at high risk of extinction and not viable (Williams *et al.* 2011).

Limiting Factors. Threats from natural or man-made factors have worsened in recent years, primarily due to four factors: small population dynamics, climate change, multi-year drought, and poor ocean conditions (NOAA Fisheries 2011; NMFS 2014). Limiting factors for this species include:

- Lack of floodplain and channel structure
- Impaired water quality
- Altered hydrologic function (timing of volume of water flow)
- Impaired estuary/mainstem function
- Degraded riparian forest conditions
- Altered sediment supply
- Increased disease/predation/competition
- Barriers to migration
- Fishery-related effects
- Hatchery-related effects

Southern DPS Green Sturgeon

The NMFS has released a recovery outline for this species (NMFS 2010). This preliminary document identifies important threats to abate, including exposure to contaminants, loss of estuarine and delta function, and other activities that impact spawning, rearing and feeding habitats. Key recovery needs are restoring access to suitable habitat, improving potential habitat, and establishing additional spawning populations.

Spatial Structure and Diversity. Two DPSs have been defined for green sturgeon (*Acipenser medirostris*), a northern DPS (with spawning populations in the Klamath and Rogue rivers) and a southern DPS (with spawning populations in the Sacramento River). The southern green sturgeon DPS includes all naturally-spawned populations of green sturgeon that occur south of the Eel River in Humboldt County, California. When not spawning, this anadromous species is broadly distributed in nearshore marine areas from Mexico to the Bering Sea. Although it is commonly observed in bays, estuaries, and sometimes the deep riverine mainstem in lower elevation reaches of non-natal rivers along the west coast of North America, the distribution and timing of estuarine use are poorly understood.

In addition to the PS recovery domain, southern green sturgeon occur in the WLC, OC, and SONCC recovery domains. The NMFS is developing a recovery plan for this species.

Limiting Factors. The principal factor for the decline of southern green sturgeon is the reduction of its spawning area to a single known population limited to a small portion of the Sacramento River. It is currently at risk of extinction primarily because of human-induced ‘‘takes’’ involving elimination of freshwater spawning habitat, degradation of freshwater and estuarine habitat quality, water diversions, fishing, and other causes (USDC 2010). Adequate water flow and temperature are issues of concern. Water diversions pose an unknown but potentially serious threat within the Sacramento and Feather Rivers and the Sacramento River Delta. Poaching also poses an unknown but potentially serious threat because of high demand for sturgeon caviar. The effects of contaminants and nonnative species are also unknown but potentially serious. Retention of green sturgeon in both recreational and commercial fisheries is now prohibited within the western states, but the effect of capture/release in these fisheries is

unknown. There is evidence of fish being retained illegally, although the magnitude of this activity likely is small (NOAA Fisheries 2011).

Eulachon

On June 21, 2013, NMFS announced a Federal recovery plan outline, which is to serve as interim guidance for recovery efforts (USDC 2013b). A draft recovery plan is targeted for completion by September 2015. The major threats to eulachon are impacts of climate change on oceanic and freshwater habitats (species-wide), fishery by-catch (species-wide), dams and water diversions (Klamath and Columbia subpopulations) and predation (Fraser River and British Columbia sub-populations) (NMFS 2013b). Preliminary key recovery actions in the recovery outline include maintaining conservative harvest, reducing by-catch, restoring more natural flows and water quality in the Columbia River, maintaining dredging best management practices, removing Klamath River dams, and completing research on life history and genetics, climate effects, and habitat effects (NMFS 2013b).

Spatial Structure and Diversity. ESA-listed eulachon occur in three salmon recovery domains in Oregon: the Willamette and Lower Columbia, Oregon Coast, and Southern Oregon/Northern California Coasts. The ESA-listed population of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Core populations for this species include the Fraser River, Columbia River and (historically) the Klamath River. Eulachon leave saltwater to spawn in their natal streams late winter through early summer, and typically spawn at night in the lower reaches of larger rivers fed by snowmelt. After hatching, larvae are carried downstream and widely dispersed by estuarine and ocean currents. Eulachon movements in the ocean are poorly known, although the amount of eulachon by-catch in the pink shrimp fishery seems to indicate that the distribution of these organisms overlap in the ocean.

Abundance and Productivity. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River (Drake *et al.* 2008). Persistent low returns and landings of eulachon in the Columbia River from 1993-2000 prompted the states of Oregon and Washington to adopt a Joint State Eulachon Management Plan in 2001 that provides for restricted harvest management when parental run strength, juvenile production, and ocean productivity forecast a poor return (WDFW and ODFW 2001). Despite a brief period of improved returns in 2001-2003, the returns and associated commercial landings evenually declined to the low levels observed in the mid-1990s (Joint Columbia River Management Staff 2009). Starting in 2005, the fishery has operated at the most conservative level allowed in the management plan (Joint Columbia River Management Staff 2009). Large commercial and recreational fisheries have occurred in the Sandy River in the past. The most recent commercial harvest in the Sandy River was in 2003. No commercial harvest has been recorded for the Grays River from 1990 to the present, but larval sampling has confirmed successful spawning in recent years (USDC 2011). Starting in 2011, returns in the Columbia River have rebounded by up to two orders of magnitude (Figure 8).

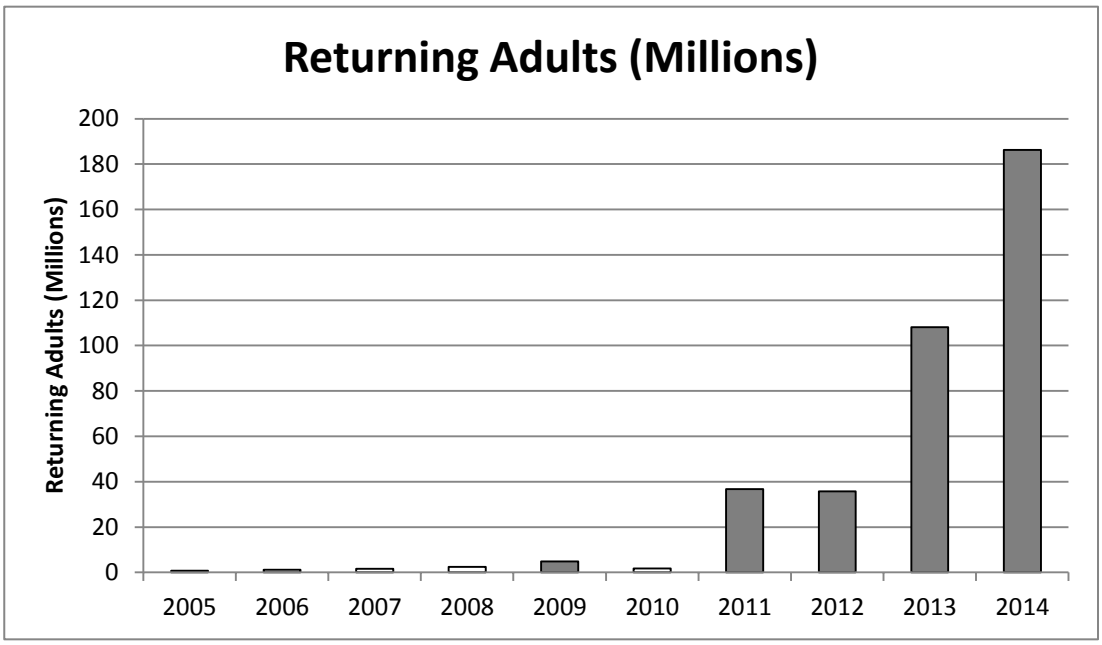


Figure 8. Annual Columbia River eulachon run size 2000-2014; pounds converted to numbers of fish at 11.16 fish pound^{-1} (WDFW 2015). The estimates were calculated based on methods developed by Parker (1985), Jackson and Cheng (2001), and Hay *et al.* (2002) to estimate spawning biomass of pelagic fishes. For 2000 through 2010 estimates were back-calculated using historical larval density.

Threats. The NMFS has not identified limiting factors for this species. However, the status review for this species (Gustafson *et al.* 2010) listed threats to this species (Table 73).

Table 73. Threats to eulachon populations with the most severe threat ranked number 1. Statutory listing factors (ESA section 4(a)(1)(A)–(C), and (E)) include (A): the present or threatened destruction, modification, or curtailment of its habitat or range; (B): overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; and (E) other natural or man-made factors affecting its continued existence. Source: Gustafson *et al.* (2010), p. 160-170.

Threat	Klamath River	Columbia River	Fraser River	British Columbia	Listing Factor
	Ranking				
Climate change impacts on ocean conditions	1	1	1	1	A
Dams/water diversions	2	4	8	11	A
Eulachon by-catch	3	2	2	2	E
Climate change impacts on freshwater habitats	4	3	4	4	A
Predation	5	7	3	3	C
Water quality	6	5	5	8	A
Catastrophic events	7	8	10	5	A
Disease	8	11	11	7	C
Competition	9	12	12	9	E
Shoreline construction	10	10	9	6	A
Tribal/First Nation fisheries	11	14	13	10	B
Nonindigenous species	12	15	15	13	E
Recreational harvest	13	13	14	14	B
Scientific monitoring	-	16	16	15	B
Commercial harvest	-	9	6	-	A
Dredging	-	6	7	12	A

(-) = no ranking due to insufficient data.

2. Status of Critical Habitat

This section examines the status of designated CH affected by the proposed action by examining the condition and trends of essential physical and biological features throughout the designated areas. These features are essential to the conservation of the listed species because they support one or more of the species' life stages (*e.g.*, sites with conditions that support spawning, rearing, migration and foraging).

Salmon and Steelhead

For salmon and steelhead, NMFS ranked watersheds within designated CH at the scale of the fifth-field hydrologic unit code (HUC_5) in terms of the conservation value they provide to each listed species they support.[11] The conservation rankings are high, medium, or low. To determine the conservation value of each watershed to species viability, NMFS' critical habitat analytical review teams (CHARTs) evaluated the quantity and quality of habitat features (for example,

[11] The conservation value of a site depends upon "(1) the importance of the populations associated with a site to the ESU [or DPS] conservation, and (2) the contribution of that site to the conservation of the population through demonstrated or potential productivity of the area" (NOAA Fisheries 2005).

spawning gravels, wood and water condition, side channels), the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area (NOAA Fisheries 2005). Thus, even a location that has poor quality habitat could be ranked with a high conservation value if it were essential due to factors such as limited availability (*e.g.*, one of a very few spawning areas), a unique contribution of the population it served (*e.g.*, a population at the extreme end of geographic distribution), or if it serves another important role (*e.g.*, obligate area for migration to upstream spawning areas).

The physical or biological features of freshwater spawning and incubation sites include water flow, quality, and temperature; suitable substrate for spawning and incubation; and migratory access for adults and juveniles (Table 74, Table 75). These features are essential to conservation because without them the species cannot successfully spawn and produce offspring. The physical or biological features of freshwater migration corridors associated with spawning and incubation sites include water flow, quality and temperature conditions supporting larval and adult mobility, abundant prey items supporting larval feeding after yolk sac depletion, and free passage (no obstructions) for adults and juveniles. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

Table 74. Primary constituent elements of critical habitat designated for ESA-listed salmon and steelhead species in this biological assessment (except SONCC coho salmon) and corresponding life history events.

Primary Constituent Elements		Life History Event
Site Type	**Site Attribute**	
Freshwater spawning	Substrate Water quality Water quantity	Adult spawning Embryo incubation Alevin growth and development
Freshwater rearing	Floodplain connectivity Forage Natural cover Water quality Water quantity	Fry emergence from gravel Fry/parr/smolt growth and development
Freshwater migration	Free of artificial obstruction Natural cover Water quality Water quantity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Estuarine areas	Forage Free of artificial obstruction Natural cover Salinity Water quality Water quantity	Adult sexual maturation and “reverse smoltification” Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Nearshore marine areas	Forage Free of artificial obstruction Natural cover Water quantity Water quality	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing

Table 75. Essential features of critical habitat designated for SONCC coho salmon and corresponding life history events.

Essential Features		Life History Event
Site	**Site Attribute**	
Spawning and juvenile rearing areas	Access (sockeye) Cover/shelter Food (juvenile rearing) Riparian vegetation Space (Chinook, coho) Spawning gravel Water quality Water temp (sockeye) Water quantity	Adult spawning Embryo incubation Alevin growth and development Fry emergence from gravel Fry/parr/smolt growth and development
Adult and juvenile migration corridors	Cover/shelter Food (juvenile) Riparian vegetation Safe passage Space Substrate Water quality Water quantity Water temperature Water velocity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Areas for growth and development to adulthood	Ocean areas – not identified	Nearshore juvenile rearing Subadult rearing Adult growth and sexual maturation Adult spawning migration

CHART Salmon and Steelhead Critical Habitat Assessments

The CHART for each recovery domain assessed biological information pertaining to areas occupied by listed salmon and steelhead, determine whether those areas contained PCEs essential for the conservation of those species, and whether unoccupied areas existed within the historical range of the listed salmon and steelhead that are also essential for conservation. The CHARTs assigned a 0 to 3 point score for the PCEs in each HUC_5 watershed for:

Factor 1. Quantity,
Factor 2. Quality – Current Condition,
Factor 3. Quality – Potential Condition,
Factor 4. Support of Rarity Importance,
Factor 5. Support of Abundant Populations, and
Factor 6. Support of Spawning/Rearing.

Thus, the quality of habitat in a given watershed was characterized by the scores for Factor 2 (quality – current condition), which considers the existing condition of the quality of PCEs in the HUC_5 watershed; and Factor 3 (quality – potential condition), which considers the likelihood of achieving PCE potential in the HUC_5 watershed, either naturally or through active

conservation/restoration, given known limiting factors, likely biophysical responses, and feasibility.

Southern DPS Green Sturgeon. A team similar to the CHARTs, referred to as a Critical Habitat Review Team (CHRT), identified and analyzed the conservation value of particular areas occupied by southern green sturgeon, and unoccupied areas they felt are necessary to ensure the conservation of the species (USDC 2009). The CHRT did not identify those particular areas using HUC nomenclature, but did provide geographic place names for those areas, including the names of freshwater rivers, the bypasses, the Sacramento-San Joaquin Delta, coastal bays and estuaries, and coastal marine areas (within 110 m depth) extending from the California/Mexico border north to Monterey Bay, California, and from the Alaska/Canada border northwest to the Bering Strait; and certain coastal bays and estuaries in California, Oregon, and Washington.

For freshwater rivers north of and including the Eel River, the areas upstream of the head of the tide were not considered part of the geographical area occupied by the southern DPS. However, the critical habitat designation recognizes not only the importance of natal habitats, but of habitats throughout their range. Critical habitat has been designated in coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; the lower Columbia River estuary; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor) (USDC 2009). The designated areas in Oregon bays include all tidally influenced areas up to the elevation of mean higher high water, including, but not limited to, areas upstream to the head of tide in various streams that drain into the bays, as listed in (Table 1 in USDC 2009). In the Columbia River, the designated area includes all tidally influenced areas of the lower Columbia River estuary from the mouth upstream to river kilometer 74, up to the elevation of mean higher high water, including, but not limited to, areas upstream to the head of tide endpoint in various streams that drain into the estuary, as listed in Table 1 of USDC (2009).

Table 76 lists the physical and biological features (PBFs) of critical habitat designated for southern green sturgeon and corresponding species life history events. All geographic locations in Oregon evaluated by the CHRT have the same PCEs present. They are food, migratory corridors, sediment quality (contaminants) and water quality (Table 2, NMFS 2009).

Table 76. Physical or biological features of critical habitat designated for southern green sturgeon and corresponding species life history events.

Physical or Biological Features		Species Life History Event
Site Type	**Site Attribute**	
Freshwater riverine system	Food resources Migratory corridor Sediment quality Substrate type or size Water depth Water flow Water quality	Adult spawning Embryo incubation, growth and development Larval emergence, growth and development Juvenile metamorphosis, growth and development
Estuarine areas	Food resources Migratory corridor Sediment quality Water flow Water depth Water quality	Juvenile growth, development, seaward migration Subadult growth, development, seasonal holding, and movement between estuarine and marine areas Adult growth, development, seasonal holding, movements between estuarine and marine areas, upstream spawning movement, and seaward post-spawning movement
Coastal marine areas	Food resources Migratory corridor Water quality	Subadult growth and development, movement between estuarine and marine areas, and migration between marine areas Adult sexual maturation, growth and development, movements between estuarine and marine areas, migration between marine areas, and spawning migration

The CHRT identified several activities that threaten the PBFs in coastal bays and estuaries and necessitate the need for special management considerations or protection. The application of pesticides is likely to adversely affect prey resources and water quality within the bays and estuaries, as well as the growth and reproductive health of Southern DPS green sturgeon through bioaccumulation. Other activities of concern include those that disturb bottom substrates, adversely affect prey resources, or degrade water quality through re-suspension of contaminated sediments. Of particular concern are activities that affect prey resources. Prey resources are affected by: commercial shipping and activities generating point source pollution and non-point source pollution that discharge contaminants and result in bioaccumulation of contaminants in green sturgeon; disposal of dredged materials that bury prey resources; and bottom trawl fisheries that disturb the bottom (but result in beneficial or adverse effects on prey resources for green sturgeon). In addition, petroleum spills from commercial shipping and proposed hydrokinetic energy projects are likely to affect water quality or hinder the migration of green sturgeon along the coast (USDC 2009).

Southern DPS Eulachon. Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington (USDC 2011). All of these areas are designated as migration and spawning habitat for this species. In Oregon, the NMFS designated 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek. The mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles is also designated as critical habitat. Table 77 lists the physical or biological features of critical habitat designated for eulachon and corresponding species life history events.

Table 77. Physical or biological features of critical habitats designated for eulachon and corresponding species life history events.

Physical or biological features		Species Life History Event
Site Type	**Site Attribute**	
Freshwater spawning and incubation	Flow Water quality Water temperature Substrate	Adult spawning Incubation
Freshwater migration	Flow Water quality Water temperature Food	Adult and larval mobility Larval feeding

The range of eulachon in the Pacific Northwest completely overlaps with the range of several ESA-listed stocks of salmon and steelhead as well as green sturgeon. Although the habitat requirements of these fishes differ somewhat from eulachon, efforts to protect habitat generally focus on the maintenance of watershed processes that would be expected to benefit eulachon. The BRT identified dams and water diversions as moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath systems, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods (Gustafson *et al.* 2010). Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown (Gustafson *et al.* 2010). The BRT identified dredging as a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental.

The lower Columbia River mainstem provides spawning and incubation sites, and a large migratory corridor to spawning areas in the tributaries. Prior to the construction of Bonneville Dam, eulachon ascended the Columbia River as far as Hood River, Oregon. Major tributaries that support spawning runs include the Grays, Skamokawa, Elochoman, Kalama, Lewis and Sandy rivers.

The number of eulachon returning to the Umpqua River seems to have declined in the 1980s, and does not appear to have rebounded to previous levels. Additionally, eulachon are regularly caught in salmonid smolt traps operated in the lower reaches of Tenmile Creek by the Oregon Dpartment of Fish and Wildlife (ODFW).

Willamette-Lower Columbia Recovery Domain. Critical habitat was designated in the WLC recovery domain for UWR Chinook salmon, LCR Chinook salmon, LCR steelhead, UWR steelhead, CR chum salmon, southern green sturgeon, and eulachon, and has been proposed for LCR coho salmon. The miles and percentages of designated CH by BLM and other ownerships, by ESU and DPS in this domain, are presented in Table 78.

Table 78. Critical habitat miles and percentages by land ownership by salmon and steelhead ESU or DPS within the planning area boundaries in the Willamette-Lower Columbia River Recovery Domain.

Lower Columbia River Chinook salmon				
Total ESU Miles	BLM Miles in Planning Area	BLM Percent of Total Miles in Planning Area	Other Miles in Planning Area	Other Percent of Total Miles in Planning Area
1,312.9	7.0	1.7 %	398.7	98.3%
Lower Columbia River steelhead				
Total DPS Miles	BLM Miles in Planning Area	BLM Percent of Total Miles in Planning Area	Other Miles in Planning Area	Other Percent of Total Miles in Planning Area
2,444.6	17.7	3.0%	599.0	97.0%
Lower Columbia River coho salmon				
Total ESU Miles	BLM Miles in Planning Area	BLM Percent of Total Miles in Planning Area	Other Miles in Planning Area	Other Percent of Total Miles in Planning Area
3,208.4	18.0	1.6%	1,089	98.4%
Upper Willamette River Chinook salmon				
Total ESU Miles	BLM Miles in Planning Area	BLM Percent of Total Miles in Planning Area	Other Miles in Planning Area	Other Percent of Total Miles in Planning Area
1,471.5	38.8	2.7%	1,399.2	97.3%
Upper Willamette River steelhead				
Total DPS Miles	BLM Miles in Planning Area	BLM Percent of Total Miles in Planning Area	Other Miles in Planning Area	Other Percent of Total Miles in Planning Area
1,284.8	42.0	3.4%	1,209.3	96.6%

The BLM manages lands containing a small percentage of the stream miles for designated CH within each salmon/steelhead ESU or DPS within the planning area boundary. Miles of streams on BLM land with designated CH by ESU or DPS range from 7.0 to 42.0, and percentages of total miles of stream with designated CH within the planning area boundary by ESU or DPS range from 1.6% to 3.4%.

In addition to the Willamette and Columbia River mainstems, important tributaries on the Oregon side of the WLC include Youngs Bay, Big Creek, Clatskanie River, and Scappoose River in the Oregon Coast subbasin; Hood River in the Gorge; and the Sandy, Clackamas, Molalla, North and South Santiam, Calapooia, McKenzie, and Middle Fork Willamette rivers in the West Cascades subbasin.

Land management activities have severely degraded stream habitat conditions in the Willamette River mainstem above Willamette Falls and in associated subbasins. In the Willamette River mainstem and lower sub-basin mainstem reaches, high density urban development and widespread agricultural effects have reduced aquatic and riparian habitat quality and complexity,

and altered sediment and water quality and quantity, and watershed processes. The Willamette River, once a highly braided river system, has been dramatically simplified through channelization, dredging, and other activities that have reduced rearing habitat by as much as 75%. In addition, the construction of 37 dams in the basin blocked access to more than 435 miles of stream and river spawning habitat. The dams alter the temperature regime of the Willamette River and its tributaries, affecting the timing and development of naturally-spawned eggs and fry. Logging in the Cascade and Coast Ranges, and agriculture, urbanization, and gravel mining on valley floors have contributed to increased erosion and sediment loads throughout the WLC domain.

The mainstem Willamette River has been channelized and stripped of large wood. Development began to encroach on the riparian forest beginning in the 1870s (Sedell and Froggatt 1984). The total area of river channels and islands in the Willamette River decreased from 41,000 to 23,000 acres, and the total length of all channels decreased from 355 miles to 264 miles, between 1895 and 1995 (Gregory *et al.* 2002a). They noted that the lower reach, from the mouth of the river to Newberg (RM 50), is confined within a basaltic trench, and that due to this geomorphic constraint, less channel area has been lost than in upstream areas. The middle reach from Newberg to Albany (RM 50 to 120) incurred losses of 12% of primary channel area, 16% of side channels, 33% of alcoves, and 9% of island area. Even greater changes occurred in the upper reach, from Albany to Eugene (RM 187). There, approximately 40% of both channel length and channel area were lost, along with 21% of the primary channel, 41% of side channels, 74% of alcoves, and 80% of island areas.

The banks of the Willamette River have more than 96 miles of revetments; approximately half were constructed by the USACE. Generally, the revetments were placed in the vicinity of roads or on the outside bank of river bends, so that while only 26% of the total length is revetted, 65% of the meander bends are revetted (Gregory *et al.* 2002b). The majority of dynamic sections have been armored, reducing adjustments in channel bed and sediment storage by the river, and thereby diminishing both the complexity and productivity of aquatic habitats (Gregory *et al.* 2002b).

Riparian forests have diminished considerably in the lower reaches of the Willamette River (Gregory *et al.* 2002c). Sedell and Froggatt (1984) noted that agriculture and cutting of streamside trees were major agents of change for riparian vegetation, along with snagging of large wood in the channel. The reduced shoreline, fewer and smaller snags, and reduced riparian forest comprise large functional losses to the river, reducing structural features, inputs of wood and litter, shade, entrained allochthonous materials, and flood flow filtering capacity. Extensive changes began before the major dams were built, with navigational and agricultural demands dominating the early use of the river. The once expansive forests of the Willamette River floodplain provided valuable nutrients and organic matter during flood pulses, food sources for macroinvertebrates, and slow-water refugia for fish during flood events. These forests also cooled river temperatures as the river flowed through its many channels.

Hyporheic flow in the Willamette River has been examined through discharge measurements and is significant in some areas, particularly those with gravel deposits (Wentz *et al.* 1998; Fernald *et al.* 2001). The loss of channel complexity and meandering that fosters creations of gravel

deposits decreases the potential for hyporheic flows, as does gravel mining. Hyporheic flow processes water and affects its quality on reemerging into the main channel, stabilizing variations in physical and chemical water characteristics. Hyporheic flow is important for ecological functions, some aspects of water quality (such as temperature and dissolved oxygen), and some benthic invertebrate life stages. Alcove habitat, which has been limited by channelization, combines low hydraulic stress and high food availability with the potential for hyporheic flows across the steep hydraulic gradients in the gravel separating them from the main channel (Fernald *et al.* 2001).

On the mainstem of the Columbia River, hydropower projects, including the Federal Columbia River Hydropower System (FCRPS), have significantly degraded salmon and steelhead habitats (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011e; NMFS 2013a). The series of dams and reservoirs that make up the FCRPS block an estimated 12 million cubic yards of debris and sediment that would otherwise naturally flow down the Columbia River and replenish shorelines along the Washington and Oregon coasts.

Industrial harbor and port development are also significant influences on the Lower Willamette and Lower Columbia rivers (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011e; NMFS 2013a). Since 1878, 100 miles of river channel within the mainstem Columbia River, its estuary, and Oregon's Willamette River have been dredged as a navigation channel by the USACE. Originally dredged to a 20-foot minimum depth, the Federal navigation channel of the Lower Columbia River is now maintained at a depth of 43 feet and a width of 600 feet. The Lower Columbia River supports five ports on the Washington State side: Kalama, Longview, Skamania County, Woodland, and Vancouver. In addition to loss of riparian habitat, and disruption of benthic habitat due to dredging, high levels of several sediment chemicals — such as arsenic and polycyclic aromatic hydrocarbons — have been identified in Lower Columbia River watersheds in the vicinity of the ports and associated industrial facilities.

The most extensive urban development in the Lower Columbia River subbasin has occurred in the Portland/Vancouver area. Outside of this major urban area, the majority of residences and businesses rely on septic systems. Common water quality issues with urban development and residential septic systems include higher water temperatures, lowered dissolved oxygen, increased fecal coliform bacteria, and increased chemicals associated with pesticides and urban runoff.

The Columbia River estuary has lost a significant amount of the tidal marsh and tidal swamp habitats that are critical to juvenile salmon and steelhead, particularly small or ocean-type species (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011e; NMFS 2013a). Edges of marsh areas provide sheltered habitats for juvenile salmon and steelhead where food, in the form of amphipods or other small invertebrates that feed on marsh detritus, is plentiful, and larger predatory fish can be avoided. Historically, floodwaters of the Columbia River inundated the margins and floodplains along the estuary, allowing juvenile salmon and steelhead access to a wide expanse of low-velocity marshland and tidal channel habitats. In general, the riverbanks were gently sloping, with riparian and wetland vegetation at the higher elevations of the river floodplain becoming habitat for salmon and steelhead during flooding river discharges or flood tides. Sherwood *et al.* (1990) estimated that the Columbia River estuary lost 20,000 acres of tidal

swamps, 10,000 acres of tidal marshes, and 3,000 acres of tidal flats between 1870 and 1970. This study further estimated an 80% reduction in emergent vegetation production and a 15% decline in benthic algal production.

Habitat and food-web changes within the estuary, and other factors affecting salmon population structure and life histories, have altered the estuary's capacity to support juvenile salmon (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011e; NMFS 2013a). Diking and filling have reduced the tidal prism and eliminated emergent and forested wetlands and floodplain habitats. These changes have likely reduced the estuary's salmon-rearing capacity. Moreover, water and sediment in the Lower Columbia River and its tributaries contain toxins that are harmful to aquatic resources (Lower Columbia River Estuary Partnership 2007). Contaminants of concern include dioxins and furans, heavy metals, polychlorinated biphenyls (PCBs) and organochlorine pesticides such as DDT. Simplification of the population structure and life-history diversity of salmon possibly is yet another important factor affecting juvenile salmon viability. Restoration of estuarine habitats, particularly diked emergent and forested wetlands, reduction of avian predation by terns, and flow manipulations to restore historical flow patterns have likely begun to enhance the estuary's capacity to support salmon, although historical changes in population structure and salmon life histories may prevent salmon from making full use of the estuarine habitats.

The WLC recovery domain CHART determined that most HUC_5 watersheds with PCEs for salmon or steelhead are in fair-to-poor or fair-to-good condition (NOAA Fisheries 2005). However, most of these watersheds have some or a high potential for improvement. Only watersheds in the upper McKenzie River and its tributaries are in good to excellent condition with no potential for improvement (Table 79).

Table 79. Willamette-Lower Columbia Recovery Domain: Current and potential quality of HUC_5 watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (CK), chum salmon (CM), and steelhead (ST) (NOAA Fisheries 2005).[12] Watersheds are ranked primarily by "current quality" and secondly by their "potential for restoration."

Current PCE Condition	Potential PCE Condition
3 = good to excellent 2 = fair to good 1 = fair to poor 0 = poor	3 = highly functioning, at historical potential 2 = high potential for improvement 1 = some potential for improvement 0 = little or no potential for improvement

Watershed Name(s) and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Columbia Gorge #1707010xxx			
Wind River (511)	CK/ST	2/2	2/2
East Fork Hood (506), & Upper (404) & Lower Cispus (405) rivers	CK/ST	2/2	2/2
Plympton Creek (306)	CK	2	2
Little White Salmon River (510)	CK	2	0
Grays Creek (512) & Eagle Creek (513)	CK/CM/ST	2/1/2	1/1/2
White Salmon River (509)	CK/CM	2/1	1/2
West Fork Hood River (507)	CK/ST	1/2	2/2
Hood River (508)	CK/ST	1/1	2/2
Unoccupied habitat: Wind River (511)	Chum conservation value "Possibly High"		
Cascade and Coast Range #1708000xxx			
Lower Gorge Tributaries (107)	CK/CM/ST	2/2/2	2/3/2
Lower Lewis (206) & North Fork Toutle (504) rivers	CK/CM/ST	1/3/1	2/1/2
Salmon (101), Zigzag (102), & Upper Sandy (103) rivers	CK/ST	2/2	2/2
Big Creek (602)	CK/CM	2/2	2/2
Coweeman River (508)	CK/CM/ST	2/2/1	2/1/2
Kalama River (301)	CK/CM/ST	1/2/2	2/1/2
Cowlitz Headwaters (401)	CK/ST	2/2	1/1
Skamokawa/Elochoman (305)	CK/CM	2/1	2
Salmon Creek (109)	CK/CM/ST	1/2/1	2/3/2
Green (505) & South Fork Toutle (506) rivers	CK/CM/ST	1/1/2	2/1/2
Jackson Prairie (503) & East Willapa (507)	CK/CM/ST	1/2/1	1/1/2
Grays Bay (603)	CK/CM	1/2	2/3
Upper Middle Fork Willamette River (101)	CK	2	1
Germany/Abernathy creeks (304)	CK/CM	1/2	2
Mid-Sandy (104), Bull Run (105), & Lower Sandy (108) rivers	CK/ST	1/1	2/2
Washougal (106) & East Fork Lewis (205) rivers	CK/CM/ST	1/1/1	2/1/2

[12] On January 14, 2013, NMFS published a proposed rule for the designation of critical habitat for LCR coho salmon (USDC 2013c). The NMFS also completed a draft biological report on critical habitat (NMFS 2012a). Habitat quality assessments for LCR coho salmon are out for review; therefore, they are not included on this table.

Current PCE Condition	Potential PCE Condition
3 = good to excellent 2 = fair to good 1 = fair to poor 0 = poor	3 = highly functioning, at historical potential 2 = high potential for improvement 1 = some potential for improvement 0 = little or no potential for improvement

Watershed Name(s) and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Upper Cowlitz (402) & Tilton rivers (501) & Cowlitz Valley Frontal (403)	CK/ST	1/1	2/1
Clatskanie (303) & Young rivers (601)	CK	1	2
Rifle Reservoir (502)	CK/ST	1	1
Beaver Creek (302)	CK	0	1
Unoccupied Habitat: Upper Lewis (201) & Muddy (202) rivers; Swift (203) & Yale (204) reservoirs	CK & ST Conservation Value "Possibly High"		
Willamette River #1709000xxx			
Upper (401) & South Fork (403) McKenzie rivers; Horse Creek (402); & McKenzie River/Quartz Creek (405)	CK	3	3
Lower McKenzie River (407)	CK	2	3
South Santiam River (606)	CK/ST	2/2	1/3
South Santiam River/Foster Reservoir (607)	CK/ST	2/2	1/2
North Fork of Middle Fork Willamette (106) & Blue (404) rivers	CK	2	1
Upper South Yamhill River (801)	ST	2	1
Little North Santiam River (505)	CK/ST	1/2	3/3
Upper Molalla River (905)	CK/ST	1/2	1/1
Abernethy Creek (704)	CK/ST	1/1	1/2
Luckiamute River (306) & Yamhill (807) Lower Molalla (906) rivers; Middle (504) & Lower (506) North Santiam rivers; Hamilton Creek/South Santiam River (601); Wiley Creek (608); Mill Creek/Willamette River (701); & Willamette River/Chehalem Creek (703); Lower South (804) & North (806) Yamhill rivers; & Salt Creek/South Yamhill River (805)	CK/ST	1	1
Hills (102) & Salmon (104) creeks; Salt Creek/Willamette River (103), Hills Creek Reservoir (105), Middle Fork Willamette/Lookout Point (107); Little Fall (108) & Fall (109) creeks; Lower Middle Fork of Willamette (110), Long Tom (301), Marys (305) & Mohawk (406) rivers	CK	1	1
Willamina Creek (802) & Mill Creek/South Yamhill River (803)	ST	1	1
Calapooia River (303); Oak (304) Crabtree (602), Thomas (603) & Rickreall (702) creeks; Abiqua (901), Butte (902) & Rock (903) creeks/Pudding River; & Senecal Creek/Mill Creek (904)	CK/ST	1/1	0/1
Row River (201), Mosby (202) & Muddy (302) creeks, Upper (203) & Lower (205) Coast Fork Willamette River	CK	1	0
Unoccupied habitat in North Santiam (501) & North Fork Breitenbush (502) rivers; Quartzville Creek (604) and Middle Santiam River (605)	CK & ST Conservation Value "Possibly High"		
Unoccupied habitat in Detroit Reservoir/Blowout Divide Creek (503)	Conservation Value: CK "Possibly Medium"; ST Possibly High"		
Lower Willamette #1709001xxx			

Current PCE Condition	Potential PCE Condition
3 = good to excellent 2 = fair to good 1 = fair to poor 0 = poor	3 = highly functioning, at historical potential 2 = high potential for improvement 1 = some potential for improvement 0 = little or no potential for improvement

Watershed Name(s) and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Collawash (101), Upper Clackamas (102), & Oak Grove Fork (103) Clackamas rivers	CK/ST	2/2	3/2
Middle Clackamas River (104)	CK/ST	2/1	3/2
Eagle Creek (105)	CK/ST	2/2	1/2
Gales Creek (002)	ST	2	1
Lower Clackamas River (106) & Scappoose Creek (202)	CK/ST	1	2
Dairy (001) & Scoggins (003) creeks; Rock Creek/Tualatin River (004); & Tualatin River (005)	ST	1	1
Johnson Creek (201)	CK/ST	0/1	2/2
Lower Willamette/Columbia Slough (203)	CK/ST	0	2

Oregon Coast Recovery Domain. In this recovery domain, critical habitat has been designated for OC coho salmon, southern green sturgeon, and eulachon. The miles and percentages of designated CH by BLM and other ownerships for the OC coho ESU in this domain are presented in Table 80.

Table 80. Critical habitat miles and percentages by land ownership for the Oregon Coast coho salmon ESU.

Total ESU Miles	BLM Miles in Planning Area	BLM Percent of Total Miles in Planning Area	Other Miles in Planning Area	Other Percent of Total Miles in Planning Area
6,649.8	687.8	10.3%	5,961.9	89.7%

The BLM manages lands containing 687.8 miles of OC coho salmon designated CH within the planning area boundary. This represents 10.3 percent of all OC coho salmon designated CH within the planning area. Many large and small rivers supporting significant populations of coho salmon flow through this domain, including the Nehalem, Nestucca, Siletz, Yaquina, Alsea, Siuslaw, Umpqua, Coos, and Coquille.

The historical disturbance regime in the central Oregon Coast Range was dominated by a mixture of high and low-severity fires, with a natural rotation of approximately 271 years. Old-growth forest coverage in the Oregon Coast Range varied from 25 to 75% during the past 3,000 years, with a mean of 47%, and never fell below 5% (Wimberly *et al.* 2000). Currently, the Coast Range has approximately 5% old-growth, almost all of it on Federal lands. The dominant disturbance now is logging on a cycle of approximately 30 to 100 years, with fires suppressed.

Oregon's assessment of OC coho salmon (Nicholas *et al.* 2005) mapped how streams with high intrinsic potential for rearing are distributed by land ownership categories. Agricultural lands and private industrial forests have by far the highest percentage of land ownership in high intrinsic potential areas and along all coho salmon stream miles. Federal lands have only about 20% of coho salmon stream miles and 10% of high intrinsic potential stream reaches. BLM land ownership in the OC coho ESU is 10.3% of designated CH stream miles and 7.2% of high intrinsic potential stream reaches. Because of this distribution, activities in lowland agricultural areas are particularly important to the conservation of OC coho salmon.

The OC coho salmon assessment concluded that at the scale of the entire domain, pools are generally abundant, although slow-water and off-channel habitat (which are important refugia for coho salmon during high winter flows) are limited in the majority of streams when compared to reference streams in minimally-disturbed areas. The amount of large wood in streams is low in all four ODFW monitoring areas and land-use types relative to reference conditions. Amounts of fine sediment are high in three of the four monitoring areas, and were comparable to reference conditions only on public lands. Approximately 62 to 91% of tidal wetland acres (depending on estimation procedures) have been lost for functionally and potentially independent populations of coho salmon.

As part of the coastal coho salmon assessment, the Oregon Department of Environmental Quality analyzed the status and trends of water quality in the range of OC coho salmon using the Oregon water quality index, which is based on a combination of temperature, dissolved oxygen, biological oxygen demand, pH, total solids, nitrogen, total phosphates, and bacteria. Using the index at the species scale, 42% of monitored sites had excellent to good water quality, and 29% show poor to very poor water quality (ODEQ 2005). Within the four monitoring areas, the North Coast had the best overall conditions (six sites in excellent or good condition out of nine sites), and the Mid-South coast had the poorest conditions (no excellent condition sites, and only two out of eight sites in good condition). For the 10-year period monitored between 1992 and 2002, no sites showed a declining trend in water quality. The area with the most improving trends was the North Coast, where 66% of the sites (six out of nine) had a significant improvement in index scores. The Umpqua River basin, with one out of nine sites (11%) showing an improving trend, had the lowest number of improving sites.

Southern Oregon/Northern California Coast Recovery Domain. In this recovery domain critical habitat has been designated for SONCC coho salmon and southern green sturgeon. The miles and percentages of designated CH by BLM and other ownerships for the SONCC coho salmon ESU in this domain are presented in Table 81.

Table 81. Critical habitat miles and percentages by land ownership for the Southern Oregon/Northern California Coast coho salmon ESU.

Total ESU Miles	BLM Miles in Planning Area	BLM Percent of Total Miles in Planning Area	Other Miles in Planning Area	Other Percent of Total Miles in Planning Area
3,133.1	375.3	12.1%	2,721.6	87.9%

The BLM manages lands containing 375.3 miles of SONCC coho salmon designated CH within the planning area boundary. This represents 12.1% percent of all SONCC coho salmon designated CH within the planning area.

Many large and small rivers supporting significant populations of coho salmon flow through this area, including the Elk, Rogue, Chetco, Smith and Klamath. The following summary of critical habitat information in the Elk, Rogue, and Chetco rivers generally applies to habitat characteristics and limiting factors in other basins in this area.

The Elk River flows through Curry County, and drains approximately 92 square miles (or 58,678 acres) (Maguire 2001). Historical logging, mining, and road building have degraded stream and riparian habitats in the Elk River basin. Limiting factors identified for salmon and steelhead production in this basin include sparse riparian cover, especially in the lower reaches, excessive fine sediment, high water temperatures, and noxious weed invasions (Maguire 2001).

The Rogue River drains approximately 5,160 square miles within Curry, Jackson and Josephine counties in southwest Oregon. The mainstem is about 200 miles long and traverses the coastal mountain range into the Cascades. The Rogue River estuary has been modified from its historical condition. Jetties were built by the U.S Army Corps of Engineers (USACE) in 1960, which stabilized and deepened the mouth of the river. A dike that extends from the south shore near Highway 101 to the south jetty was completed in 1973. This dike created a backwater for the large shallow area that existed here, which has been developed into a boat basin and marina, eliminating most of the tidal marsh.

The quantity of estuary habitat is naturally limited in the Rogue River. The Rogue River has a large drainage area, but its 1,880 acres estuary is one of the smallest among Oregon's coastal rivers. Between 1960 and 1972, approximately 13 acres of intertidal and 14 acres of subtidal land were filled in to build the boat basin dike, the marina, north shore riprap and the other north shore developments (Hicks 2005). Jetties constructed in 1960 to stabilize the mouth of the river and prevent shoaling have altered the Rogue River, which historically formed a sill during summer months (Hicks 2005).

The Lower Rogue Watershed Council's watershed analysis (Hicks 2005) lists factors limiting fish production in tributaries to the Lower Rogue River watershed. The list includes water temperatures, low stream flows, riparian forest conditions, fish passage and over-wintering habitat. Limiting factors identified for the Upper Rogue River basin include fish passage barriers, high water temperatures, insufficient water quantity, lack of large wood, low habitat complexity, and excessive fine sediment (Rogue Basin Coordinating Council 2006).

The Chetco River estuary has been significantly modified from its historical condition. Jetties were erected by the USACE in 1957, which stabilized and deepened the mouth of the river. These jetties have greatly altered the mouth of the Chetco River and how the estuary functions as habitat for salmon migrating to the ocean. A boat basin and marina were built in the late 1950s and eliminated most of the functional tidal marsh. The structures eliminated shallow water habitats and vegetation in favor of banks stabilized with riprap. Since then, nearly all remaining bank habitat in the estuary has been stabilized with riprap. The factors limiting fish production in

the Chetco River appear to be high water temperature caused by lack of shade, especially in tributaries, high rates of sedimentation due to roads, poor over-wintering habitat due to a lack of large wood in tributaries and the mainstem, and poor quality estuary habitat (Maguire 2001).

B. Fish species under the jurisdiction of the FWS

1. Status of the Species

The description of the status of Lost River and shortnose sucker species and their designated CH presented below is from USFWS (2015). Due to the similarities of the two species, the USFWS combined the discussions of the two species and their designated CH. The description of the status of bull trout and its designated CH is also from USFWS (2015).

Lost River and Shortnose Sucker

Legal Status

The Lost River sucker and shortnose sucker were listed as endangered on July 18, 1988 (53 FR 27130). They also are designated endangered by the states of Oregon and California. A recovery plan for both species was finalized on March 17, 1993 (USFWS 1993). Five-year reviews for the Lost River sucker and shortnose sucker were most recently completed in 2012 (USFWS 2012a and 2012b). A considerable amount of scientific information had been collected since the 1993 recovery plan and an updated, revised recovery plan for the Lost River sucker and shortnose sucker was released in 2013 (USFWS 2013).

On December 1, 1994, the USWFS published proposed critical habitat for Lost River sucker and shortnose sucker (59 FR 61744); that proposal was never finalized. A final rule designating CH for the Lost River sucker and shortnose sucker was published on December 11, 2012 (77 FR 73740).

Life history

Reproduction

Both sucker species spawn from February through May over gravel substrates in streams and rivers (Buettner and Scoppettone 1990, pp. 19-20, 44-46). The Lost River sucker also spawns over rock and gravel substrates associated with shallow, spring-influenced areas along the eastern shore of Upper Klamath Lake (Barry et al. 2007a, pp. 18-19). Females broadcast their eggs where they fall into crevices between gravel or they are buried slightly (Buettner and Scoppettone 1990, p. 19).

Both sucker species grow rapidly in their first five to six years, reaching sexual maturity sometime between years four and six for shortnose sucker and four and nine for Lost River sucker (Perkins et al. 2000b, p. 21). Lost River sucker and shortnose sucker have been aged to 55 and 33 years, respectively. Females produce a large number of eggs, 44,000 to 200,000 per year for Lost River sucker and 18,000 to 70,000 per year for shortnose sucker when they spawn (Buettner and Scoppettone 1990, pp. 20, 47). Larger, older females produce substantially more eggs and, therefore, can contribute relatively more to recruitment than a recently matured female. However, only a small percentage of the eggs survive to become larvae. Because adults are potentially long-lived and fecund, these life history traits should make the species less sensitive

to larval and juvenile mortality, but under current conditions adult survival is low and there is inadequate recruitment, as will be discussed later (USFWS 2013, p. v). Lost River sucker and shortnose sucker do not normally die after spawning and can spawn many times during their lifetime.

Population Dynamics

Population Structure

The Lost River sucker population in the Upper Klamath Lake appears to consist of two distinct stocks: (1) several thousand Lost River sucker and a few shortnose sucker that spawn along shoreline springs, and (2) tens of thousands Lost River suckers that spawn in the Williamson and Sprague Rivers (Perkins et al. 2000b, p. 33). Mark-recapture data show that the two stocks maintain a high degree of fidelity to spawning areas and therefore seldom interbreed (Hayes et al. 2002, p. 39; Barry et al. 2007b, p. 41, b, p. 23). Shortnose sucker spawning is primarily confined to the Williamson River system, so there is only one substantial population or stock in Upper Klamath Lake (USFWS 2013, p. 6).

Ecological Habitat Characteristics

The Lost River sucker and shortnose sucker have complex life histories that include stream/river, lake, marsh, and shoreline spring habitats and both species use a number of different aquatic habitats through their lives (USFWS 2013, pp. 13-14). Adults primarily occupy open-water habitats with depths of 3 feet to 15 feet, but appear to prefer depths from 5 feet to 10 feet (Peck 2000, p. 3; Reiser et al. 2001, ch. 5 pp. 28-30; Banish et al. 2009, pp. 163-164). Lost River sucker and shortnose sucker are generally limited to lake habitats when not spawning, although river-resident fish have been documented, especially in the Lost River system (Buettner and Scoppettone 1991, pp. 14, 20).

Soon after hatching, when larvae reach about 0.2 to 0.6 inches total length (TL) and are mostly transparent with a small yolk sac, they move out of the gravel and into the water column (Buettner and Scoppettone 1990, pp. 101-102). Larval suckers spend relatively little time in rivers/streams before drifting downstream to the lakes by mid-July (Cooperman and Markle 2003, pp. 1147, 1149; 2004 p. 366; Ellsworth et al. 2009, p. 27); however, some instream rearing has been observed in the Sprague River and elsewhere. Larval habitat is generally in shallow water along the shoreline in both vegetated and unvegetated habitats (Buettner and Scoppettone 1990, pp. 30, 51; Cooperman and Markle 2004, p. 375; Crandall et al. 2008, p. 403). Juvenile suckers also occupy a wide variety of near and off-shores habitat in Upper Klamath Lake including emergent wetlands and non-vegetated areas with sand, mud, gravel, and cobble substrates (Buettner and Scoppettone 1990, pp. 33, 51; Simon and Markle 2001, p. 12, 2004, p. 12; Simon et al. 1996, p. 14, 1998, p. 7; Hendrixson et al. 2007a, p. 2, b, entire; Burdick et al. 2008, entire) and move offshore into the lake as they grow. Water quality, especially dissolved oxygen concentrations are likely to affect distributions (Burdick et al. 2009, p. 2; Burdick and VanderKooi 2010, p. 13; Rasmussen 2011, p. 450; USFWS 2013, p. 14).

Status and Distribution

Historical status and distribution

Prior to Anglo-European settlement, Lost River suckers and shortnose suckers occurred in Upper Klamath Lake, Tule Lake, Lower Klamath Lake, and presumably Clear Lake, as well as their tributaries. However, at the time of listing, these species were known from Upper Klamath Lake and its tributaries and outlet (Klamath Co., Oregon), including a "substantial population" of shortnose sucker in Copco Reservoir (Siskiyou Co., California), as well as collections of both species from Iron Gate Reservoir (Siskiyou Co., California) and J.C. Boyle Reservoir (Klamath Co., Oregon), and Lost River sucker from Sheepy Lake and Lower Klamath Lake (Siskiyou Co., California; USFWS 1988, 2013). Remnants or highly hybridized populations were also stated to occur in the Lost River system (Klamath Co., Oregon, and Modoc and Siskiyou Co., California) including both species in Clear Lake Reservoir (Modoc Co., California) and Lost River sucker in Tule Lake (Siskiyou Co., California; USFWS 1988, p. 5017).

Although not stated explicitly, the reference in the listing document to "highly hybridized populations" in the Lost River Basin probably refers to shortnose suckers within Gerber Reservoir (Klamath Co., Oregon). Spawning likely occurred throughout the Upper Klamath Lake drainage in both rivers and springs along shoreline of the lake (Andreasen 1975, pp. 38-39; Stine 1982, p. 9; NRC 2004, p. 194). Spawning also occurred in significant numbers in the Lost River system (Bendire 1889, p. 444; Howe 1969, p. 156), some of which occurred in the Big Springs area at Bonanza, Oregon.

These two fishes were once very abundant and were important seasonal foods of Native Americans and white settlers in the upper Klamath River basin prior to about 1900 (Cope 1879, p. 785; Gilbert 1898, p. 6; Stern 1965, pp. 11-12; Howe 1969, p. 134). Sucker spawning migrations occurred in the spring at a critical time when winter food stores had been exhausted (Stern 1965, p. 11). The Klamath and Modoc Indians dried suckers for later use. It was estimated that the aboriginal harvest at one site on the Lost River may have been 50 tons annually (Stern 1965, p. 11). Settlers built a cannery on the Lost River and suckers were also processed into oil and salted for shipment. In 1900, the Klamath Republican newspaper reported that "mullet," as suckers were referred to, were so thick in the Lost River that a man with a pitch fork could throw out a wagon load in an hour. The first reference to sport fishing of "mullet" appears to be a 1909 reference to sportsmen snagging "mullet" in the Link River at Klamath Falls (Klamath Republican, 1909).

In 1959, suckers were made a game species under Oregon State law and snagging suckers in the Williamson and Sprague River was popular with locals and out-of-town sportsmen (Bragg 2001, entire, Markle and Cooperman 2002, p. 98). In the 1960s, Oregon Department of Fish and Wildlife (ODFW) estimated 100,000 pounds of suckers per year (approximately 12,500 fish) were harvested (Eugene Register-Guard, 1967). ODFW data indicated from 1966 through 1978, an approximate 50 percent decline in catches (from 3.5-5.6 suckers per angler-day before the 1969 bag limit, to 1.5-3.0 afterwards, Markle and Cooperman 2002, p. 98). More than 3,000 suckers were taken in the snag fishery in 1968 (Golden 1969, p. 9). Numbers of harvested suckers from spawning runs in the Sprague and lower Williamson Rivers increased from 1.2 fish per hour in 1966 to 4.7 fish/hour in 1969 and then, from 1969 on, there was a steady decline to 0.8 fish/hour in 1974 (Andreasen 1975, p. 36). Average weight of suckers caught in the fishery

declined about 40 percent from 1966 to 1974 (from 7.5 to 4.9 pounds), and declines continued to the time of listing. By 1985, Bienz and Ziller (1987) estimated the harvest had dropped by about 95 percent, and based on this information, the game fishery was terminated in 1987, just prior to federal listing in 1988 (USFWS 1988, p. 5017).

Current status and distribution

At the time of listing, Lost River sucker and shortnose sucker were known from Upper Klamath Lake and its tributaries (Klamath Co., Oregon), the Lost River (Klamath Co. Oregon, and Modoc and Siskiyou Co., California), Clear Lake (Modoc Co., California), the Klamath River above Keno (Klamath Co., Oregon), and Klamath Rivers below Keno (Klamath Co., Oregon, and Siskiyou Co., California; USFWS 1988, p. 5017; 2013, p. 12) (Figure 9). The largest populations occur in Upper Klamath Lake and Clear Lake and their tributaries.

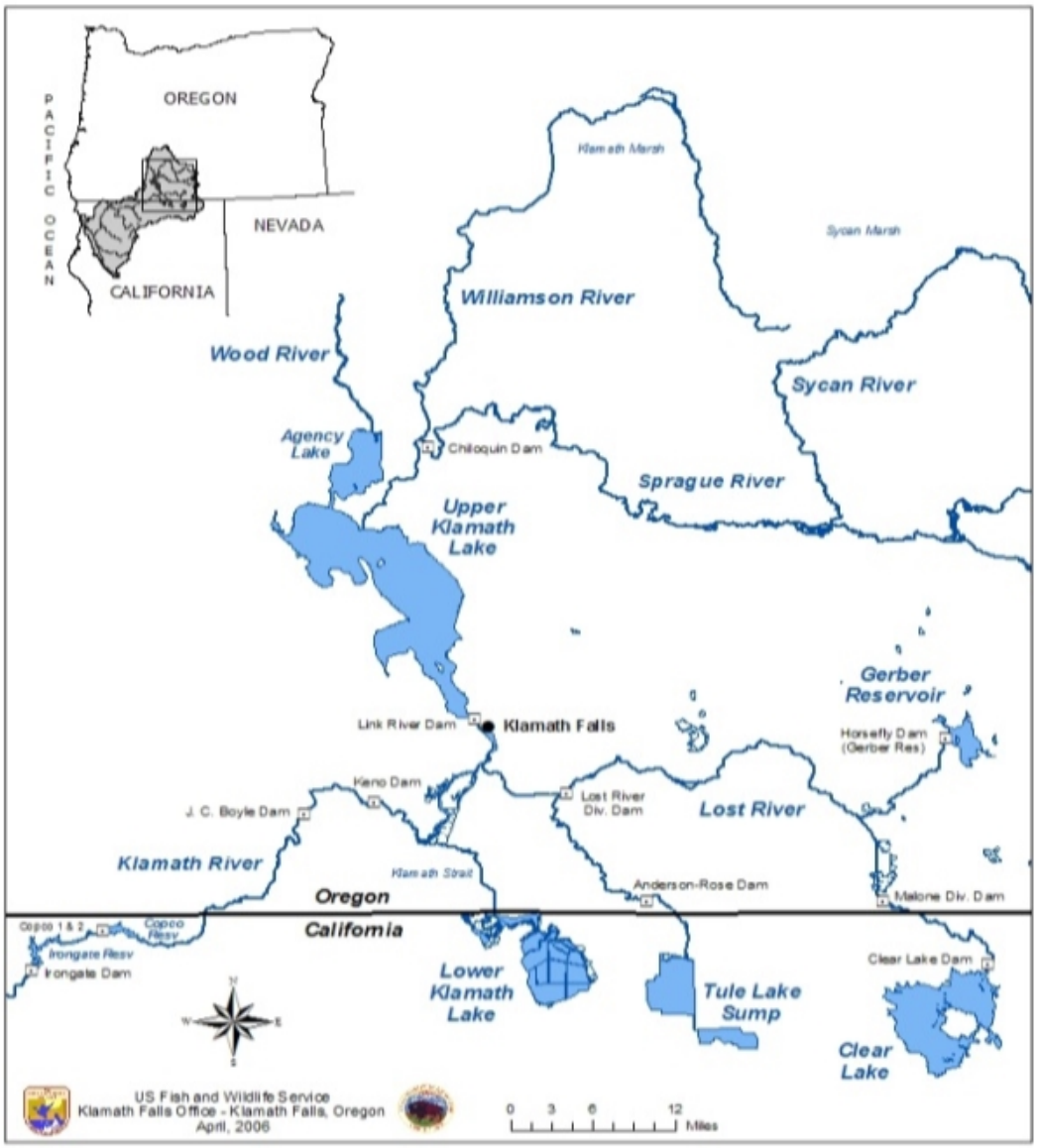


Figure 9. Map of the Upper Klamath River Basin showing primary water bodies.

Currently the total area of occupied lake habitat for Lost River sucker and shortnose sucker is about 118,000 acres, of which approximately 65 percent is in Upper Klamath Lake, which covers approximately 77,000 acres at full pool (Rasmussen 2011, p. 445; USFWS 2013, pp. 3-4). The remaining habitat is in Clear Lake (25,000 acres); Tule Lake sump 1A (9,000 acres); Gerber Reservoir (4,000 acres); and Keno Reservoir (2,500 acres). Disjunct 'populations' also occupy areas outside of their historic distribution in Copco, Iron Gate, and J.C. Boyle Reservoirs on the Klamath River (NRC 2004, p. 192). Additional information about the distribution of the Lost River sucker and shortnose sucker is presented in the recent 5-year status reviews (USFWS 2012a, pp. 5-6, b, pp. 5-6), the revised recovery plan for the Lost River sucker and shortnose sucker (USFWS 2013, entire), and the 2013 Klamath Project biological opinion (NMFS and USFWS 2013, entire).

Upper Klamath Lake and Tributaries

Upper Klamath Lake, in Klamath County, at 77,000 acres, is the largest natural lake in Oregon. Adult Lost River and shortnose suckers are widely distributed in Upper Klamath Lake during the fall and winter (NRC 2004, pp. 26-27, 189-193). In the spring months, they congregate in the north end of the lake near Goose Bay and Modoc Point prior to moving into tributaries or shoreline areas for spawning (Hendrixson et al. 2003, p. 100). During summer months, adults are primarily found in the northern portion of the lake north of Bare Island (Peck 2000, pp. 6-7; Banish et al. 2009, p. 159). Reasons for this summer distribution appear to be related to better water quality near spring-fed Pelican Bay and the Williamson River (Reiser et al. 2001, ch. 6 p. 38; Banish et al. 2009, pp. 163-164). During the summer and early fall, Upper Klamath Lake water quality conditions periodically deteriorate to stressful and even lethal levels for suckers as a result of decomposition of massive algae blooms and resultant low levels of dissolved oxygen (Perkins et al. 2000b, p. 4; Loftus 2001, ch.1 p. 3; Wood et al. 2006, p. 3; Morace 2007, p. 2). Multi-year radio telemetry studies have documented Lost River and shortnose suckers concentrating in or near Pelican Bay during periods of deteriorating water quality, presumably to seek refuge at areas of better water quality (Peck 2000, p. 2; Banish et al. 2009, p. 163).

A discrete group of Lost River and shortnose suckers are known to spawn at sites along the eastern shoreline of Upper Klamath Lake below Modoc Rim, a prominent fault scarp (Andreasen 1975, p. 39; Buettner and Scoppettone 1990, p. 19; Hayes and Shively 2001, p. 43; Shively et al. 2000, entire, Barry et al. 2007b, p. 18). All of the sites are associated with spring seeps that affect water temperature, which is warmer than the adjacent lake during the spawning season. Current spawning populations at the shoreline springs of Upper Klamath Lake are likely to number in the thousands of Lost River suckers and less than 100 shortnose suckers (Barry et al. 2007b, p. 21; USFWS 2013, pp. 2, 6).

Known areas of concentrated Lost River sucker spawning in the Williamson and Sprague Rivers include the lower Williamson River from River Mile (RM) 6 to the confluence of the Sprague River (RM 11), lower Sprague River below Chiloquin Dam, and in the Beatty Gap area of the upper Sprague River (RM 75) (Buettner and Scoppettone 1990, p. 19; Tyler et al. 2007, pp. 10-11; Ellsworth et al. 2008, p. 3). Removal of the Chiloquin Dam unblocks approximately 75 miles for spawning and migrations, but it is too early to assess the overall impact to the Lost River sucker (USFWS 2012a, p. 17). Other areas in the Sprague River watershed where Lost River suckers may spawn include the lower Sycan River and in the Sprague River near the Nine Mile area (Ellsworth et al. 2008, p. 15). Shortnose suckers from Upper Klamath Lake currently spawn in the lower Williamson and Sprague Rivers (Tyler et al. 2007, pp. 12-13; Ellsworth et al. 2008, p. 3). The few adult shortnose suckers captured at shoreline spawning areas in Upper Klamath Lake indicate that some shortnose sucker spawning is likely to still occur at these locations (Hayes et al. 2002, p. 39; Barry et al. 2007a, pp. 1-3, b, p. 21). Although species identification is not clear, a small number of suckers presumed to be shortnose sucker may spawn in the Wood River (USFWS 2012b, p. 5). It is possible that sucker spawning may occur in other tributaries to Upper Klamath Lake; however, recent investigations have not located suckers in tributaries other than the Williamson, Sprague, and Wood Rivers.

In the Williamson River, larval out-migration begins in April and is generally completed by July (USFWS 2013, p. 13). Downstream movement takes place mostly at night and near the water surface (Klamath Tribes 1996, pp. 5-6; Cooperman 2004, p. 7; Ellsworth et al. 2008, pp. 11-12,

2009, p. 15), but movement does occur along the river margin during the day, at least in the lower river. Once in the lake, larvae disperse to near-shore areas where they move into shallow, near-shore, vegetated and unvegetated habitats (Cooperman 2004, p. 7; Cooperman and Markle 2004, pp. 365-366; Crandall et al. 2008, p. 403; Erdman and Hendrixson 2009, p. iii, 2010, p. 6).

In Upper Klamath Lake, larval suckers are first captured by researchers in early April during most years, with peak catches occurring in late May to early July (Cooperman and Markle 2000, pp. 8-10; Crandall et al. 2008, p. 407; Erdman and Hendrixson 2009, p. 9, 2010, pp. 7, 12). Larval habitat is generally along the shoreline, in water 0.5-3 feet deep (Buettner and Scoppettone 1990, p. 30; Cooperman and Markle 2004, p. 373). Larval density in near-shore habitats is usually low (less than $10/m^2$), but densities as high as 120 larvae/m^2 have been documented (Buettner and Scoppettone 1990, p. 30; Markle and Simon 1993, p. iv; Simon and Markle 2001, p. 32, 2004, p. 20; Simon et al. 1995, pp. 11-12, 1996, pp. 10-11).

Keno Reservoir

Keno Reservoir is the first of five reservoirs on the Klamath River and is located just downstream of Upper Klamath Lake, near Klamath Falls, Oregon. Fisheries surveys in Keno Reservoir have been conducted infrequently and have generally been short in duration (Hummel 1993, p. 1; Piaskowski 2003, p. 1). The only intensive monitoring effort was conducted by Terwilliger et al. (2004, entire). Larvae and age-0 suckers were generally most abundant in the upper part of Keno Reservoir and decreased downstream. Juvenile, sub-adult and adult suckers are less common; although, U.S. Bureau of Reclamation (USBR) biologists have captured small numbers of adult suckers in Lake Ewauna, which is located at the upper end of the Keno Reservoir, indicating that a population numbering several thousand resides there (Kyger and Wilkens 2011, p. 3).

The relatively low number of adult suckers residing in Keno Reservoir appears to be related primarily to poor water quality in the summer (Piaskowski 2003, p. 7). Keno Reservoir is listed by the State of Oregon for not meeting CWA Section 303(d) water quality standards for pH, chlorophyll-a, dissolved oxygen and dissolved oxygen concentrations (Piaskowski 2003, p. 1). The reservoir regularly reaches stressful and lethal levels for suckers during July and August (Piaskowski 2003, p. 7; Deas and Vaughn 2006, p. i; USBR 2007, p. 109; Kirk et al 2010, ch. 3 p. 11; Sullivan et al 2011, p. 4). Fish die-offs, including juvenile suckers, have been a regular occurrence in the reservoir (Tinniswood 2006, entire).

Gerber Reservoir

Gerber Reservoir is a small reservoir with a surface area of approximately 4,000 acres and is located in southeastern Klamath County, Oregon (Figure 10). Monitoring in Gerber Reservoir has documented a substantial shortnose sucker population (or shortnose sucker x Klamath largescale suckers [*Catostomus snyderi*]) exhibiting multiple size classes and presumably multiple age classes. Data from 2004 to 2006 indicate a lower frequency of larger adults compared to those from 2000 (Piaskowski and Buettner 2003, pp. 15-16; Leeseberg et al. 2007, pp. 7-8; Barry et al. 2007c, pp. 6-8). Such a change in length frequency suggests relatively good recruitment but low adult survivorship (USFWS 2002, p. 34). Lost River suckers do not occur in Gerber Reservoir probably because none were upstream of dam when it was constructed (Piaskowski and Buettner 2003, p. 4; Leeseberg et al. 2007, p. 4; Barry et al. 2007c, p. 3).

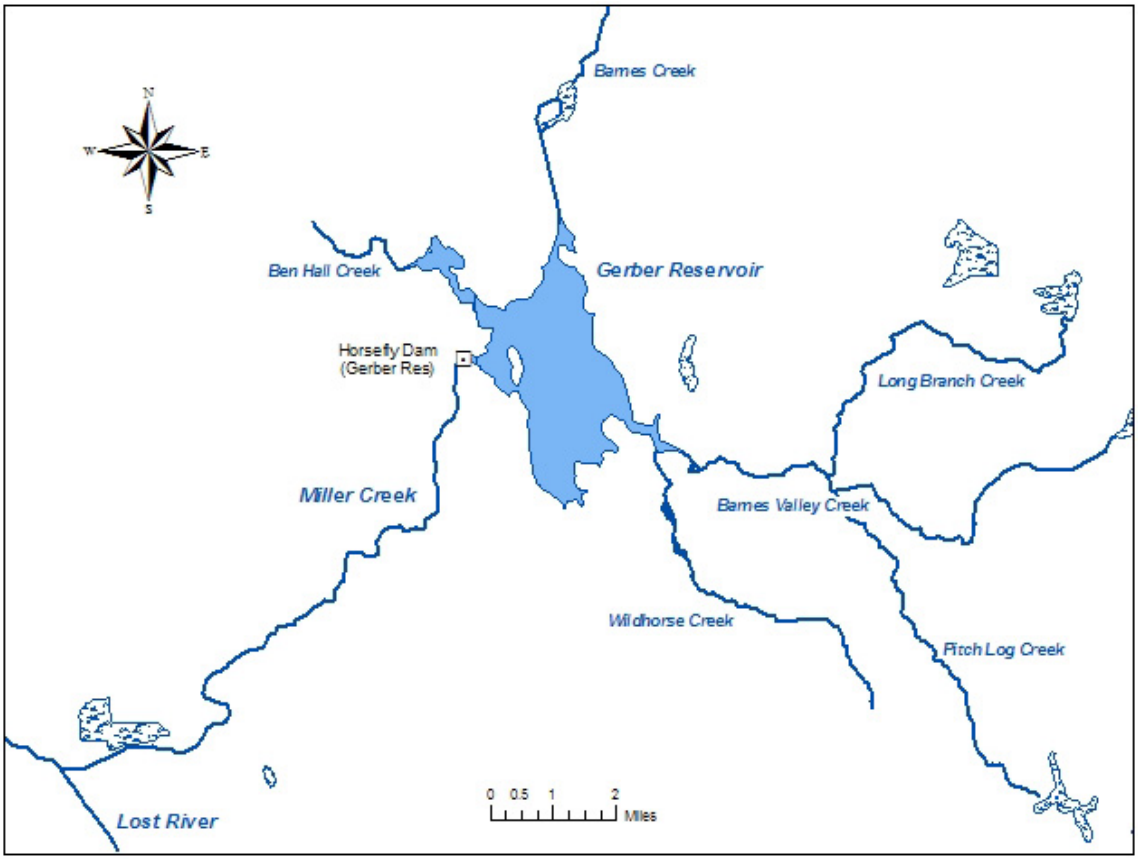


Figure 10. Vicinity map for the Gerber Reservoir area in Klamath County, Oregon.

While the population of shortnose sucker in Gerber Reservoir appears to have more frequent recruitment than some other populations, the problems of restricted distribution and lack of genetic connectivity with other populations still exist (USFWS 2012b, p. 15). A high degree of hybridization between shortnose and Klamath largescale suckers are thought to occur in Gerber Reservoir (Markle et al. 2005, p. 486). However, until the taxonomic status of these fish has been resolved, USFWS considers the Gerber Reservoir and tributary sucker population to be shortnose sucker.

Adult Demography and Population Trends in Upper Klamath Lake

The size of Upper Klamath Lake and the scarcity of Lost River and shortnose suckers make it difficult to accurately estimate their abundance in the lake. Lost River and shortnose sucker demography has been monitored since the mid-1990s using mark-recapture methods and PIT tags. It is also difficult to determine the age of Lost River and shortnose suckers. The length of fish is often used to estimate age of individuals, and the distribution of fish in various age classes is often estimated by assessing the number of fish of various lengths.

Lost River sucker and shortnose sucker populations transformed from ones dominated by old fish with little size diversity and consistently poor recruitment in the late 1980s and early to mid-1990s, to populations dominated by smaller young adult fish and very few remaining large

individuals by the late 1990s (Janney et al. 2008, p. 1812; USFWS 2012a, p. 4). This marked shift in size structure to smaller individuals suggests that substantial recruitment in these populations occurred sometime during the mid-1990s from fish born in the early 1990s. In recent years, populations of both species exhibited a slightly increasing trend in length (i.e., 1 to 1.5 cm increase in median fork length per year) while the number of age classes in the population decreased (Janney and Shively 2007, p. 5; Janney et al. 2008, pp. 1818-1820; USFWS 2012a, p. 4, b, p. 4). Decreasing relative abundance of younger fish suggests that populations are comprised mostly of similarly-aged, older individuals, and that recent substantial recruitment is lacking.

One way ecologists determine if a population is increasing or decreasing is by evaluating survival, mortality, and recruitment, and calculating a variable called lambda (λ) over time. When λ is greater than 1, the population is increasing, and when it is less than 1 the population is decreasing. Several sources of information can be used to derive λ, such as regular counts of individuals, recruitment rates, and survival rates. This information can be determined from regular sampling, but it must be quantified several times before accurate assessments of trends in abundance can be made. When λ is known from a number of samplings conducted over a long period of time, the relative change in the size of a population can be determined, which is a variable known as Δt.

When the USGS Lost River and shortnose sucker capture-recapture program began in 1995, few fish were captured and tagged and mean estimates of survival and λ had little precision or statistical rigor, and Δt could not be accurately calculated. As the number of tagged fish increased each year, precision of these estimates improved and in 2001 (for Williamson-Sprague River spawning shortnose suckers) and 2002 (for shoreline- spawning Lost River suckers) information became adequately precise to accurately calculate λ; relatively accurate estimates of Δt also became possible (USFWS 2012a, p. 8, b, p. 8).

Results from PIT tag studies in Upper Klamath Lake from 2002 to 2007 show that annual survival probabilities of shoreline springs spawning Lost River sucker ranged from 0.80 to 0.95, with a mean of 0.90, and Δt over the period was 0.56 for males and 0.75 for females (USFWS 2012a, p. 10). These Δts show that the abundance of male and female, shoreline-spring-spawning Lost River sucker in 2007 was 56 percent and 75 percent, respectively, of their 2002 abundance (USFWS 2012a, p. 10). Estimates for river-spawning shortnose sucker show that annual survival probabilities were lower for this subpopulation. Over this period, Δts of male and female, river-spawning shortnose sucker were 0.42 and 0.49, respectively (USFWS 2012b, p. 10). Similar data are not currently available for Upper Klamath Lake Lost River sucker river-spawning fish or for Clear Lake Lost River sucker and shortnose sucker populations. This information will be forthcoming in the future when the number of tagged fish is sufficiently large to provide relatively precise, statistically rigorous estimates.

Demography of Lost River sucker and shortnose sucker Populations in Clear Lake

Historically, large Lost River sucker and shortnose sucker spawning migrations occurred from Tule Lake up the Lost River to near Olene and Big Springs near Bonanza, both in Oregon (Howe 1969, pp. 156-158, USFWS 2002, p. 35). Clear Lake currently supports the only substantial populations of shortnose sucker and Lost River sucker in the Lost River sub-basin. Less is known about shortnose suckers and Lost River suckers in Clear Lake than those in Upper

Klamath Lake because monitoring studies have been sporadic over the past 35 years, and studies similar those conducted by Janney et al. (2008, entire) in Upper Klamath Lake were not initiated in Clear Lake until 2006 (Barry et al. 2009, entire). Data collected by Koch et al. (1973 entire) and Andreasen (1975, p. ii) suggested both populations were in decline; however, monitoring from 1989-2000 indicated that populations were relatively large and had diverse age structures (Buettner and Scoppettone 1991, pp. 44-48; USBR 1994, pp. 10-13; Scoppettone et al. 1995, pp. 10-11). In Upper Klamath Lake, 15 age classes were documented in the shortnose sucker population during 1989 and nine during 1993. Similar data are not available for Lost River sucker in Clear Lake, because they appear to be less abundant than shortnose sucker.

Summarizing historical and recently collected data, Barry et al. (2009, p. 9) observed that populations of both species in Clear Lake have undergone major demographic changes during the past 15 years. Populations in the mid-1990s showed little evidence of recruitment and consisted mostly of large and presumably older suckers. The abundance of large suckers decreased in the late 1990s and early 2000s, and current populations are mostly ones recruited into the adult population in the late 1990s (Barry et al. 2009, p. 9). Length-frequencies from 2005 – 2009 studies found little evidence of shortnose sucker recruitment and that recruitment into the Lost River sucker population had been relatively consistent over the period. Variability in age class structure, longevity, and abundance of Lost River sucker and shortnose sucker in Clear Lake is poorly understood in comparison with populations in Upper Klamath Lake. Several more years of sampling and analysis are needed before data are sufficient to discern current status of these populations and their demographic health.

Threats

The reasons for listing as well as threats to the continued survival of Lost River sucker and shortnose sucker are well reviewed in a number of reports and peer reviewed articles (USFWS 1988, p. 5017, 2012a, pp. 15-25, b, pp. 15-25, 2013, pp. v-vi; Markle and Cooperman 2002, entire; NRC 2004, pp. 200-209; ISRP 2005, entire; Rasmussen 2011, entire; NMFS and USFWS 2013, pp. 24-34) . The major threats are discussed below.

Effects of Habitat Loss and Alteration

Loss and alteration of habitats (including spawning and rearing habitats) were major factors leading to the listing of both species (USFWS 1988, p. 5017) and continue to be significant threats to recovery. As noted above, both species use the spectrum of aquatic habitats during some stage of the life cycle, including river or stream habitats, open-water lake habitats, and the wetlands areas along banks and shores. However, negative impacts and alterations to each of these different habitats have occurred, and continue to threaten the recovery of these species. Suitable habitat has drastically declined due to conversion of wetlands to agricultural use and construction of irrigation and hydroelectric facilities, both of which drained lakes and wetlands, created barriers preventing access to spawning habitat, and caused mortality by entraining fish.

Effects of Nonnative Fishes

Nonnative fishes were identified as a potential threat at the time of listing through predation or as sources of exotic diseases/parasites, although no direct evidence was cited. Since then, controlled experiments have demonstrated that adult fathead minnows prey on sucker larvae (Markle and Dunsmoor 2007, p. 567). In Upper Klamath Lake negative relationships between

fathead minnow population size and larval sucker survival rates (i.e., higher fathead minnow populations are associated with lower sucker survival rates) have been observed (Markle and Dunsmoor 2007, p. 567). Likewise, as indirect evidence, higher larval survival rates were also associated with greater water depth and shoreline vegetative cover, habitat which help larvae avoid predation (Markle and Dunsmoor 2007, p. 575). These data suggest that predation by highly-abundant fathead minnows may be an important threat to larval sucker survival, and that loss of emergent wetland habitat may exacerbate this. Other nonnative fishes may also pose a threat to Lost River sucker and shortnose sucker; however, little quantitative information exists to indicate their influence on sucker abundance and distribution.

Effects of Adverse Water Quality

Most water bodies currently occupied by Lost River and shortnose suckers do not meet water quality standards for nutrients, dissolved oxygen, temperature, and pH set by the States of Oregon and California (Boyd et al. 2002, p. i; Kirk et al. 2010, ch. 1 p. 5). Lost River and shortnose suckers are relatively tolerant of degraded water quality conditions in comparison to species like trout and salmon. Suckers tolerate higher pH, temperature, and un-ionized ammonia concentrations, and lower dissolved oxygen concentrations than many other fishes (Saiki et al. 1999, pp. 41-43; Meyer and Hansen 2002, entire; NRC 2004, p. 200). Nevertheless, both species are regularly adversely affected by poor summer water quality in Upper Klamath Lake, Keno Reservoir, Lost River sub-basin, and the hydropower reservoirs downstream in the Klamath River (NRC 2004, pp. 201-202). Adverse water-quality conditions, which have primarily occurred in summer, have caused multiple incidents of mass adult mortality (Perkins et al. 2000b, pp. 6-23). The primary cause of water-quality-related mortality appears to be caused by hypoxia (i.e., low levels of dissolved oxygen), but high concentrations of un-ionized ammonia resulting from elevated total ammonia concentrations and high pH, could also be a contributing factor (Perkins et al. pp. 26-27). Additionally, in the fish die-offs that occurred in Upper Klamath Lake in the 1990s, disease outbreaks contributed to mortality and continued to affect suckers after the adverse water conditions had abated (Perkins et al. 2000b, pp. 28-29; NRC 2004, p. 238).

Adverse water quality conditions in Upper Klamath Lake are attributed to high nutrient loading, especially phosphorus, and the presence of blue-green algae, *Aphanizomenon flos-aquae*. This alga (actually categorized as a "cyanobacterium") now dominates the algal community from June to November, and because of the high concentrations of nutrients, especially phosphorus, available, is able to reach seasonally high biomass levels that can lead to highly degraded water quality (Boyd et al. 2002, p. 31; NRC 2004, pp. 5-6; Wood et al. 2006, p. 46; Morace 2007, pp. 9, 39). These conditions affect Lost River and shortnose suckers because rapid algal decay depletes dissolved oxygen levels and can create toxic conditions for suckers, especially when water temperatures are high and wind speeds low (Perkins et al. 2000b, p. 19; Boyd et al. 2002, p. 135; NRC 2004, p. 6; Wood et al. 2006, p. 47; Morace 2007, pp. 44-49).

Water quality remains one of the most important, if not the most important, proximate factor threatening sucker existence; however, the uncertainty surrounding many of the potential ultimate factors (i.e., the complex interactions of factors causing poor water quality), including wetland reduction, natural nutrient loads, nonpoint sources, and water management, also make it one of the most difficult threats to address.

Effects of Algal Toxins

Some cyanobacteria, such as *Microcystis aeruginosa*, which is also present in Upper Klamath Lake, produce toxins that may directly result in mortality or may indirectly cause mortality through a combination of disease and stress produced by hypoxia (low dissolved oxygen), high pH, and high ammonia concentrations. Recent studies by USGS provide preliminary support for a hypothesis that juvenile suckers in Upper Klamath Lake are at risk from biotoxins produced by *M. aeruginosa* (VanderKooi et al 2010, entire, http://pubs.usgs.gov/fs/2009/3111/). The toxin, microcystin, attacks liver cells. Up to 50 percent of juveniles sampled showed evidence of liver damage, some severe enough that death would likely result. Microcystin levels in the water samples in 2008 were up to 17x higher than is considered safe for drinking water. Microcystin is an algal toxin that affects the liver and can lead to death. In a 2007 survey in Upper Klamath Lake, 49 percent of a sample of juvenile suckers collected at 11 shoreline sites exhibited indications of microcystin exposure (VanderKooi et al. 2010, entire). However, these data are preliminary and further investigations are required to determine the extent of microcystin exposure and of the effects. Additionally, the means by which the toxin is introduced into the body remains unknown, but there is some evidence suggesting that the toxin is indirectly ingested when suckers consume midge larvae, which feed on the algae.

Effects of Pathogens and Parasites

Degraded water quality conditions may weaken fish and increase their susceptibility to disease and parasites (Holt 1997, p. i; Perkins et al. 2000a, p. 29). Parasites and pathogens were not identified as important threats at the time of listing; however, new information indicates that pathogens and parasites likely contribute to low rates of sucker survival, especially during adverse water quality events (USFWS 2012a, p. 19, b, p. 19, 2013, p. 30). A number of pathogens have been identified from moribund (dying) suckers, but Columnaris disease or "gill rot" seems to be the primary organism involved (Foott 1997, pp. 1-2; Holt 1997, p. i). It is caused by the bacterium *Flavobacterium columnare,* which can damage gills and produce body lesions, which leads to respiratory problems and an imbalance of internal salt concentrations, which provides an entry route for lethal systemic pathogens.

Anchor worm, an external, copepod parasite affects suckers and other fish in Upper Klamath Lake and its incidence on age-0 suckers appears to be increasing (ISRP 2005, p. 167). From 1994-1996, the percent of age-0 suckers parasitized by anchor worms ranged from 0 percent to 7 percent, but by 1997-2000 it had increased to between 9 percent and 40 percent. Anchor worms now infect about half of age-0 shortnose suckers. Recently Markle et al. (2013, p. 1) stated that mortality of juvenile shortnose suckers had occurred in Upper Klamath Lake as a result of infections from black spot disease, a type of trematode flatworm or fluke. Parasites like anchor worm may not directly cause death to suckers, but they can provide a route for pathogens to enter fish, since they create a wound, or can make fish more susceptible to predation (Robinson et al. 1998, p. 599). To determine the degree to which parasites threaten sucker survival and productivity requires further study.

Effects of Fish-eating Birds

Fish-eating birds, such as the American white pelican (*Pelecanus erythrorhynchus*), could have substantial negative impacts on adult sucker populations, especially those in Clear Lake where the suckers are exposed to pelican predation during the spawning migration in Willow Creek.

Early data indicate that American white pelican predation rates on sub-adult or adult suckers in Clear Lake Reservoir may be as high as 20 percent in some years; however, additional research is needed to clarify the magnitude of this threat (Roby and Collis 2011, pp. 64-65; NMFS and USFWS 2013, p. 52).

Effects of Entrainment Losses

Movement of fish into irrigation systems through unscreened diversions was identified as a threat to the suckers at the time of listing (USFWS 1988, p. 5017). At that time thousands of suckers, including some adults, were entrained into the A-Canal, the largest diversion in the upper basin located near the Link River Dam. Although some of these fish were salvaged, many likely died (NRC 2004, pp. 24, 231). The impact of entrainment into the irrigation system of the Klamath Project was reduced by construction of screening facilities over the A-Canal; although larvae are still at risk. Fish screened from entering the A-Canal are returned via pipeline to the Link River above the dam (Marine and Gorman 2005, p. 1). Further investigations are needed to determine the overall effects and stress on transferred fish and if fish expelled through the pipeline remain in Upper Klamath Lake or are subsequently entrained by flows through the Link River Dam (NMFS and USFWS 2013, p. 102).

Substantial entrainment occurs at the river gates of the Link River Dam. Currently these gates have no structures to prevent drawing fish downstream. During the late summer of 2006, over 3,500 age-0 juvenile suckers were collected in the Link River just below the dam with intermittent sampling of a small fraction of the channel (Tyler 2007, p. 4). The Committee on Endangered and Threatened Fishes in the Klamath River Basin of the National Research Council recommended screening to prevent downstream losses at Link River Dam (NRC 2004, p. 7). Efforts to assess the impacts of this operation found significantly lower numbers of suckers were entrained during surface spill versus bottom spill experiments (Marine and Lappe 2009, ch. 4 p. 1). Gutermuth et al. (2000, p. 33) also documented tens of thousands of young suckers entrained at the PacifiCorp hydropower canals and turbines associated with the Link River Dam. Nonetheless, further research is required to better quantify the threats these structures pose to recovery.

Most suckers that pass through the gates at Link River Dam, or that survive passage through the hydroelectric facilities, are believed to be lost from the breeding population in Upper Klamath Lake. Most likely, these fish either die in poor summer water quality conditions in Keno Reservoir, or pass further downstream into reservoirs along the Klamath River, from which upstream passage is blocked. A fish ladder was constructed at Link River Dam in 2004 through which PIT tagged adult suckers have been documented in low numbers moving upstream through Link River (Korson et al. 2008, p. 2; Kyger and Wilkens 2011, p. 2); additional untagged suckers likely also passed upstream through the ladder undetected.

In addition to major diversion point in the Keno Reservoir, the Lost River Diversion Channel, several hundred small, typically unscreened diversions in tributary streams and rivers and the lakes proper may also affect Lost River sucker and shortnose sucker. The influence of these diversions on sucker abundance and recovery is unknown.

Effects of Climate Change

Climate variability, such as fluctuations between wet and dry periods, is part of natural processes; however, climatic models and other information suggest that much of the recent trends is driven by anthropogenic pollutants, primarily CO_2 (Barnett et al. 2008, p. 1080). Since the 1950s, western North America generally has exhibited trends toward less snowfall, earlier snowmelt, and earlier peak spring runoff, much of which cannot be attributed to natural fluctuations (Hamlet et al. 2005, entire; Stewart et al. 2005, entire; Knowles et al. 2006, entire). Furthermore, models indicate that these trends are likely to continue (Barnett et al. 2008, p. 1082). Perhaps the greatest foreseeable concern related to climate change is more intense summer heat waves that have the potential to create especially severe water-quality conditions in Upper Klamath Lake.

It is difficult to predict how such climatic changes will affect these species (Matthews and Marsh-Matthews 2003). Certainly these species have evolved under variable climates, sometimes with severe dry periods (Negrini 2002, entire; Malevich et al. 2013, p. 13); however, given the current lack of recruitment, lack of population connectivity even in wet years when it should be higher, degraded habitat including poor water quality, the overall low number of individuals, and other threats, the USFWS considers populations of these species to be highly vulnerable to negative impacts from climate change, either from distinct droughts or from extended periods of declining trends. If current trends continue into the future, important changes, which may threaten the continued existence of these species, e.g., further reductions in water quality, water-quality refuge availability, food-web alterations, and spawning run timing, are likely to occur (Dahm et al. 2003, pp. 1224-1229; Magoulick and Kobza 2003, entire). Further reductions in water quality and reduced inflows as a result of climate change, if they occur, could be a serious threat to the survival and recovery of the Lost River and shortnose suckers, especially for populations in Upper Klamath Lake.

The ability to assign the effects of gradual global climate change to Lost River sucker and shortnose suckers or to a specific location on the ground is beyond the USWFS technical capabilities at this time.

Conservation Needs

The following eight conservation needs or recovery actions were identified in the revised recovery plan (USFWS 2013, pp. 49-51).

1. Restore or enhance spawning and nursery habitat in the Upper Klamath Lake and Lost River Recovery Units

The relationship between spawning and nursery habitat with healthy population demography is critical. Given the extensive losses of habitat in general, including loss of connectivity, it is vital that such habitats be restored to functionality. The primary components of this recovery action are to (1) develop and implement a range wide spawning and rearing enhancement plan, (2) conduct and apply research on how to best manage lake levels to protect spawning habitat, (3) reestablish stream and river connectivity, (4) conserve and restore wetland and riparian areas, (5) improve habitat quantity and quality of eastern shoreline springs in Upper Klamath Lake (Lost River sucker specific), and (6) identify and assess the feasibility of potential habitat improvements for suckers in Lake Ewauna/Keno Reservoir (USFWS 2013, pp. 52-55).

2. Reduce negative impacts of poor water quality

Lost River sucker and shortnose sucker are able to tolerate relatively harsh conditions, but periodic die-offs show that they are susceptible to poor water quality that occurs primarily during summer. Actions to reduce these effects by providing sufficient habitat that provides refuge and minimizes the occurrence of poor water quality events should occur. Specifically, these include (1) ensure continued connectivity and access to refugial areas, (2) conduct and apply research on the dynamics of algal cycles within Upper Klamath Lake and their effects on sucker populations, and (3) conserver and restore riparian and wetland areas along the Wood, Williamson, and Spragure Rivers, and Upper Klamath Lake to improve water quality (USFWS 2013, pp. 55-56).

3. Clarify and reduce the effects of introduced species on all life stages by conducting and applying appropriate scientific investigations

Approximately 85 percent of the fish biomass in Upper Klamath Lake when the suckers were listed was comprised of non-native species. The fathead minnow and yellow perch are most likely to affect Lost River sucker and shortnose sucker through predation on and competition for food and space with young suckers. Additional work is needed to clarify these experiments and their effects on trends, distribution and demography of suckers (USFWS 2013, pp. 56-57).

4. Reduce loss of individuals to entrainment

Entrainment of individuals, especially larvae and juveniles, can remove significant numbers of individuals from populations. It is critical that a reduction in the number of individuals lost to entrainment occur. The primary components of this recovery action include (1) develop and implement an entrainment reduction plan, (2) assure the efficacy of A-canal bypass, and (3) improve the efficacy of the Link River Dam fish ladder (USFWS 2013, pp. 56-57).

5. Establish a redundancy and resiliency enhancement program

The purpose of this program will be to support and enhance effort to improve *in situ* conditions through creation or maintenance of populations that provide redundancy and potentially produce individuals for augmentation to increase resiliency of the most important populations for the species, Upper Klamath Lake and Clear Lake Reservoir. The primary components of this recovery actions include (1) develop and implement a Genetics Assessment and Management Plan, (2) prepare emergency response protocols for Upper Klamath Lake, Clear Lake Reservoir, Gerber Reservoir, and Tule Lake populations, (3) establish at least two auxiliary populations, and (4) develop a controlled propagation program (USFWS 2013, pp. 57-59).

6. Increase juvenile survival and recruitment to spawning populations

Relatively little is known about the ecology and demography of these species as juveniles. Therefore, this recovery action consists of the following components: (1) develop and implement a plan to assess, monitor, and improve juvenile and sub-adult vital rates and demography and (2) improve understanding of juvenile life history and ecology through study of Clear Lake Reservoir populations (USFWS 2013, pp. 60).

7. Maintain and increase the number of recurring, successful spawning populations

The number of total spawning aggregations has decreased dramatically for both Lost River sucker and shortnose sucker. Successful establishment of additional spawning aggregations will likely increase the species' ability to overcome many threats. Specific components of this recovery action include (1) increase the number of spawning sub-populations in Upper Klamath Lake, (2) facilitate successful spawning for the Tule Lake population, (3) continue monitoring of adult populations, and (4) determine the status of shortnose sucker in Gerber Reservoir (USFWS 2013, pp. 60-62).

8. Establish a Klamath Basin Sucker Recovery Program

The recovery implementation program was formally established in 2014 and consists of several focused "teams" that coordinate public outreach, scientific collaboration, and assessment of current program direction (USFWS 2013, pp. 62-63).

Current Actions

The USFWS has worked with other agencies and stakeholders to recover the endangered suckers since 1994 (USFWS 2013, p. 34). Important cooperators include USBR, National Resources Conservation Service (NRCS), The Nature Conservancy (TNC), ODEQ, National Fish and Wildlife Conservation Fund, Klamath Water Users, and Modoc Irrigation District. Approximately 300 on-the-ground restoration projects, including 90 wetland, 130 riparian, 45 in-stream, 25 upland, and 15 fish passage projects have been funded and implemented in the Upper Klamath River Basin that directly or indirectly benefit Lost River and shortnose suckers since 2009. Many of the projects included elements of more than one category of restoration project type. These projects have had significant cost share from multiple sources, including Federal programs such as Partners for Fish and Wildlife, Hatfield, Jobs in the Woods, and Oregon Resources Conservation Act programs, as well as state and private grants, and contributions from landowners.

Major sucker recovery oriented projects completed include: screening of the main irrigation diversion on the Klamath Project (A-Canal) in 2002 and the outlet to Clear Lake Dam in 2003, and screening of Modoc Irrigation District's diversion on the Williamson River (2007), and the Geary Canal diversion in Howard Bay on Upper Klamath Lake in 2009; construction of a new fish ladder at Link River Dam (2004); restoration of Williamson River Delta approximately 6,000 acres between 2000 and 2008, restoration of the lower 3 miles of the Wood River in 1999; and removal of Chiloquin Dam in 2008, a major impediment to upstream migration of listed suckers. Removal of Chiloquin Dam provides improved upstream passage to spawning areas.

It is too early to assess the efficacy of these projects to support recovery, and some project modification may be required for the full benefit of each program to be realized. This is particularly true with the project screening the A-Canal. Under present design, fish screened from entering the A-Canal are delivered via pipeline to Upper Klamath Lake at a point that is upstream of the Link River Dam. Investigations are needed to determine if these suckers remain in Upper Klamath Lake or pass downstream into Lake Ewauna and possibly are lost to the spawning population because of (1) poor water quality conditions in the lake during the summer and/or because (2) suckers are having difficulties moving upstream past the dam.

The NRCS completed a large number of projects under the 2002 Farm Bill to improve water quality and water conservation. This has resulted in restoration of over 2,200 acres of wetland habitat and conservation of over 6,700 acre-feet of on-farm water. Conservation systems on over 70,000 acres have been planned, and practices have been applied to over 30,000 acres to manage soil, water, air, plants, and animals on private lands.

The Sprague River, the primary spawning habitat for suckers in Upper Klamath Lake and the largest tributary to the Williamson River, is listed as water quality impaired for nutrients, temperature, sediment, and dissolved oxygen (DO) under the Section 303(d) of the Clean Water Act. In 2002, ODEQ completed a TMDL process for the Sprague River and Upper Klamath Lake (Boyd et al. 2002, entire), and in 2010 it was followed by a TMDL for the Lost and Klamath Rivers in Oregon (Kirk et al. 2010, entire). Water quality management plans were developed which provide targets and guidance on improving water quality in the Sprague River and Upper Klamath Lake. Many wetland and riparian restoration projects are now designed to address TMDL issues.

In 2004, Oregon State University Agricultural Extension Service and the Klamath Watershed Council (now called the Klamath Watershed Partnership) began a series of monthly meetings with rural landowners in the Sprague River Valley to discuss watershed restoration goals. With the help of USFWS, NRCS and the Klamath Soil & Water Conservation District, this effort has effectively connected landowners with appropriate state and federal resource conservation programs. As a result, more than 70 percent of the private lands within the Sprague River Valley are partnering with local, state and federal agencies on land conservation and natural resource actions. The efforts of the Klamath Watershed Partnership have brought additional fiscal partners (e.g., Oregon Department of Agriculture, Klamath County, and Oregon Watershed Enhancement Board) into the conservation partnership. These partnership-forming actions will continue and build on themselves and enable more restoration to be done in the future.

The tributaries in the Wood River Valley supply a large portion of the inflow to Upper Klamath Lake. This valley also supports about half of the livestock in the Upper Basin and is responsible for approximately one-third of the external phosphorus loading to the lake. Because of this, it was identified by ODEQ as a priority water quality impaired area. The Klamath Basin Rangeland Trust has been active in the Wood River Valley encouraging landowners to adopt sustainable land and water management practices. Since 2002, the number of landowners who partner with this trust on conservation and restoration activities has increased to include approximately 50 percent of the agricultural lands in the watershed.

Klamath River Basin stakeholders signed the Klamath Basin Restoration Agreement (KBRA) in February 2010. The agreement is intended to result in effective and durable solutions which will restore native fishes throughout the Klamath Basin including listed suckers; establish reliable water and power supplies which sustain agricultural uses, communities, and National Wildlife Refuges; and contribute to the public welfare and the sustainability of all Klamath Basin communities. The KBRA has not yet been authorized by congress; however, with authorization and appropriation of funds from federal and state governments and subsequent implementation of the Agreement, substantial progress should be made toward the recovery of Lost River sucker and shortnose sucker.

Bull Trout

The description of the status of bull trout and its designated CH that follows is from USFWS (2015).

Legal Status

The coterminous United States population of the bull trout (*Salvelinus confluentus*) was listed as threatened on November 1, 1999 (USFWS 1999a, entire). The bull trout generally occurs in the Klamath River Basin of south-central Oregon; the Jarbidge River in Nevada; the Willamette River Basin in Oregon; Pacific Coast drainages of Washington, including Puget Sound; major rivers in Idaho, Oregon, Washington, and Montana, within the Columbia River Basin; and the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Bond 1992, p. 4; Brewin and Brewin 1997, pp. 209-216; Cavender 1978, pp. 165-166; Leary and Allendorf 1997, pp. 715-720).

On June 21, 2011, the U.S. Fish and Wildlife Service, in cooperation with the State of Oregon, USDA Forest Service and other project partners, published a final rule in the Federal Register to establish a nonessential experimental population (NEP) of bull trout in the Clackamas River and its tributaries in Clackamas County, Oregon, under section 10(j) of the Endangered Species Act of 1973. Subsequent to establishing the NEP, bull trout were reintroduced into the Clackamas River beginning in 2012. Any experimental population designated for a listed species will be treated for purposes of section 7 consultation as a species *proposed* to be listed under the Act as a threatened species.

There are BLM lands included within the geographic boundary of the NEP that fall within the action area of the PRMP for Western Oregon. Conferencing on a proposed threatened species (in this case, population) is done to evaluate the potential implications of a proposed action moving that entity toward jeopardy or the adverse modification of critical habitat. In the case of Clackamas NEP the BLM believes that a conference is not required because:

- The portion of lands belonging to the BLM within the NEP is small when compared to other ownerships
- The NEP represents a small portion of the conterminous bull trout population
- Therefore the potential for large-scale impacts to the species as a whole from activities on BLM lands is very small
- No critical habitat is designated for the NEP per *16 U.S.C. § 1539(j)(2)(c)(ii).*

Throughout its range, bull trout are threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, poor water quality, entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels, and introduced non-native species (USFWS 1999a, p. 58910). Although all salmonids are likely to be affected by climate change, bull trout are especially vulnerable given that spawning and rearing are constrained by their location in upper watersheds and the requirement for cold water temperatures (Battin et al. 2007, entire; Rieman et

al. 2007, entire; Porter and Nelitz. 2009, pages 4-8). Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats.

Distinct Population Segments and Population Units

The bull trout was initially listed as three separate DPSs (USFWS 1998, pp. 31649-31650; USFWS 1999b, p. 17112). The preamble to the final listing rule for the United States coterminous population of the bull trout discusses the consolidation of these DPSs with the Columbia and Klamath population segments into one listed taxon and the application of the jeopardy standard under section 7 of the ESA relative to this species (USFWS 1999a, p. 58930):

Life History

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

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

Bull trout typically spawn from August through November during periods of increasing flows and decreasing water temperatures. Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989, p. 141). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989, pp. 15-16; Pratt 1992, pp. 6-7; Rieman and McIntyre 1996, p. 133). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p. 1). After hatching, fry remain in the substrate, and time from egg deposition to emergence may surpass 220 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992, p. 1; Ratliff and Howell 1992, p. 10).

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

A literature review conducted by the Washington Department of Ecology (WDOE 2002, p. 9) indicates that adverse effects of lower oxygen concentrations on embryo survival are magnified as temperatures increase above optimal (for incubation). Normal oxygen levels seen in rivers used by bull trout during spawning ranged from 8 to 12 mg/L (in the gravel), with corresponding

instream levels of 10 to 11.5 mg/L (Stewart et al. 2007, p. 10). In addition, IGDO concentrations, water velocities in the water column, and especially the intergravel flow rate, are interrelated variables that affect the survival of incubating embryos (ODEQ 1995, Ch. 2 pp. 23-24). Due to a long incubation period of 220+ days, bull trout are particularly sensitive to adequate IGDO levels. An IGDO level below 8 mg/L is likely to result in mortality of eggs, embryos, and fry.

Population Dynamics

Population Structure

Bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993, p. 2). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Goetz 1989, p. 15). Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989, p. 138; Goetz 1989, p. 24), or saltwater (anadromous form) to rear as subadults and to live as adults (Brenkman and Corbett 2005, entire; McPhail and Baxter 1996, p. i; WDFW et al. 1997, p. 16). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. They are iteroparous (they spawn more than once in a lifetime). Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Fraley and Shepard 1989, p. 135; Leathe and Graham 1982, p. 95; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Migratory forms of bull trout may develop when habitat conditions allow movement between spawning and rearing streams and larger rivers, lakes or nearshore marine habitat where foraging opportunities may be enhanced (Brenkman and Corbett 2005, pp. 1075-1076; Goetz et al. 2004, p. 105). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002, pp. 96, 98-106). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams, lakes, and marine waters; greater fecundity resulting in increased reproductive potential; and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Frissell 1999, pp. 861-863; MBTSG 1998, p. 13; Rieman and McIntyre 1993, pp. 2-3). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbances make local habitats temporarily unsuitable. Therefore, the range of the species is diminished, and the potential for a greater reproductive contribution from larger size fish with higher fecundity is lost (Rieman and McIntyre 1993, p. 2).

Whitesel et al. (2004, p. 2) noted that although there are multiple resources that contribute to the subject, Spruell et al. (2003, entire) best summarized genetic information on bull trout population structure. Spruell et al. (2003, entire) analyzed 1,847 bull trout from 65 sampling locations, four located in three coastal drainages (Klamath, Queets, and Skagit Rivers), one in the Saskatchewan

River drainage (Belly River), and 60 scattered throughout the Columbia River Basin. They concluded that there is a consistent pattern among genetic studies of bull trout, regardless of whether examining allozymes, mitochondrial DNA, or most recently microsatellite loci. Typically, the genetic pattern shows relatively little genetic variation within populations, but substantial divergence among populations. Microsatellite loci analysis supports the existence of at least three major genetically differentiated groups (or evolutionary lineages) of bull trout (Spruell et al. 2003, p. 17). They were characterized as:

i. "Coastal", including the Deschutes River and all of the Columbia River drainage downstream, as well as most coastal streams in Washington, Oregon, and British Columbia. A compelling case also exists that the Klamath Basin represents a unique evolutionary lineage within the coastal group.

ii. "Snake River", which also included the John Day, Umatilla, and Walla Walla rivers. Despite close proximity of the John Day and Deschutes Rivers, a striking level of divergence between bull trout in these two systems was observed.

iii. "Upper Columbia River" which includes the entire basin in Montana and northern Idaho. A tentative assignment was made by Spruell et al. (2003, p. 25) of the Saskatchewan River drainage populations (east of the continental divide), grouping them with the upper Columbia River group.

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

More recently, the USFWS identified additional genetic units within the coastal and interior lineages (Ardren et al. 2011, p. 18). Based on a recommendation in the USFWS's 5-year review of the species' status (USFWS 2008a, p. 45), the USFWS reanalyzed the 27 recovery units identified in the 2002 draft bull trout recovery plan (USFWS 2002a, p. 48) by utilizing, in part, information from previous genetic studies and new information from additional analysis (Ardren et al. 2011, entire). In this examination, the USFWS applied relevant factors from the joint USFWS and NMFS Distinct Population Segment (DPS) policy (USFWS 1996, entire) and subsequently identified six draft recovery units that contain assemblages of core areas that retain genetic and ecological integrity across the range of bull trout in the coterminous United States. These six draft recovery units were used to inform designation of critical habitat for bull trout by providing a context for deciding what habitats are essential for recovery (USFWS 2010a, p. 63898). The six draft recovery units identified for bull trout in the coterminous United States include: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake. These six draft recovery units were also identified in the USFWS's revised draft recovery plan (USFWS 2014, p. 35).

Population Dynamics

Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993, p. 4). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991, entire). Burkey (1989, entire) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth for local populations may be low and probability of extinction high (Burkey 1989, entire; Burkey 1995, entire).

Metapopulation concepts of conservation biology theory have been suggested relative to the distribution and characteristics of bull trout, although empirical evidence is relatively scant (Rieman and McIntyre 1993, p. 15; Dunham and Rieman 1999, entire; Rieman and Dunham 2000, entire). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994, pp. 189-190). For inland bull trout, metapopulation theory is likely most applicable at the watershed scale where habitat consists of discrete patches or collections of habitat capable of supporting local populations; local populations are for the most part independent and represent discrete reproductive units; and long-term, low-rate dispersal patterns among component populations influences the persistence of at least some of the local populations (Rieman and Dunham 2000, entire). Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely. However, habitat alteration, primarily through the construction of impoundments, dams, and water diversions has fragmented habitats, eliminated migratory corridors, and in many cases isolated bull trout in the headwaters of tributaries (Rieman and Clayton 1997, pp. 10-12; Dunham and Rieman 1999, p. 645; Spruell et al. 1999, pp. 118-120; Rieman and Dunham 2000, p. 55).

Human-induced factors as well as natural factors affecting bull trout distribution have likely limited the expression of the metapopulation concept for bull trout to patches of habitat within the overall distribution of the species (Dunham and Rieman 1999, entire). However, despite the theoretical fit, the relatively recent and brief time period during which bull trout investigations have taken place does not provide certainty as to whether a metapopulation dynamic is occurring (e.g., a balance between local extirpations and recolonizations) across the range of the bull trout or whether the persistence of bull trout in large or closely interconnected habitat patches (Dunham and Rieman 1999, entire) is simply reflective of a general deterministic trend towards extinction of the species where the larger or interconnected patches are relics of historically wider distribution (Rieman and Dunham 2000, pp. 56-57). Recent research (Whiteley et al. 2003, entire) does, however, provide genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River Basin of Idaho.

Habitat Characteristics

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993, p. 4). Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors (Fraley and Shepard 1989, entire; Goetz 1989, pp. 23, 25; Hoelscher and Bjornn 1989, pp. 19, 25; Howell and Buchanan 1992, pp. 30, 32; Pratt 1992, entire; Rich 1996, p. 17; Rieman and McIntyre 1993, pp. 4-6; Rieman and McIntyre 1995, entire;

Sedell and Everest 1991, entire; Watson and Hillman 1997, entire). Watson and Hillman (1997, pp. 247-250) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993, pp. 4-6), bull trout should not be expected to simultaneously occupy all available habitats.

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

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

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

Although bull trout are found primarily in cold streams, occasionally these fish are found in larger, warmer river systems throughout the Columbia River basin (Buchanan and Gregory 1997, p. 2; Fraley and Shepard 1989, pp. 133, 135; Rieman and McIntyre 1993, pp. 3-4; Rieman and McIntyre 1995, p. 287). Availability and proximity of cold water patches and food productivity can influence bull trout ability to survive in warmer rivers (Myrick 2002, pp. 6 and 13). For example, bull trout in the Lostine and Wallowa rivers in Oregon used relatively warm waters even when cooler water was available and spawned in lower reaches of the river where temperatures were warmer (Howell et al. 2009, p. 103-104). Fish in this study were found up to 16 days in a maximum 7 day average of the daily maximum temperatures in a stream (7DADM) of 20-21°C and spawned at maximum 7DADM temperatures of 11-18°C (Howell et al. 2009, p. 101-102).

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

Diet

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. A single optimal foraging strategy is not necessarily a consistent feature in the life of a fish, because this strategy can change as the fish progresses from one life stage to another (i.e., juvenile to subadult). Fish growth depends on the quantity and quality of food that is eaten, and as fish grow their foraging strategy changes as their food changes, in quantity, size, or other characteristics (Quinn 2005, pp. 195-200). Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987, p. 58; Donald and Alger 1993, pp. 242-243; Goetz 1989, pp. 33-34). Subadult and adult migratory bull trout feed on various fish species (Donald and Alger 1993, pp. 241-243; Fraley and Shepard 1989, pp. 135, 138; Leathe and Graham 1982, pp. 13, 50-56). Bull trout of all sizes other than fry have been found to eat fish half their length (Beauchamp and VanTassell 2001, p. 204). In nearshore marine areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) (Goetz et al. 2004, p. 105; WDFW et al. 1997, p. 23).

Bull trout migration and life history strategies are closely related to their feeding and foraging strategies. Migration allows bull trout to access optimal foraging areas and exploit a wider variety of prey resources. For example, in the Skagit River system, anadromous bull trout make migrations as long as 121 miles between marine foraging areas in Puget Sound and headwater spawning grounds, foraging on salmon eggs and juvenile salmon along their migration route (WDFW et al. 1997, p. 25). Anadromous bull trout also use marine waters as migration corridors to reach seasonal habitats in non-natal watersheds to forage and possibly overwinter (Brenkman and Corbett 2005, pp. 1078-1079; Goetz et al. 2004, entire).

Status and Distribution

Distribution

The historical range of bull trout includes major river basins in the Pacific Northwest at about 41 to 60 degrees North latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, pp. 165-166; Bond 1992, p. 2). To the west, the bull trout's range includes Puget Sound, various coastal rivers of British Columbia, Canada, and

southeast Alaska (Bond 1992, p. 2). Bull trout occur in portions of the Columbia River and tributaries within the basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south-central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and Montana and in the MacKenzie River system in Alberta and British Columbia, Canada (Cavender 1978, pp. 165-166; Brewin and Brewin 1997, entire).

Each of the following IRUs (below) is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions. Since the time of listing, no local populations have been lost and one new core area has been established through reintroduction (Clackamas River Core Area).

Jarbidge River IRU

This IRU currently contains a single core area with six local populations. Less than 500 resident and migratory adult bull trout, representing about 50 to 125 spawning adults, are estimated to occur in the core area. The current condition of the bull trout in this IRU is attributed to the effects of livestock grazing, roads, incidental mortalities of released bull trout from recreational angling, historic angler harvest, timber harvest, and the introduction of non-native fishes (USFWS 2004b, p. iii). The 2004 draft bull trout recovery plan (USFWS 2004b, pp. 62-63) identifies the following conservation needs for this IRU: 1) maintain the current distribution of the bull trout within the core area, 2) maintain stable or increasing trends in abundance of both resident and migratory bull trout in the core area, 3) restore and maintain suitable habitat conditions for all life history stages and forms, and 4) conserve genetic diversity and increase natural opportunities for genetic exchange between resident and migratory forms of the bull trout. An estimated 270 to 1,000 spawning bull trout per year are needed to provide for the persistence and viability of the core area and to support both resident and migratory adult bull trout (USFWS 2004b, p. vi).

Klamath River IRU

This IRU currently contains three core areas and seven local populations. The current abundance, distribution, and range of the bull trout in the Klamath River Basin are greatly reduced from historical levels due to habitat loss and degradation caused by reduced water quality, timber harvest, livestock grazing, water diversions, roads, and the introduction of non-native fishes (USFWS 2002b, pp. 71236-71240). Bull trout populations in this IRU face a high risk of extirpation (USFWS 2002b, p. 71239). The draft Klamath River bull trout recovery plan (USFWS 2002a, p. v) identifies the following conservation needs for this IRU: 1) maintain the current distribution of bull trout and restore distribution in previously occupied areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all life history stages and strategies, 4) conserve genetic diversity and provide the opportunity for genetic exchange among appropriate core area populations. Eight to 15 new local populations and an increase in population size from about 2,400 adults currently to 8,250 adults are needed to provide for the persistence and viability of the three core areas (USFWS 2002b, p. vi).

Columbia River IRU

The Columbia River IRU includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin, and presently occur in 45 percent of their estimated historical range (Quigley and Arbelbide 1997, p.1177). This IRU currently contains 97 core areas and 527 local populations. About 65 percent of these core areas and local populations occur in central Idaho and northwestern Montana. The Columbia River IRU has declined in overall range and numbers of fish (USFWS 1998, p. 31647). Although some strongholds still exist with migratory fish present, bull trout generally occur as isolated local populations in headwater lakes or tributaries where the migratory life history form has been lost. Though still widespread, there have been numerous local extirpations reported throughout the Columbia River basin. The draft Columbia River bull trout recovery plan (USFWS 2002a, p. v) identifies the following conservation needs for this IRU: 1) maintain or expand the current distribution of the bull trout within core areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all bull trout life history stages and strategies, and 4) conserve genetic diversity and provide opportunities for genetic exchange.

The condition of the bull trout within the 97 core areas in the Columbia River IRUs varies from poor to good. All core areas have been subject to the combined effects of habitat degradation and fragmentation caused by the following activities: dewatering; road construction and maintenance; mining; grazing; the blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment into diversion channels; and introduced non-native species. The USFWS completed a core area conservation assessment for the 5-year status review and determined that, of the 97 core areas in this IRU, 38 are at high risk of extirpation, 35 are at risk, 20 are at potential risk, 2 are at low risk, and 2 are at unknown risk (USFWS 2005, entire).

Coastal-Puget Sound IRU

Bull trout in the Coastal-Puget Sound IRU exhibit anadromous, adfluvial, fluvial, and resident life history patterns. The anadromous life history form is unique to this IRU. This IRU currently contains 14 core areas and 67 local populations (USFWS 2004a, pp. 35785-35796). Bull trout are distributed throughout most of the large rivers and associated tributary systems within this IRU. Bull trout continue to be present in nearly all major watersheds where they likely occurred historically, although local extirpations have occurred throughout this IRU. Many remaining populations are isolated or fragmented and abundance has declined, especially in the southeastern portion of the IRU. The current condition of the bull trout in this IRU is attributed to the adverse effects of dams, forest management practices (e.g., timber harvest and associated road building activities), agricultural practices (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation), livestock grazing, roads, mining, urbanization, poaching, incidental mortality from other targeted fisheries, and the introduction of non-native species. The draft Coastal-Puget Sound bull trout recovery plan (USFWS 2004a, pp. 35774-35777) identifies the following conservation needs for this IRU: 1) maintain or expand the current distribution of bull trout within existing core areas, 2) increase bull trout abundance to about 16,500 adults across all core areas, and 3) maintain or increase connectivity between local populations within each core area.

St. Mary-Belly River IRU

This IRU currently contains six core areas and nine local populations (USFWS 2002c, p. v). Currently, bull trout are widely distributed in the St. Mary-Belly River drainage and occur in nearly all of the waters that it inhabited historically. Bull trout are found only in a 1.2-mile reach of the North Fork Belly River within the United States. Redd count surveys of the North Fork Belly River documented an increase from 27 redds in 1995 to 119 redds in 1999. This increase was attributed primarily to protection from angler harvest (USFWS 2002c, p. 37). The current condition of the bull trout in this IRU is primarily attributed to the effects of dams, water diversions, roads, mining, and the introduction of non-native fishes (USFWS 2002c, pp. v, 51). The draft St. Mary-Belly bull trout recovery plan (USFWS 2002a, p. v) identifies the following conservation needs for this IRU: 1) maintain the current distribution of the bull trout and restore distribution in previously occupied areas, 2) maintain stable or increasing trends in bull trout abundance, 3) restore and maintain suitable habitat conditions for all life history stages and forms, 4) conserve genetic diversity and provide the opportunity for genetic exchange, and 5) establish good working relations with Canadian interests because local bull trout populations in this IRU are comprised mostly of migratory fish, whose habitat is mostly in Canada.

Reasons for Listing

Bull trout distribution, abundance, and habitat quality have declined range-wide (Bond 1992, pp. 2-3; Schill 1992, p. 42; Thomas 1992, entire; Ziller 1992, entire; Rieman and McIntyre 1993, p. 1; Newton and Pribyl 1994, pp. 4-5; McPhail and Baxter 1996, p. 1). Several local extirpations have been documented, beginning in the 1950s (Rode 1990, pp. 26-32; Ratliff and Howell 1992, entire; Donald and Alger 1993, entire; Goetz 1994, p. 1; Newton and Pribyl 1994, pp. 8-9; Light et al. 1996, pp. 6-7; Buchanan et al. 1997, p. 15; WDFW 1998, pp. 2-3). Bull trout were extirpated from the southernmost portion of their historic range, the McCloud River in California, around 1975 (Rode 1990, p. 32). 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, pp. 31651-31652).

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 nonnative species. Specific land and water management activities that depress bull trout populations and degrade habitat include the effects of 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, entire; Chamberlain et al. 1991, entire; Furniss et al. 1991, entire; Meehan 1991, entire; Nehlsen et al. 1991, entire; Sedell and Everest 1991, entire; Craig and Wissmar 1993pp, 18-19; Henjum et al. 1994, pp. 5-6; McIntosh et al. 1994, entire; Wissmar et al. 1994, entire; MBTSG 1995a, p. 1; MBTSG 1995b. pp. i-ii; MBTSG 1995c, pp. i-ii; MBTSG 1995d, p. 22; MBTSG 1995e, p. i; MBTSG 1996a, p. i-ii; MBTSG 1996b, p. i; MBTSG 1996c, p. i; MBTSG 1996d, p. i; MBTSG 1996e, p. i; MBTSG 1996f, p. 11; Light et al. 1996, pp. 6-7; USDA and USDI 1995, p. 2).

New Threats

Climate Change

The BLM concludes that the following narrative describing the effects of climate change to bull trout is also applicable to the ESA-listed Pacific salmon species within the planning area.

Global climate change, and the related warming of global climate, have been well documented (IPCC 2007, entire; ISAB 2007, entire; Combes 2003, entire). Evidence of global climate change/warming includes widespread increases in average air and ocean temperatures and accelerated melting of glaciers, and rising sea level. Given the increasing certainty that climate change is occurring and is accelerating (IPCC 2007, p. 253; Battin et al. 2007, p. 6720), the USFWS can no longer assume that climate conditions in the future will resemble those in the past.

Patterns consistent with changes in climate have already been observed in the range of many species and in a wide range of environmental trends (ISAB 2007, entire; Hari et al. 2006, entire; Rieman et al. 2007, entire). In the northern hemisphere, the duration of ice cover over lakes and rivers has decreased by almost 20 days since the mid-1800's (Magnuson et al. 2000, p. 1743). The range of many species has shifted poleward and elevationally upward. For cold-water associated salmonids in mountainous regions, where their upper distribution is often limited by impassable barriers, an upward thermal shift in suitable habitat can result in a reduction in range, which in turn can lead to a population decline (Hari et al. 2006, entire).

In the Pacific Northwest, most models project warmer air temperatures and increases in winter precipitation and decreases in summer precipitation. Warmer temperatures will lead to more precipitation falling as rain rather than snow. As the seasonal amount of snow pack diminishes, the timing and volume of stream flow are likely to change and peak river flows are likely to increase in affected areas. Higher air temperatures are also likely to increase water temperatures (ISAB 2007, pp. 15-17). For example, stream gauge data from western Washington over the past 5 to 25 years indicate a marked increasing trend in water temperatures in most major rivers.

Climate change has the potential to profoundly alter the aquatic ecosystems upon which the bull trout depends via alterations in water yield, peak flows, and stream temperature, and an increase in the frequency and magnitude of catastrophic wildfires in adjacent terrestrial habitats (Bisson et al. 2003, pp 216-217).

All life stages of the bull trout rely on cold water. Increasing air temperatures are likely to impact the availability of suitable cold water habitat. For example, ground water temperature is generally correlated with mean annual air temperature, and has been shown to strongly influence the distribution of other chars. Ground water temperature is linked to bull trout selection of spawning sites, and has been shown to influence the survival of embryos and early juvenile rearing of bull trout (Baxter 1997, p. 82). Increases in air temperature are likely to be reflected in increases in both surface and groundwater temperatures.

Climate change is likely to affect the frequency and magnitude of fires, especially in warmer drier areas such as are found on the eastside of the Cascade Mountains. Bisson et al. (2003, pp. 216-217) note that the forest that naturally occurred in a particular area may or may not be the forest that will be responding to the fire regimes of an altered climate. In several studies related to the effect of large fires on bull trout populations, bull trout appear to have adapted to past fire disturbances through mechanisms such as dispersal and plasticity. However, as stated earlier, the

future may well be different than the past and extreme fire events may have a dramatic effect on bull trout and other aquatic species, especially in the context of continued habitat loss, simplification and fragmentation of aquatic systems, and the introduction and expansion of exotic species (Bisson et al. 2003, pp. 218-219).

Migratory bull trout can be found in lakes, large rivers and marine waters. Effects of climate change on lakes are likely to impact migratory adfluvial bull trout that seasonally rely upon lakes for their greater availability of prey and access to tributaries. Climate-warming impacts to lakes will likely lead to longer periods of thermal stratification and coldwater fish such as adfluvial bull trout will be restricted to these bottom layers for greater periods of time. Deeper thermoclines resulting from climate change may further reduce the area of suitable temperatures in the bottom layers and intensify competition for food (Shuter and Meisner 1992. p. 11).

Bull trout require very cold water for spawning and incubation. Suitable spawning habitat is often found in accessible higher elevation tributaries and headwaters of rivers. However, impacts on hydrology associated with climate change are related to shifts in timing, magnitude and distribution of peak flows that are also likely to be most pronounced in these high elevation stream basins (Battin et al. 2007, p. 6720). The increased magnitude of winter peak flows in high elevation areas is likely to impact the location, timing, and success of spawning and incubation for the bull trout. Although lower elevation river reaches are not expected to experience as severe an impact from alterations in stream hydrology, they are unlikely to provide suitably cold temperatures for bull trout spawning, incubation and juvenile rearing.

As climate change progresses and stream temperatures warm, thermal refugia will be critical to the persistence of many bull trout populations. Thermal refugia are important for providing bull trout with patches of suitable habitat during migration through or to make feeding forays into areas with greater than optimal temperatures.

There is still a great deal of uncertainty associated with predictions relative to the timing, location, and magnitude of future climate change. It is also likely that the intensity of effects will vary by region (ISAB 2007, p 7). For example, several studies indicate that climate change has the potential to impact ecosystems in nearly all streams throughout the State of Washington (ISAB 2007, p. 13; Battin et al. 2007, p. 6722; Rieman et al. 2007, pp. 1558-1561). In streams and rivers with temperatures approaching or at the upper limit of allowable water temperatures, there is little if any likelihood that bull trout will be able to adapt to or avoid the effects of climate change/warming. There is little doubt that climate change is and will be an important factor affecting bull trout distribution. As its distribution contracts, patch size decreases and connectivity is truncated, bull trout populations that may be currently connected may face increasing isolation, which could accelerate the rate of local extinction beyond that resulting from changes in stream temperature alone (Rieman et al. 2007, pp. 1559-1560). Due to variations in land form and geographic location across the range of the bull trout, it appears that some populations face higher risks than others. Bull trout in areas with currently degraded water temperatures and/or at the southern edge of its range may already be at risk of adverse impacts from current as well as future climate change.

The ability to assign the effects of gradual global climate change to bull trout or to a specific location on the ground is beyond the USFWS technical capabilities at this time.

Conservation

Conservation Needs

The conservation needs of bull trout are often generally expressed as the four "Cs": cold, clean, complex, and connected habitat. Cold stream temperatures, clean water quality that is relatively free of sediment and contaminants, complex channel characteristics (including abundant large wood and undercut banks), and large patches of such habitat that are well connected by unobstructed migratory pathways are all needed to promote conservation of bull trout at multiple scales ranging from the coterminous to local populations (a local population is a group of bull trout that spawn within a particular stream or portion of a stream system). The recovery planning process for bull trout (USFWS 2002a, p. v; 2004a, pp. 35774-35776; 2004b, p. viii) has also identified the following conservation needs: 1) maintenance and restoration of multiple, interconnected populations in diverse habitats across the range of each IRU, 2) preservation of the diversity of life-history strategies, 3) maintenance of genetic and phenotypic diversity across the range of each IRU, and 4) establishment of a positive population trend. It has also been recognized that bull trout populations need to be protected from catastrophic fires across the range of each IRU (Rieman et al. 2003, entire).

Central to the survival and recovery of bull trout is the maintenance of viable core areas (USFWS 2002a, p. vi; USFWS 2004a, p. 35768; USFWS 2004b, p. iv). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat. Each of the IRUs listed above consists of one or more core areas. There are 121 core areas recognized across the coterminous range of the bull trout (USFWS 2004a, pp. 35784-35797).

1) *Maintenance and restoration of multiple, interconnected populations in diverse habitats across the range of each* IRU

Multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events (Hard 1995, pp. 313-314; Healy and Prince 1995, pp. 182-183; Rieman and Allendorf 2001, pp. 761-763; Rieman and McIntyre 1993, pp. 15-17; Spruell et al. 1999, pp. 118-119). Current patterns in bull trout distribution and other empirical evidence, when interpreted in view of emerging conservation theory, indicate that further declines and local extinctions are likely (Dunham and Rieman 1999, p. 643; Rieman and Allendorf 2001, pp. 761-762; Rieman et al. 1997, pp. 18-20). Based in part on guidance from Rieman and McIntyre (1993, p. 22), bull trout core areas with fewer than five local populations are at increased risk of extirpation; core areas with between 5 to 10 local populations are at intermediate risk of extirpation; and core areas which have more than 10 interconnected local populations are at diminished risk of extirpation.

Maintaining and restoring connectivity between existing populations of bull trout is important for the persistence of the species (Rieman and McIntyre 1993, pp. 15-17). Migration and occasional spawning between populations increases genetic variability and strengthens population variability (Rieman and McIntyre 1993, p. 7). Migratory corridors allow individuals access to unoccupied but suitable habitats, foraging areas, and refuges from disturbances (Saunders et al. 1991, p. 23).

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 adaptations 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, entire; Healy and Prince 1995, entire; Leary et al. 1993, entire; Rieman and Allendorf 2001, entire; Rieman and McIntyre 1993, pp. 15-18; Spruell et al. 1999, p. 118; Taylor et al. 1999, p. 1166). Changes in habitats and prevailing environmental conditions are increasingly likely to result in extinction of bull trout if genetic and phenotypic diversity is lost.

2) Preservation of the diversity of life-history strategies

The bull trout has multiple life history strategies, including migratory forms, throughout its range (Rieman and McIntyre 1993, p. 2). 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 1997, p. 5). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002, pp. 96-106). 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 (Frissell 1997, pp. 5-10; MBTSG 1998, pp. 12-13; Rieman and McIntyre 1993, p. 2).

3) Maintenance of genetic and phenotypic diversity across the range of each IRU

Healy and Prince (1995, p. 182) 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, p. 182) 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 (Healy and Prince 1995, p.182). 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, p. 304) as an important component in maintaining intraspecific adaptability (i.e., phenotypic plasticity) and ecological diversity within a genotype (Hard 1995, p. 304). 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, p. 15; Taylor et al. 1999, p. 1166).

4) Establishment of a positive population trend

A stable or increasing population is a key criterion for recovery under the requirements of the ESA. Measures of the trend of a population (the tendency to increase, decrease, or remain stable) include population growth rate or productivity. Estimates of population growth rate (*i.e.*, productivity over the entire life cycle) that indicate a population is consistently failing to replace itself, indicate increased extinction risk. Therefore, the reproductive rate should indicate the population is replacing itself, or growing.

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

The population growth rate is an indicator of extinction probability. The probability of going extinct cannot be measured directly; it can, however, be estimated as the consequence of the population growth rate and the variability in that rate. For a population to be considered viable, its natural productivity should be sufficient to replace itself from generation to generation. Evaluations of population status will also have to take into account uncertainty in estimates of population growth rate or productivity. For a population to contribute to recovery, its growth rate must indicate that the population is stable or increasing for a period of time (USFWS 2002a, p. 51)

5) Protect Bull Trout from Catastrophic Fires

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, p. 193).

Rieman and Clayton (1997a, entire) discussed relationships 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 (Rieman and Clayton 1997, p. 6). For example, Rieman and Clayton (1997, entire) 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 and Clayton 1997, p. 10). 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, p. 11).

In terms of conserving bull trout, the appropriate strategy to reduce the effects 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.

Changes in Status since Listing

Coastal-Puget Sound IRU

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

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

Columbia River IRU

The overall status of the Columbia River IRU has not changed appreciably since its listing on June 10, 1998. Populations of bull trout and their habitat in this area have been affected by a number of actions addressed under section 7 of the ESA. Most of these actions resulted in degradation of the environmental baseline of bull trout habitat, and all permitted or analyzed the

potential for incidental take of bull trout. The Plum Creek Cascades HCP, Plum Creek Native Fish HCP, and Forest Practices HCP addressed portions of the Columbia River IRU of bull trout.

Klamath River IRU

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

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

Saint Mary-Belly River IRU

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

State Conservation Actions

Idaho*:* Conservation actions by the State of Idaho include: (1) the development of a management plan for bull trout in 1993 (Conley 1993, entire); (2) the approval of the State of Idaho Bull Trout Conservation Plan (Idaho Plan) in July 1996 (Batt 1996, entire); (3) the development of 21 problem assessments involving 59 key watersheds; (4) the implementation of conservation actions identified in the problem assessments; and, (5) the implementation of more restrictive angling regulations.

Montana: Conservation actions by the State of Montana include: (1) development of the Montana Bull Trout Restoration Plan issued in 2000 (MBTRT 2000, entire), which defines strategies for ensuring the long-term persistence of bull trout in Montana; (2) formation of the

Montana Bull Trout Restoration Team (MBTRT) and Montana Bull Trout Scientific Group (MBTSG) to produce a plan for maintaining, protecting, and increasing bull trout populations; (3) the development of watershed groups to initiate localized bull trout restoration efforts; (4) funding of habitat restoration projects, recovery actions, and genetic studies throughout the state; (5) the abolition of brook trout stocking programs; and, (6) restrictive angling regulations.

Nevada: Conservation actions by the State of Nevada include: (1) the preparation of 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, entire); (2) implementation of more restrictive State angling regulations in an attempt to protect bull trout in the Jarbidge River in Nevada; and, (3) the abolition of a rainbow trout stocking in the Jarbidge River.

Oregon: Since 1990, the State of Oregon has taken extensive action to address the conservation of bull trout, including: (1) Establishing bull trout working groups 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; (2) establishment of more restrictive harvest regulations in 1990; (3) reduced stocking of hatchery-reared rainbow trout and brook trout into areas where bull trout occur; (4) angler outreach and education efforts are also being implemented in river basins occupied by bull trout; (5) research to further examine life history, genetics, habitat needs, and limiting factors of bull trout in Oregon; (6) reintroduction of bull trout fry from the McKenzie River watershed to the adjacent Middle Fork of the Willamette River, which is historic but currently unoccupied, isolated habitat; (7) expansion of the Oregon Plan for Salmon and Watersheds (Oregon 1997, entire) to include all at-risk wild salmonids throughout the State; and, (8) reintroduction of bull trout to the Clackamas River, and important recovery action for the Willamette River Basin as identified in the USFWS's 2002 draft recovery plan.

Washington: Conservation actions by the State of Washington include: (1) establishment of the Salmon Recovery Act (Engrossed Substitute House Bill (ESHB) 2496) and Watershed Management Act (ESHB 2514) by the Washington State legislature to assist in funding and planning salmon recovery efforts; (2) abolition of brook trout stocking in streams or lakes connected to bull trout-occupied waters; (3) changing angling regulations in Washington prohibit the harvest of bull trout, except for a few areas where stocks are considered "healthy"; (4) collecting and mapping updated information on bull trout distribution, spawning and rearing areas, and potential habitat; and, (5) adopting 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.

Tribal Conservation Activities

Many Tribes throughout the range of the bull trout are participating on bull trout conservation working groups or recovery teams in their geographic areas of interest. Some tribes are also implementing projects that focus on bull trout or that address anadromous fish and benefit bull trout (e.g., habitat surveys, passage at dams and diversions, habitat improvement, and movement studies).

2. Status of Critical Habitat

Lost River and Shortnose Sucker

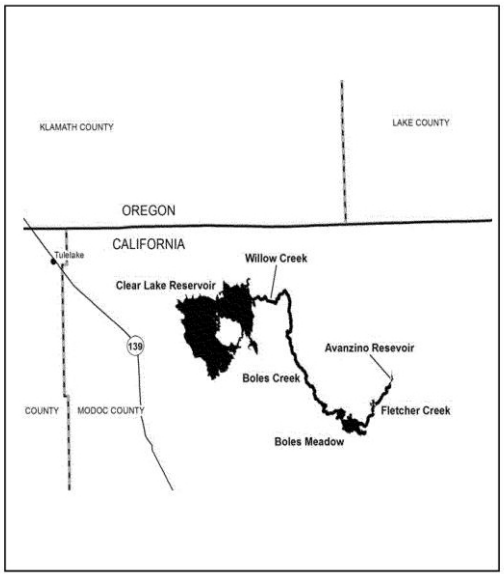
Two critical habitat units are designated for each species, as described below.

- The Upper Klamath Lake Unit 1 (Figure 11), situated in Klamath County, Oregon, includes Upper Klamath Lake and Agency Lake, the Link River and upper Klamath River downstream to Keno Dam (known as the Keno Reservoir), as well as portions of the Williamson and Sprague Rivers, for a total of 90,415 acres and 119 RM. This unit is the same for both species with the following exceptions: (1) for Lost River suckers the unit extends upstream in the Sprague River to the Beatty Gap east of Beatty (near RM 75); (2) for shortnose suckers the unit extends upstream to near RM 8 in the Sprague River.

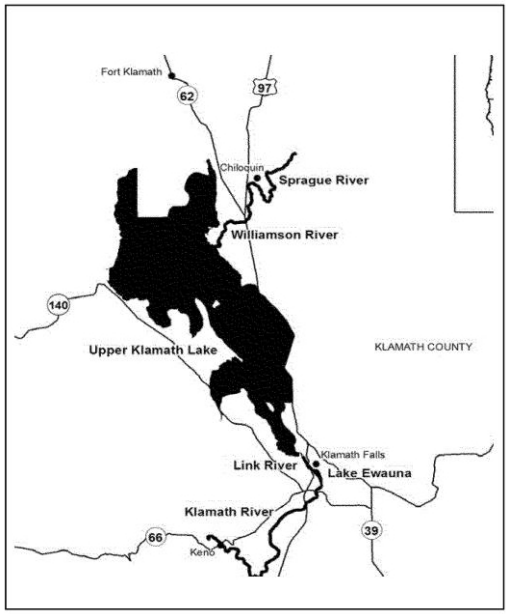
- The Lost River Basin Unit 2 (Figure 11) is situated in Klamath and Lake Counties, Oregon and Modoc County, California. It includes Clear Lake and its main tributary, Willow Creek, for both the Lost River sucker and shortnose sucker, and Gerber Reservoir and its main tributaries for the shortnose sucker only, for a total of approximately 33,000 acres and 88 RMs. Additionally there are differences in the amount of upstream critical habitat in Willow Creek for the two species. For the Lost River sucker, critical habitat includes Willow Creek and its tributary Boles Creek upstream to Avanzino Reservoir in California. For shortnose suckers, critical habitat extends up Willow Creek to Boles Creek and upstream past Fletcher Creek and includes Fourmile and Wildhorse Creeks in California and also includes Willow Creek to its East Fork in Oregon.

In total, approximately 146 miles of streams and 118,000 acres of lakes and reservoirs for Lost River sucker and approximately 136 miles of streams and 124,000 acres of lakes and reservoirs for shortnose sucker in Klamath and Lake Counties, Oregon, and Modoc County, California, fall within the boundaries of the critical habitat designation.

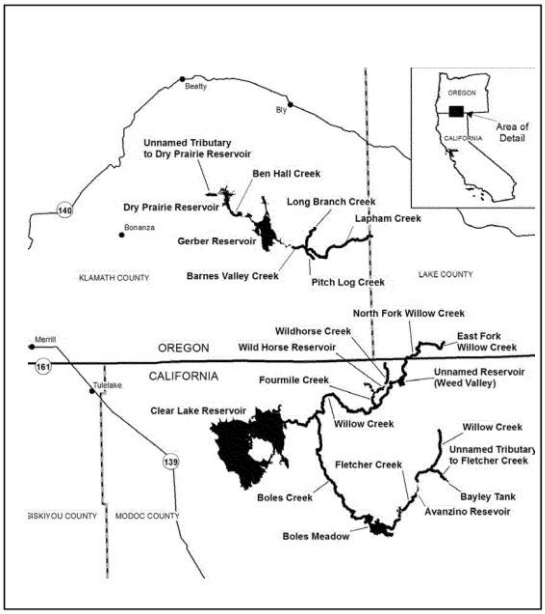
Lost River Sucker Critical Habitat Unit 1



Lost River Sucker Critical Habitat Unit 2



Shortnose Sucker Critical Habitat Unit 1



Shortnose Sucker Critical Habitat Unit 2

Figure 11. Critical habitat units for Lost River suckers and shortnose suckers designated in 2012 (USFWS 2012c, pp. 73764-73768).

The miles and percentages of designated CH by BLM and other ownerships for the Lost River sucker and shortnose sucker RUs are presented in Table 82.

Table 82. Critical habitat miles and acres, and percentages by land ownership for the Lost River sucker and shortnose sucker RUs.

Lost River Sucker				
Total RU Miles/Acres	BLM Miles/Acres in Planning Area	BLM Percent of Total Miles/Acres in Planning Area	Other Miles/Acres in Planning Area	Other Percent of Total Miles/Acres in Planning Area
140.9 / 117,848	0 / 38	0% / .04%	119.0 / 90,064	100% / 99.96%
Shortnose Sucker				
Total RU Miles/Acres	BLM Miles/Acres in Planning Area	BLM Percent of Total Miles/Acres in Planning Area	Other Miles/Acres in Planning Area	Other Percent of Total Miles/Acres in Planning Area
207.9 / 123,590	9.0 / 1,076	6.5% / 1.1%	129.3 / 94,038	93.5% / 98.9%

The BLM does not manage any land encompassing streams with designated CH for Lost River suckers. The BLM manages land adjacent to 38 acres of Lost River designated CH within the planning area boundary. This represents 0.04 percent of all Lost River designated CH within the planning area.

The primary constituent elements

Based on the current knowledge of the habitat characteristics required to sustain the species' life-history processes, the PCEs specific to self-sustaining Lost River sucker and shortnose sucker populations are:

- PCE 1—*Water*. Areas with sufficient water quantity and depth within lakes, reservoirs, streams, marshes, springs, groundwater sources, and water-quality refuge habitats with minimal physical, biological, or chemical impediments to connectivity. Water must have varied depths to accommodate each life stage: shallow water (up to 3.3 feet for larval life stage, and deeper water (up to 14.8 feet) for older life stages. The water quality characteristics should include water temperatures of less than 28.0 °C; pH less than 9.75; dissolved oxygen levels greater than 4.0 mg/L; low levels of microcystin (a liver toxin produced by cyanobacteria); and un-ionized ammonia less than 0.5 mg/L. Elements also include natural flow regimes that provide flows during the appropriate time of year or, if flows are controlled, minimal flow departure from a natural hydrograph.

- PCE 2—*Spawning and Rearing Habitat.* Streams and shoreline springs with gravel and cobble substrate at depths typically less than 4.3 feet with adequate stream velocity to allow spawning to occur. Areas containing emergent vegetation adjacent to open water provides habitat for rearing and facilitates growth and survival of suckers, as well as protection from predation and protection from currents and turbulence.

- PCE 3—*Food.* Areas that contain abundant forage base, including a broad array of chironomids, crustaceans, and other aquatic macroinvertebrates.

Special management considerations include the following:

- Protect and improve water quality by reducing sediment and nutrient loading

- Manage water bodies so that there is minimal departure from a natural hydrograph
- Maintain, improve, or reestablish instream flows to improve the quantity of water available
- Manage groundwater use to ensure it does not affect surface waters
- Address water level fluctuations in reservoirs
- Maintain appropriate depths in water quality refuge areas for access and maintaining buffers around refuge areas
- Maintain habitat in reservoirs; the timing and volume of water diverted needs to be addressed
- Improve access to spawning and rearing habitats
- Manage exotic fishes by restoring habitats for native fishes.

Bull Trout

Current Designation

The USFWS published a final critical habitat designation for the coterminous United States population of the bull trout on October 18, 2010 (USFWS 2010a, entire); the rule became effective on November 17, 2010. A justification document was also developed to support the rule and is available on the USFWS website (http://www.fws.gov/pacific/bulltrout). The scope of the designation involved the species' coterminous range, which includes the Jarbidge River, Klamath River, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments (also considered as IRUs).[13] Rangewide, the USFWS designated reservoirs/lakes and stream/shoreline miles as bull trout critical habitat (Table 83). Designated bull trout critical habitat is of two primary use types: 1) spawning and rearing (SR), and 2) foraging, migration, and overwintering (FMO).

[13] The USFWS's 5 year review (USFWS 2008a, pg. 9) identified six draft recovery units. Until the bull trout draft recovery plan is finalized, the current five interim recovery units are in affect for purposes of section 7 jeopardy analyses and recovery. The adverse modification analysis does not rely on recovery units.

Table 83. Stream/shoreline distance and reservoir/lake area designated as bull trout critical habitat.

State	Stream/Shoreline Miles	Reservoir/Lake Acres
Idaho	8,771.6	170,217.5
Montana	3,056.5	221,470.7
Nevada	71.8	-
Oregon[1]	2,835.9	30,255.5
Oregon/Idaho[2]	107.7	-
Washington	3,793.3	66,308.1
Washington (marine)	753.8	-
Washington/Idaho	37.2	-
Washington/Oregon	301.3	-
Total[3]	19,729.0	488,251.7

[1]No shore line is included in Oregon

[2]Pine Creek Drainage which falls within Oregon

[3]Total of freshwater streams: 18,975

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

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

The final rule continues to exclude some critical habitat segments based on a careful balancing of the benefits of inclusion versus the benefits of exclusion. Critical habitat does not include: (1) waters adjacent to non-Federal lands covered by legally operative incidental take permits for

habitat conservation plans (HCPs) issued under section 10(a)(1)(B) of the ESA, in which bull trout is a covered species on or before the publication of this final rule; (2) waters within or adjacent to Tribal lands subject to certain commitments to conserve bull trout or a conservation program that provides aquatic resource protection and restoration through collaborative efforts, and where the Tribes indicated that inclusion would impair their relationship with the USFWS; or (3) waters where impacts to national security have been identified (USFWS 2010a, p. 63903). Excluded areas are approximately 10 percent of the stream/shoreline miles and 4 percent of the lakes and reservoir acreage of designated critical habitat. Each excluded area is identified in the relevant Critical Habitat Unit (CHU) text, as identified in paragraphs (e)(8) through (e)(41) of the final rule. It is important to note that the exclusion of waterbodies from designated critical habitat does not negate or diminish their importance for bull trout conservation. Because exclusions reflect the often complex pattern of land ownership, designated critical habitat is often fragmented and interspersed with excluded stream segments.

The miles and percentages of designated CH by BLM and other ownerships for the bull trout coastal and Klamath Recovery Units are presented in Table 84.

Table 84. Critical habitat miles and acres, and percentages by land ownership for the bull trout Coastal and Klamath Recovery Units.

Bull Trout Coastal Recovery Unit				
Total RU Miles/Acres	BLM Miles/Acres in Planning Area	BLM Percent of Total Miles/Acres in Planning Area	Other Miles/Acres in Planning Area	Other Percent of Total Miles/Acres in Planning Area
4,677.2 / 80,401	0.8 / 0	0.3% / 0%	283.1 / 8,912	99.7% / 100%
Bull Trout Klamath Recovery Unit				
Total RU Miles/Acres	BLM Miles/Acres in Planning Area	BLM Percent of Total Miles/Acres in Planning Area	Other Miles/Acres in Planning Area	Other Percent of Total Miles/Acres in Planning Area
276.7 / 9,327	0 / 0	0% / 0%	141.9 / 9,193	100% / 100%

The BLM manages land encompassing 0.8 mile of stream and no acres of designated CH in the planning area within the bull trout Coastal Recovery Unit. The 0.8 mile is entirely within the McKenzie River basin. The BLM does not manage any land containing miles or acres of designated CH within the bull trout Klamath Recovery Unit within the planning area.

The primary constituent elements

Conservation Role and Description of Critical Habitat

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

Thirty-two CHUs within the geographical area occupied by the species at the time of listing are designated under the revised rule. Twenty-nine of the CHUs contain all of the physical or

biological features identified in this final rule and support multiple life-history requirements. Three of the mainstem river units in the Columbia and Snake River basins contain most of the physical or biological features necessary to support the bull trout's particular use of that habitat, other than those physical biological features associated with PCEs 5 and 6, which relate to breeding habitat.

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

Primary Constituent Elements for Bull Trout

Within the designated critical habitat areas, the PCEs for bull trout are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. Based on the current knowledge of the life history, biology, and ecology of this species and the characteristics of the habitat necessary to sustain its essential life-history functions, the USFWS determined that the PCEs, as described within USFWS 2010a, are essential for the conservation of bull trout. A summary of those PCEs follows.

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

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

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

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

5. Water temperatures ranging from 2 °C to 15 °C, with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

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

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

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

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

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

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

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

In marine nearshore areas, the inshore extent of critical habitat is the mean higher high-water (MHHW) line, including the uppermost reach of the saltwater wedge within tidally influenced freshwater heads of estuaries. The MHHW line refers to the average of all the higher high-water heights of the two daily tidal levels. Marine critical habitat extends offshore to the depth of 10 m

(33 ft) relative to the mean low low-water (MLLW) line (zero tidal level or average of all the lower low-water heights of the two daily tidal levels). This area between the MHHW line and minus 10 m MLLW line (the average extent of the photic zone) is considered the habitat most consistently used by bull trout in marine waters based on known use, forage fish availability, and ongoing migration studies and captures geological and ecological processes important to maintaining these habitats. This area contains essential foraging habitat and migration corridors such as estuaries, bays, inlets, shallow subtidal areas, and intertidal flats.

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

Activities that cause adverse effects to critical habitat are evaluated to determine if they are likely to "destroy or adversely modify" critical habitat by no longer serving the intended conservation role for the species or retaining those PCEs that relate to the ability of the area to at least periodically support the species. Activities that may destroy or adversely modify critical habitat are those that alter the PCEs to such an extent that the conservation value of critical habitat is appreciably reduced (USFWS 2010a, pp. 63898:63943; USFWS 2004a, pp. 140-193; USFWS 2004b, pp. 69-114). The USFWS's evaluation must be conducted at the scale of the entire critical habitat area designated, unless otherwise stated in the final critical habitat rule (USFWS and NMFS 1998, Ch. 4 p. 39). Thus, adverse modification of bull trout critical habitat is evaluated at the scale of the final designation, which includes the critical habitat designated for the Klamath River, Jarbidge River, Columbia River, Coastal-Puget Sound, and Saint Mary-Belly River population segments. However, the USFWS considers all 32 CHUs to contain features or areas essential to the conservation of the bull trout (USFWS 2010a, pp. 63898:63901, 63944). Therefore, if a proposed action would alter the physical or biological features of critical habitat to an extent that appreciably reduces the conservation function of one or more critical habitat units for bull trout, a finding of adverse modification of the entire designated critical habitat area may be warranted (USFWS 2010a, pp. 63898:63943).

Current Critical Habitat Condition Range-wide

The condition of bull trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (Ratliff and Howell 1992, entire; Schill 1992, p. 40; Thomas 1992, p. 28; Buchanan et al. 1997, p. vii; Rieman et al. 1997, pp. 15-16; Quigley and Arbelbide 1997, pp. 1176-1177). This condition reflects the condition of bull trout habitat. The decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and the introduction of nonnative species (USFWS 1998, pp. 31648-31649; USFWS 1999b, p. 17111).

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PCEs, those which appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows: 1) fragmentation and

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

Effects of Climate Change on Bull Trout Critical Habitat

The BLM concludes that the following narrative describing the effects of climate change to the PCEs of designated CH for bull trout is also applicable to the PCEs of designated CH for ESA-listed Pacific salmon species within the planning area.

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

Many of the PCEs for bull trout may be affected by the presence of toxics and/or increased water temperatures within the environment. The effects will vary greatly depending on a number of factors which include which toxic substance is present, the amount of temperature increase, the likelihood that critical habitat would be affected (probability), and the severity and intensity of any effects that might occur (magnitude).

The ability to assign the effects of gradual global climate change bull trout critical habitat or to a specific location on the ground is beyond the USFWS technical capabilities at this time.

IV. Environmental Baseline

The environmental baseline is defined in the Code of Federal Regulations as "the past and present impacts of all Federal, state or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation in process [50 CFR 402.02]."

This section begins with statistics for land ownership by ESU, DPS and RU, within and outside the PRMP planning area. Statistics for the distribution of ESA-listed fish species and designated CH on BLM land and on other ownerships is then presented by ESU, DPS and RU. The section continues with a description of general habitat conditions across the planning area, then presents AREMP monitoring results, and concludes with specific baseline conditions by ESU/DPS/RU.

A. Statistics for Land Ownership

The BLM manages a minority of the land within each analysis area (McKenzie basin for bull trout), RU (sucker species), ESU (salmon) or DPS (steelhead). Statistics for the acres of land managed by the BLM by ESU or DPS, within and outside the planning area, are displayed in **Table 85** to Table 94. BLM management of lands within the ESUs and DPSs ranges from lows of 0.8 percent of the land area within the Lower Columbia River ESUs/DPS to a high of 15.9 percent for the Oregon Coast coho salmon ESU. For McKenzie River bull trout, it is 6.1 percent. For the Lost River and shortnose sucker in the Lost Recovery Unit, it is 8.3 percent, and for the Upper Klamath Recovery Unit, it is 2.5 percent.

The BLM remains a minority land manager if one considers only those areas within the PRMP planning area. BLM land ownership ranges from 2.2 percent of the Lower Columbia River Chinook salmon and coho salmon ESUs to a high of 15.9 percent for the Oregon Coast coho salmon ESU. For McKenzie River bull trout, it is 6.1 percent. For the Lost River and shortnose sucker in the Lost Recovery Unit, it is 20 percent, and for the Upper Klamath Recovery Unit, it is 3.2 percent.

Table 85. Acres and percentages by land ownership for the McKenzie River basin bull trout analysis area, within the PRMP planning area.

McKenzie River Basin Land Ownership	Acres	% Acres in Basin	% Acres w/in PRMP Area
McKenzie River Basin bull trout	**856,409**	**100.0%**	**100.0%**
Within RMP for Western Oregon	**856,409**	**100.0%**	**100.0%**
Other Ownership	804,077	93.9%	93.9%
BLM	52,332	6.1%	6.1%

Table 86. Acres and percentages by land ownership within the Lost Recovery Unit for Lost River and shortnose suckers, within and outside of the PRMP planning area.

Evolutionarily Significant Unit and Land Ownership	Acres	% Acres in RU	% Acres w/in PRMP Area
Lost Recovery Unit	**1,921,537**	**100.0%**	**-**
Outside RMP for Western Oregon	**1,127,897**	**58.7%**	**-**
Within RMP for Western Oregon	**793,640**	**41.3%**	**100.0%**
Other Ownership	634,580	33.0%	80.0%
BLM	159,060	8.3%	20.0%

Table 87. Acres and Percentages by **land ownership within the Upper Klamath Recovery Unit for Lost River and shortnose suckers, within and outside of the PRMP planning area.**

Evolutionarily Significant Unit and Land Ownership	Acres	% Acres in ESU	% Acres w/in PRMP Area
Upper Klamath Recovery Unit	**2,940,423**	**100.0%**	**-**
Outside RMP for Western Oregon	**707,025**	**24.0%**	**-**
Within RMP for Western Oregon	**2,233,398**	**76.0%**	**100.0%**
Other Ownership	2,161,599	73.5%	96.8%
BLM	71,798	2.5%	3.2%

Table 88. Acres and percentages by land ownership for the Lower Columbia River Chinook salmon ESU, within and outside of the PRMP planning area.

Evolutionarily Significant Unit and Land Ownership	Acres	% Acres in ESU	% Acres w/in PRMP Area
Lower Columbia River Chinook Salmon	**4,770,456**	**100.0%**	**-**
Outside RMP for Western Oregon	**3,115,128**	**65.3%**	**-**
Within RMP for Western Oregon	**1,655,328**	**34.7%**	**100.0%**
Other Ownership	1,619,183	33.9%	97.8%
BLM	36,146	0.8%	2.2%

Table 89. Acres and percentages by land ownership for the Lower Columbia River coho salmon ESU, within and outside of the PRMP planning area.

Evolutionarily Significant Unit and Land Ownership	Acres	% Acres in ESU	% Acres w/in PRMP Area
Lower Columbia River Coho Salmon	**4,770,456**	**100.0%**	**-**
Outside RMP for Western Oregon	**3,115,122**	**65.3%**	**-**
Within RMP for Western Oregon	**1,655,334**	**34.7%**	**100.0%**
Other Ownership	1,619,188	33.9%	97.8%
BLM	36,146	0.8%	2.2%

Table 90. Acres and percentages by land ownership for the Lower Columbia River steelhead DPS, within and outside of the PRMP planning area.

Evolutionarily Significant Unit and Land Ownership	Acres	% Acres in ESU	% Acres w/in PRMP Area
Lower Columbia River Steelhead	**3,682,397**	**100.0%**	**-**
Outside RMP for Western Oregon	**2,641,722**	**71.7%**	**-**
Within RMP for Western Oregon	**1,040,675**	**28.3%**	**100.0%**
Other Ownership	1,011,613	27.5%	97.2%
BLM	29,062	0.8%	2.8%

Table 91. Acres and percentages by land ownership for the Oregon Coast coho salmon ESU, within and outside of the PRMP planning area.

Evolutionarily Significant Unit and Land Ownership	Acres	% Acres in ESU	% Acres w/in PRMP Area
Oregon Coast Coho Salmon	**6,873,907**	**100.0%**	**100.0%**
Within RMP for Western Oregon	**6,873,907**	**100.0%**	**100.0%**
Other Ownership	5,782,042	84.1%	84.1%
BLM	1,091,866	15.9%	15.9%

Table 92. Acres and percentages by land ownership for the Southern Oregon Northern California Coasts coho salmon ESU, within and outside of the PRMP planning area.

Evolutionarily Significant Unit and Land Ownership	Acres	% Acres in ESU	% Acres w/in PRMP Area
Southern Oregon / Northern California Coasts Coho Salmon	**11,452,007**	**100.0%**	**-**
Outside RMP for Western Oregon	**8,065,513**	**70.4%**	**-**
Within RMP for Western Oregon	**3,386,495**	**29.6%**	**100.0%**
Other Ownership	2,653,599	23.2%	78.4%
BLM	732,896	6.4%	21.6%

Table 93. Acres and percentages by land ownership for the Upper Willamette River Chinook salmon ESU, within and outside of the PRMP planning area.

Evolutionarily Significant Unit and Land Ownership	Acres	% Acres in ESU	% Acres w/in PRMP Area
Upper Willamette River Chinook Salmon	**4,344,499**	**100.0%**	**-**
Outside RMP for Western Oregon	**2,690**	**0.1%**	**-**
Within RMP for Western Oregon	**4,341,809**	**99.9%**	**100.0%**
Other Ownership	4,105,084	94.5%	94.5%
BLM	236,726	5.4%	5.5%

Table 94. Acres and percentages by land ownership for the Upper Willamette River steelhead DPS, within and outside of the PRMP planning area.

Evolutionarily Significant Unit and Land Ownership	Acres	% Acres in ESU	% Acres w/in PRMP Area
Upper Willamette River Steelhead	**3,108,539**	**100.0%**	**100.0%**
Within RMP for Western Oregon	**3,108,539**	**100.0%**	**100.0%**
Other Ownership	2,922,480	94.0%	94.0%
BLM	186,059	6.0%	6.0%

B. Statistics for the Distribution of ESA-listed Fish Species and Designated Critical Habitat within the PRMP Planning Area

Based upon information available in Streamnet for salmonid fish distribution, and USFWS distribution geospatial layers for the two sucker species, the BLM manages a minority of stream miles occupied by ESA-listed fish species within the planning area boundary. Statistics are displayed in Table 95 to Table 106. BLM management of stream miles of fish distribution ranges from zero to 3.2 percent of runs within an ESU or DPS for five of the seven Pacific salmon ESUs/DPS evaluated in this BA. The highest percentage of stream miles of fish distribution on BLM land is 10.4 percent for the Oregon Coast coho salmon and Southern Oregon Northern California Coasts ESUs. Known distribution differs from the extent of designated CH for those species for which there is distribution information.

The BLM also manages a minority of stream miles occupied by ESA-listed resident fish species within the planning area. The BLM manages land with 0.6 percent of the distribution of McKenzie Basin bull trout. For Lost River suckers, the BLM manages lands containing 3.6 and 6.6 percent of their distribution in the Lost Recovery Unit and Upper Klamath Recovery Unit, respectively. For shortnose suckers, the BLM manages lands containing 9.2 and 16.1 percent of their distribution in the Lost Recovery Unit and Upper Klamath Recovery Unit, respectively.

Table 95. Miles and percentages of Lower Columbia River Chinook salmon distribution by land ownership within the PRMP planning area.

Run and Ownership	Miles of Distribution	Percentage
Spring Run Total	**480.1**	**100.0%**
Other Ownership	470.4	98.0%
BLM	9.7	2.0%
Summer Run Total	**92.1**	**100.0%**
Other Ownership	92.1	100.0%
BLM	0.0	0.0%
Fall Run Total	**506.8**	**100.0%**
Other Ownership	504.1	99.5%
BLM	2.7	0.5%

Table 96. Miles and percentages of Lower Columbia River coho salmon distribution by land ownership within the PRMP planning area.

Ownership	Miles of Distribution	Percentage
Total	**1,189.8**	**100.0%**
Other Ownership	1171.9	98.5%
BLM	17.9	1.5%

Table 97. Miles and percentages of Lower Columbia River steelhead distribution by land ownership within the PRMP planning area.

Run and Ownership	Miles of Distribution	Percentage
Summer Run Total	**307.4**	**100.0%**
Other Ownership	298.2	97.0%
BLM	9.2	3.0%
Winter Run Total	**643.8**	**100.0%**
Other Ownership	18.9	97.1%
BLM	18.9	2.9%

Table 98. Miles and percentages of Oregon coast coho salmon distribution by land ownership within the PRMP planning area.

Ownership	Miles of Distribution	Percentage
Total	**6,982.3**	**100.0%**
Other Ownership	6,259.7	89.6%
BLM	723.1	10.4%

Table 99. Miles and percentages of Southern Oregon / Northern California Coasts coho salmon distribution by land ownership within the PRMP planning area.

Ownership	Miles of Distribution	Percentage
Total	**1,333.6**	**100.0%**
Other Ownership	1,195.1	89.6%
BLM	138.5	10.4%

Table 100. Miles and percentages of Upper Willamette River Chinook salmon ESU distribution by land ownership within the PRMP planning area.

Ownership	Miles of Distribution	Percentage
Total	**1,661.6**	**100.0%**
Other Ownership	1,612.1	97.0%
BLM	49.5	3.0%

Table 101. Miles and percentages of Upper Willamette River steelhead distribution by land ownership within the PRMP planning area.

Ownership	Miles of Distribution	Percentage
Total	**1,771.9**	**100.0%**
Other Ownership	1,714.5	96.8%
BLM	57.4	3.2%

Table 102. Miles and percentages of McKenzie River basin bull trout distribution by land ownership within the PRMP Planning area.

Ownership	Miles of Distribution	Percentage
Total	**157.86**	**100.0%**
Other Ownership	157.86	99.45%
BLM	0.87	0.55%

Table 103. Miles and percentages of Lost River sucker distribution in the Lost Recovery Unit by land ownership within the PRMP Planning area.

Ownership	Miles of Distribution	Percentage
Total	**117.6**	**100.0%**
Other Ownership	113.3	96.4%
BLM	4.3	3.6%

Table 104. Miles and percentages of Lost River sucker distribution in the Upper Klamath Recovery Unit by land ownership within the PRMP Planning area.

Ownership	Miles of Distribution	Percentage
Total	**134.5**	**100.0%**
Other Ownership	125.6	93.4%
BLM	8.9	6.6%

Table 105. Miles and percentages of shortnose sucker distribution in the Lost Recovery Unit by land ownership within the PRMP planning area.

Ownership	Miles of Distribution	Percentage
Total	**153.4**	**100.0%**
Other Ownership	139.3	90.8%
BLM	14.1	9.2%

Table 106. Miles and percentages of shortnose sucker distribution in the Upper Klamath Recovery Unit by land ownership with the PRMP planning area.

Ownership	Miles of Distribution	Percentage
Total	**55.3**	**100.0%**
Other Ownership	46.4	83.9%
BLM	8.9	16.1%

The BLM also manages a minority of the miles of designated CH within each Pacific salmon ESU or DPS. Statistics for the miles of designated CH managed by the BLM by ESU or DPS, within and outside the planning area, are displayed in Table 107 to Table 118. BLM management of miles of designated CH within the ESUs and DPSs ranges from 0.5 to 3.7 percent of the total

miles in five of seven Pacific salmon ESUs/DPSs (when considering the entire ESU or DPS). It is 10.3 and 12.0 percent for the Oregon Coast coho salmon and Southern Oregon / Northern California Coasts ESUs, respectively.

The BLM remains a minority land manager for miles of designated CH if one considers only those portions of ESUs and DPSs within the PRMP planning area. The percentages of BLM management range from 1.6 to 3.7 percent of the miles of designated CH for five of the seven Pacific salmon ESUs/DPSs. It is 10.3 and 12.1 percent for the Oregon Coast coho salmon and Southern Oregon / Northern California Coasts ESUs, respectively.

The BLM also manages a minority of designated CH stream miles for ESA-listed resident fish species within the planning area. The BLM manages land with 0.6 percent of the designated CH for McKenzie Basin bull trout. For Lost River suckers, the BLM manages lands containing 3.6 and 6.6 percent of designated CH in the Lost Recovery Unit and Upper Klamath Recovery Unit, respectively. For shortnose suckers, the BLM manages lands containing 9.2 and 16.1 percent of designated CH in the Lost Recovery Unit and Upper Klamath Recovery Unit, respectively.

Similarly, the BLM manages a minority of designated CH acres (reservoirs and lakes) for bull trout and sucker species. There is no BLM ownership of the 1,443.5 acres of bull trout designated CH in Cougar Reservoir in the McKenzie River basin. There is no BLM ownership of the 370.9 acres of Lost River sucker designated CH in the Lost Recovery unit, and 38.4 acres (0.04 percent) of the 89,732.2 acres of Lost River sucker designated CH in the Upper Klamath Recovery Unit. For shortnose sucker designated CH in the Lost Recovery unit, the BLM manages 1,038 acres (19.3 percent) of the 5,382 acres. For shortnose sucker designated CH in the Upper Klamath Recovery Unit, the BLM manages 38.4 acres (0.04 percent) of the 89,732.2 acres.

Table 107. Miles and percentages of Lower Columbia River Chinook salmon designated critical habitat by land ownership, within and outside of the PRMP planning area.

Evolutionarily Significant Unit and Land Ownership	Miles of Critical Habitat	% CH Miles in ESU	% CH Miles w/in RMP Area
Lower Columbia River Chinook Salmon	**1,312.3**	**100.0%**	**-**
Outside RMP for Western Oregon	**913.6**	**69.6%**	**-**
Within RMP for Western Oregon	**398.7**	**30.4%**	**100.0%**
Other Ownership	391.8	29.9%	98.3%
BLM	7.0	0.5%	1.8%

Table 108. Miles and percentages of Lower Columbia River coho salmon designated critical habitat by land ownership, within and outside of the PRMP planning area.

Evolutionarily Significant Unit and Land Ownership	Miles of Critical Habitat	% CH Miles in ESU	% CH Miles w/in RMP Area
Lower Columbia River Coho Salmon	**3,208.4**	**100.0%**	**-**
Outside RMP for Western Oregon	**2,101.4**	**65.5%**	**-**
Within RMP for Western Oregon	**1,107.0**	**34.7%**	**100.0%**
Other Ownership	1,089.0	33.9%	98.4%
BLM	18.0	0.8%	1.6%

Table 109. Miles and percentages of Lower Columbia River steelhead designated critical habitat by land ownership, within and outside of the PRMP planning area.

Distinct Population Segment and Land Ownership	Miles of Critical Habitat	% CH Miles in ESU	% CH Miles w/in RMP Area
Lower Columbia River Steelhead	**2,341.1**	**100.0%**	**-**
Outside RMP for Western Oregon	**1,810.8**	**77.4%**	**-**
Within RMP for Western Oregon	**530.3**	**22.7%**	**100.0%**
Other Ownership	512.6	21.9%	96.7%
BLM	17.7	0.8%	3.3%

Table 110. Miles and percentages of Oregon Coast coho salmon designated critical habitat by land ownership, within and outside of the PRMP planning area.

Evolutionarily Significant Unit and Land Ownership	Miles of Critical Habitat	% CH Miles in ESU	% CH Miles w/in RMP Area
Oregon Coast Coho Salmon	**6,648.5**	**100.0%**	**100.0%**
Within RMP for Western Oregon	**6,648.5**	**100.0%**	**100.0%**
Other Ownership	5,960.7	89.7%	89.7%
BLM	687.8	10.3%	10.3%

Table 111. Miles and percentages of Southern Oregon Northern California Coasts coho salmon designated critical habitat by land ownership, within and outside of the PRMP planning area.

Evolutionarily Significant Unit and Land Ownership	Miles of Critical Habitat	% CH Miles in ESU	% CH Miles w/in RMP Area
Southern OR\Northern CA Coasts Coho Salmon	**3,133.1**	**100.0%**	**-**
Outside RMP for Western Oregon	**36.3**	**1.2%**	**-**
Within RMP for Western Oregon	**3,096.8**	98.8%	100.0%
Other Ownership	2,721.6	86.9%	87.9%
BLM	375.3	12.0%	12.1%

Table 112. Miles and percentages of Upper Willamette River Chinook salmon designated critical habitat by land ownership, within and outside of the PRMP planning area.

Evolutionarily Significant Unit and Land Ownership	Miles of Critical Habitat	% CH Miles in ESU	% CH Miles w/in RMP Area
Upper Willamette River Chinook Salmon	**1,290.1**	**100.0%**	**100.0%**
Within RMP for Western Oregon	**1,290.1**	**100.0%**	**100.0%**
Other Ownership	1,251.4	97.0%	97.0%
BLM	38.8	3.0%	3.0%

Table 113. Miles and percentages of Upper Willamette River steelhead designated critical habitat by land ownership, within and outside of the PRMP planning area.

Distinct Population Segment and Land Ownership	Miles of Critical Habitat	% CH Miles in ESU	% CH Miles w/in RMP Area
Upper Willamette River Steelhead	**1,140.6**	**100.0%**	**100.0%**
Within RMP for Western Oregon	**1,140.6**	**100.0%**	**100.0%**
Other Ownership	1,098.6	96.3%	96.3%
BLM	42.0	3.7%	3.7%

Table 114. Miles, acres and percentages of McKenzie River basin bull trout designated critical habitat by land ownership within the PRMP planning area.

Ownership	Critical Habitat Miles	Percentage	Critical Habitat Acres	Percentage
Total	**120.15**	**100.0%**	**1,443.5**	**100%**
Other Ownership	120.15	99.3%	1,443.5	100%
BLM	0.84	0.7%	0.0	0%

Table 115. Miles, acres and percentages of Lost River sucker designated critical habitat in the Lost Recovery Unit by land ownership within the PRMP planning area.

Ownership	Critical Habitat Miles	Percentage	Critical Habitat Acres	Percentage
Total	**19.8**	**100%**	**370.9**	**100%**
Other Ownership	19.8	100%	370.9	100%
BLM	0.0	0%	0.0	0%

Table 116. Miles, acres and percentages of Lost River sucker designated critical habitat in the Upper Klamath Recovery Unit by land ownership within the PRMP planning area.

Ownership	Critical Habitat Miles	Percentage	Critical Habitat Acres	Percentage
Total	**99.2**	**100.0%**	**89,732.2**	**100.00%**
Other Ownership	99.2	100%	89,693.8	99.96%
BLM	0.0	0%	38.4	0.04%

Table 117. Miles, acres and percentages of shortnose sucker designated critical habitat in the Lost Recovery Unit by land ownership within the PRMP planning area.

Ownership	Critical Habitat Miles	Percentage	Critical Habitat Acres	Percentage
Total	**39.0**	**100.0%**	**5,382**	**100.0%**
Other Ownership	30.0	77%	4,344	80.7%
BLM	9.0	23%	1,038	19.3%

Table 118. Miles, acres and percentages of shortnose sucker designated critical habitat in the Upper Klamath Recovery unit by land ownership within the PRMP planning area.

Ownership	Critical Habitat Miles	Percentage	Critical Habitat Acres	Percentage
Total	**27.1**	**100.0%**	**89,732.2**	**100.00%**
Other Ownership	27.1	100.0%	89,693.8	99.96%
BLM	0.0	0.0%	38.4	0.04%

Figure 12 to Figure 21 are maps displaying ESA-listed fish occupancy, designated CH for salmon, steelhead, bull trout, Lost River sucker and shortnose sucker, and BLM land ownership within the ESUs/DPSs/RUs and the McKenzie River basin in the planning area. Maps are not shown for Southern DPS green sturgeon and Southern DPS Pacific eulachon because their designated CH is extremely limited within the planning area.

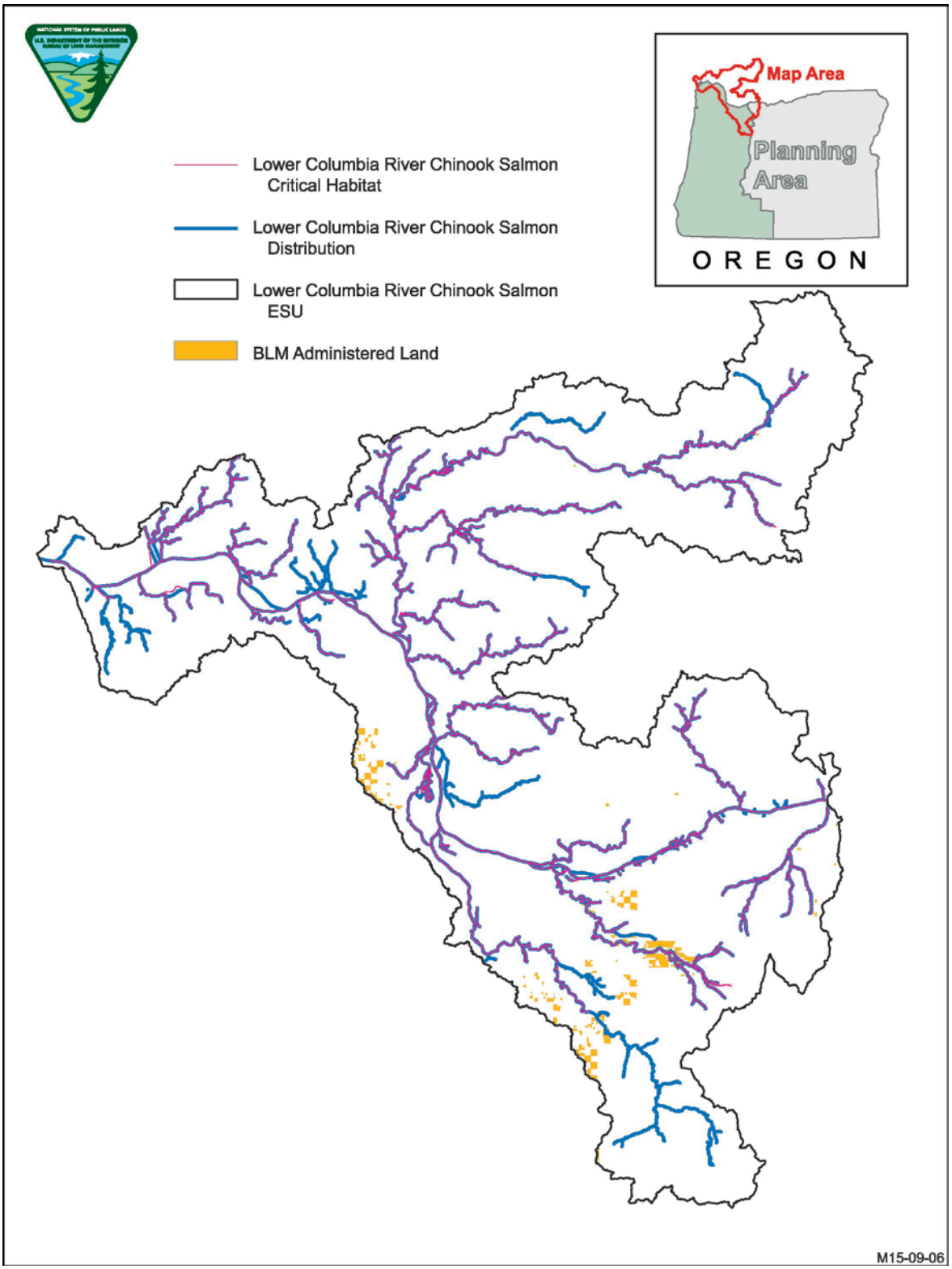


Figure 12. Lower Columbia River Chinook salmon ESU displaying occupancy, designated critical habitat and BLM land ownership within the planning area.

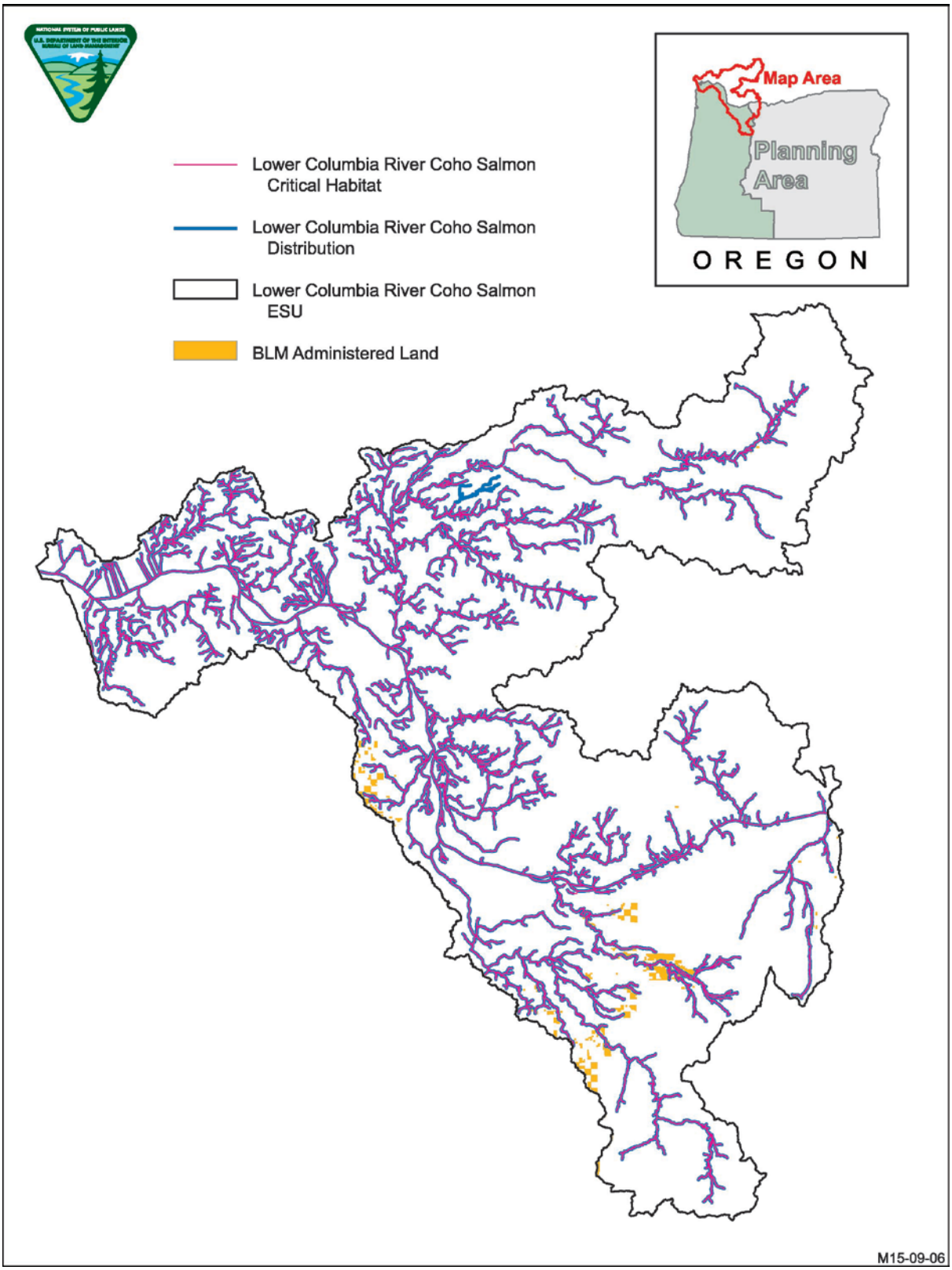


Figure 13. Lower Columbia River coho salmon ESU displaying occupancy, designated critical habitat and BLM land ownership within the planning area.

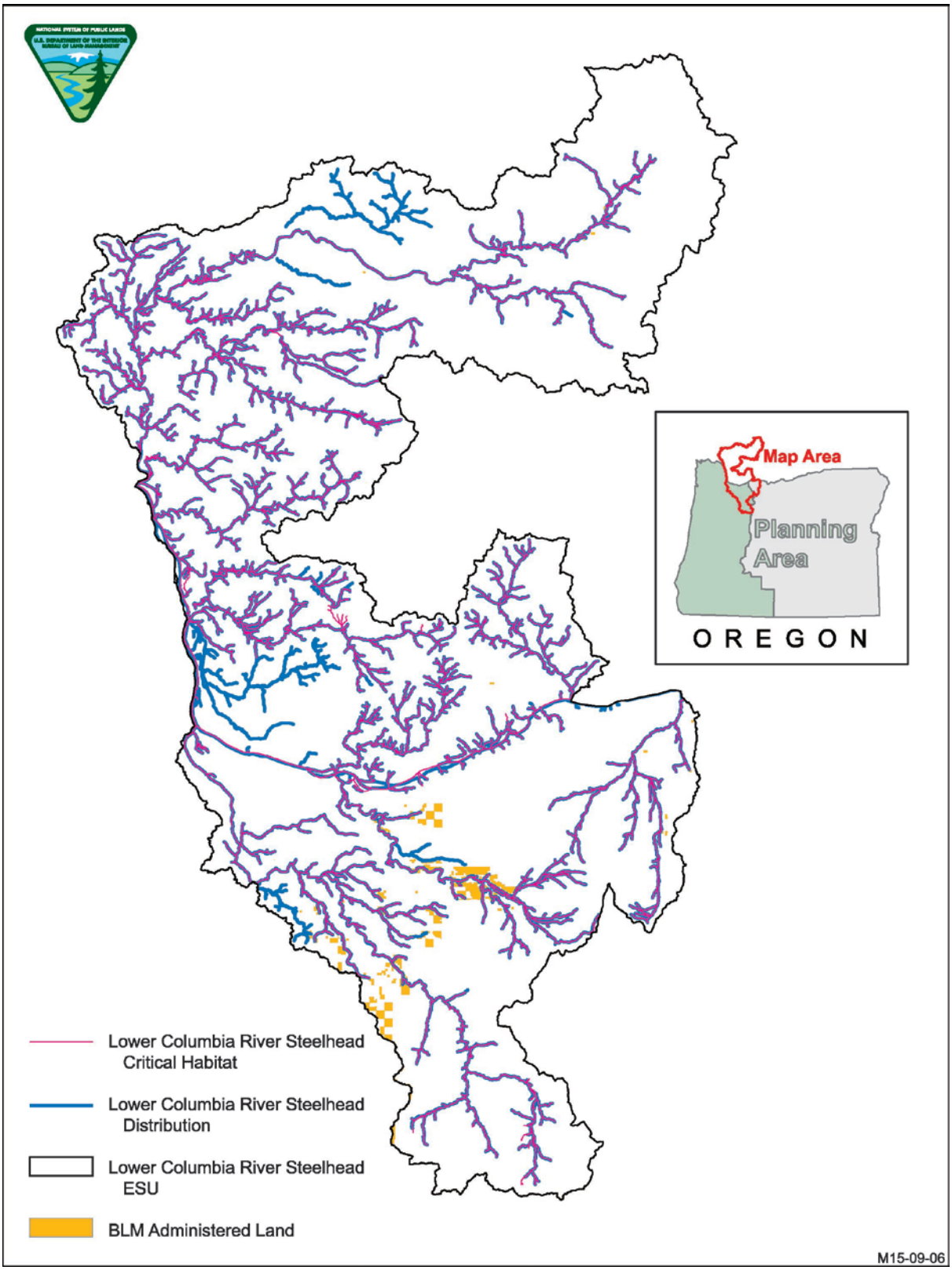


Figure 14. Lower Columbia River steelhead DPS displaying occupancy, designated critical habitat and BLM land ownership within the planning area.

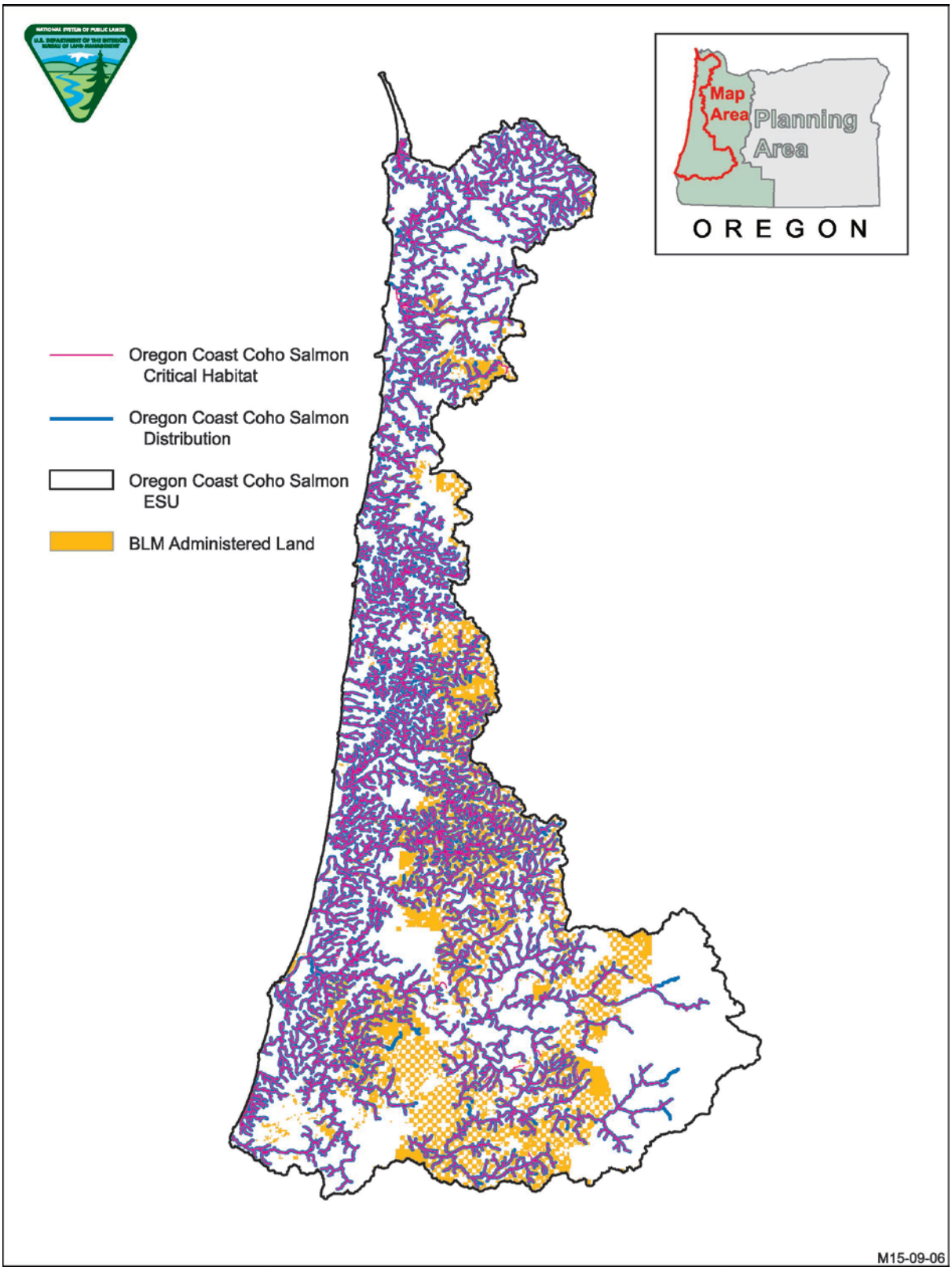


Figure 15. Oregon Coast coho salmon ESU displaying occupancy, designated critical habitat and BLM land ownership within the planning area.

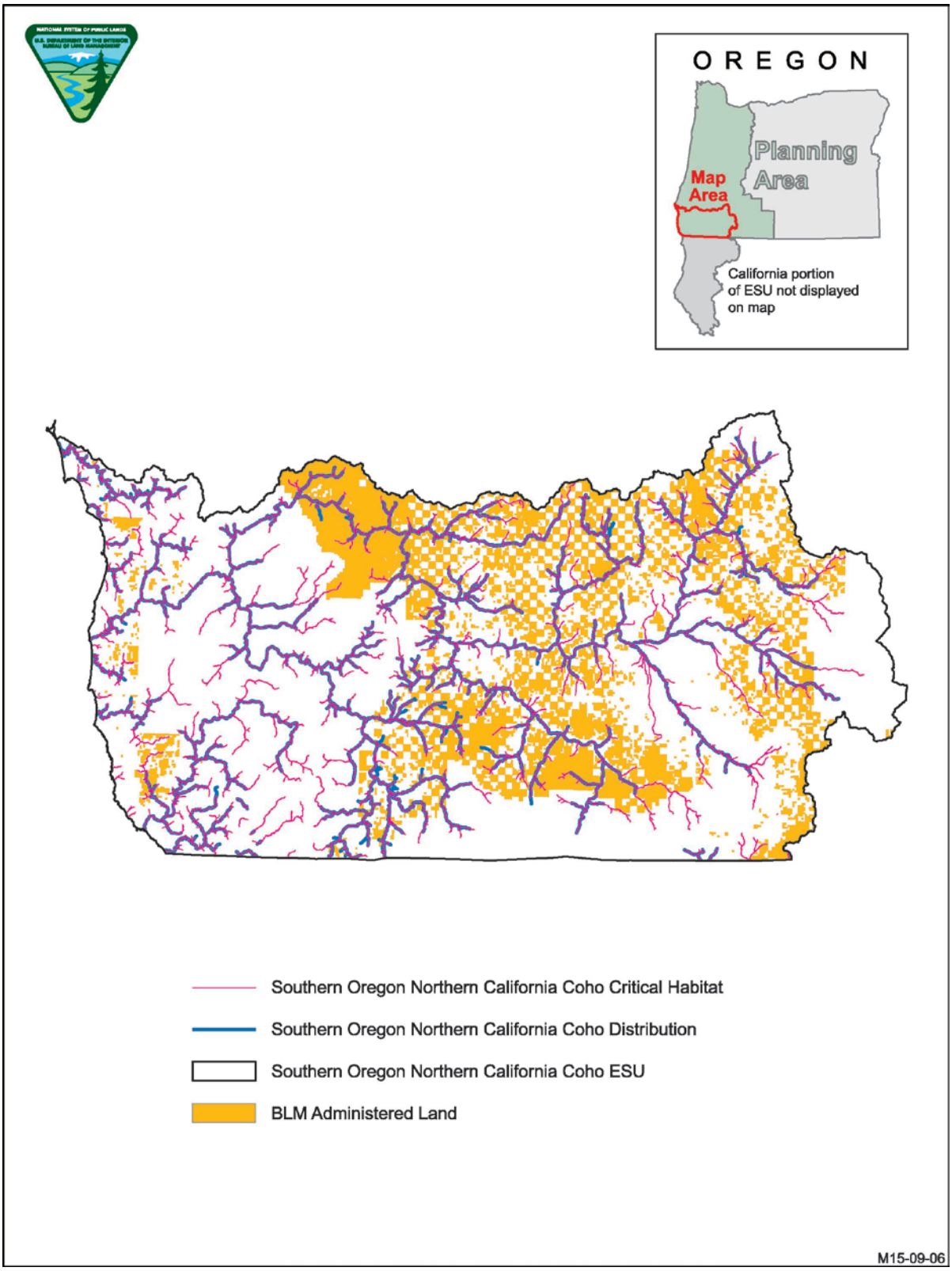


Figure 16. Southern Oregon / Northern California Coasts coho salmon ESU displaying occupancy, designated critical habitat and BLM land ownership within the planning area.

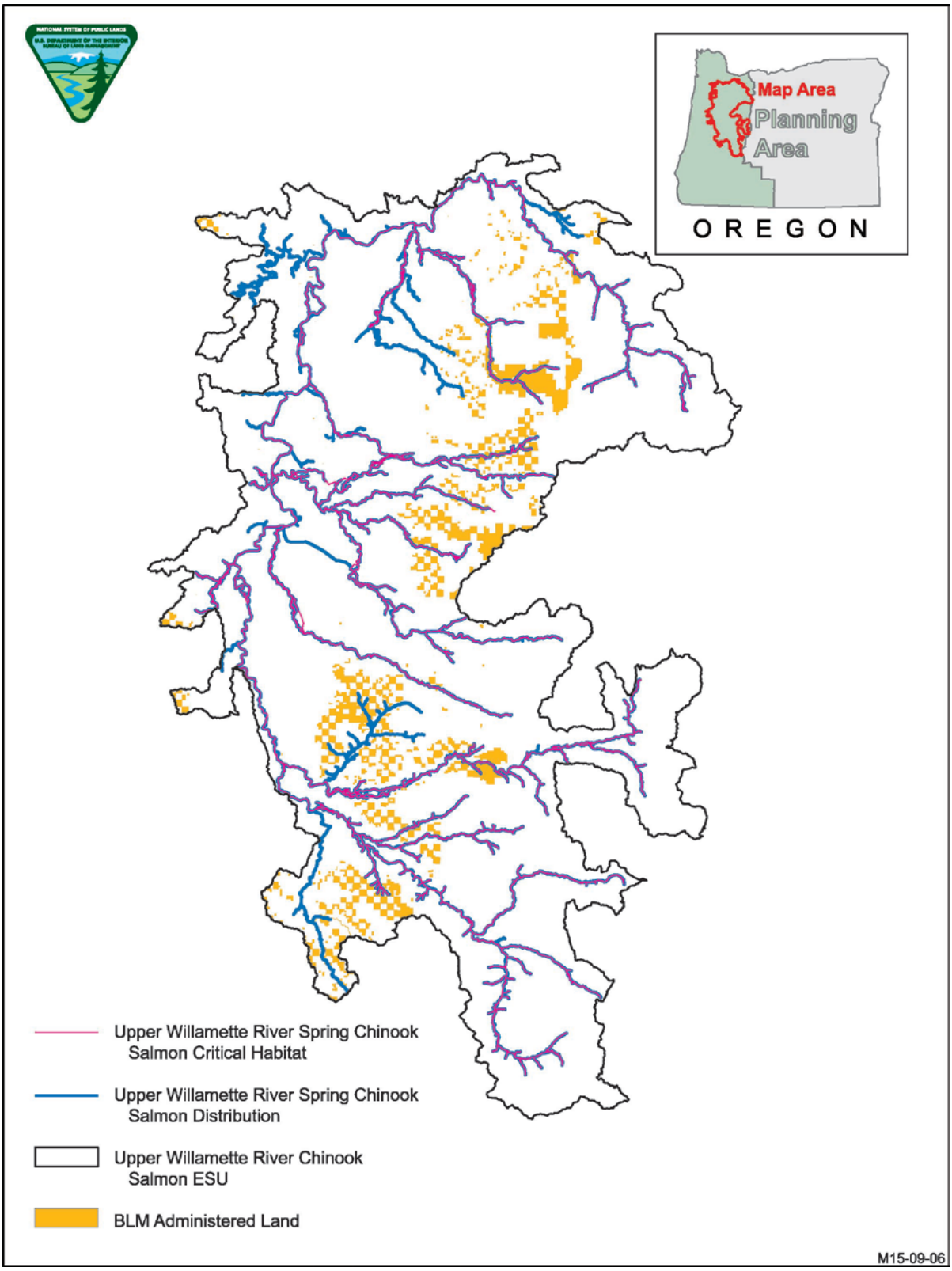


Figure 17. Upper Willamette River Chinook salmon ESU displaying occupancy, designated critical habitat and BLM land ownership within the planning area.

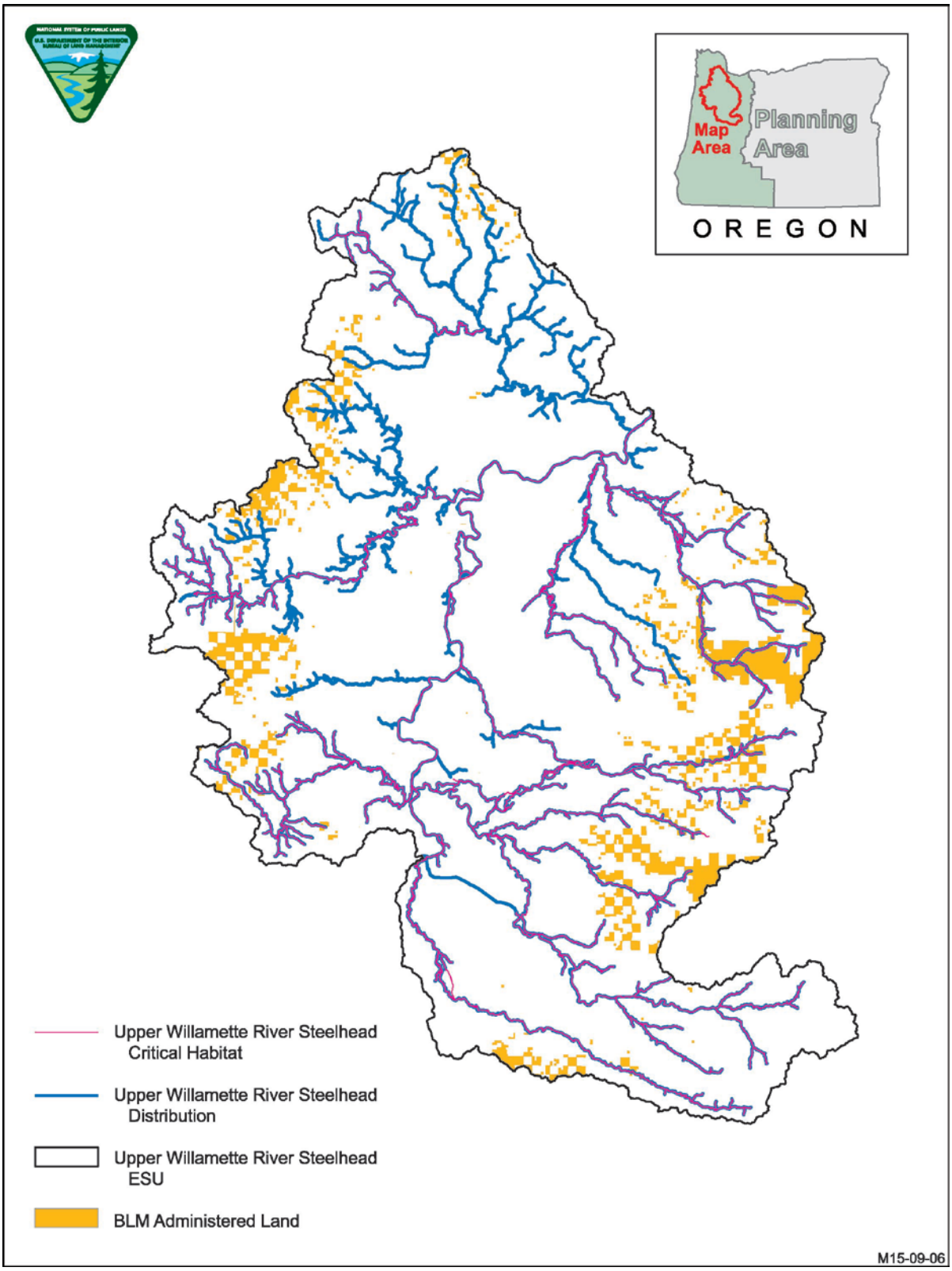


Figure 18. Upper Willamette River steelhead DPS displaying occupancy, designated critical habitat and BLM land ownership within the planning area.

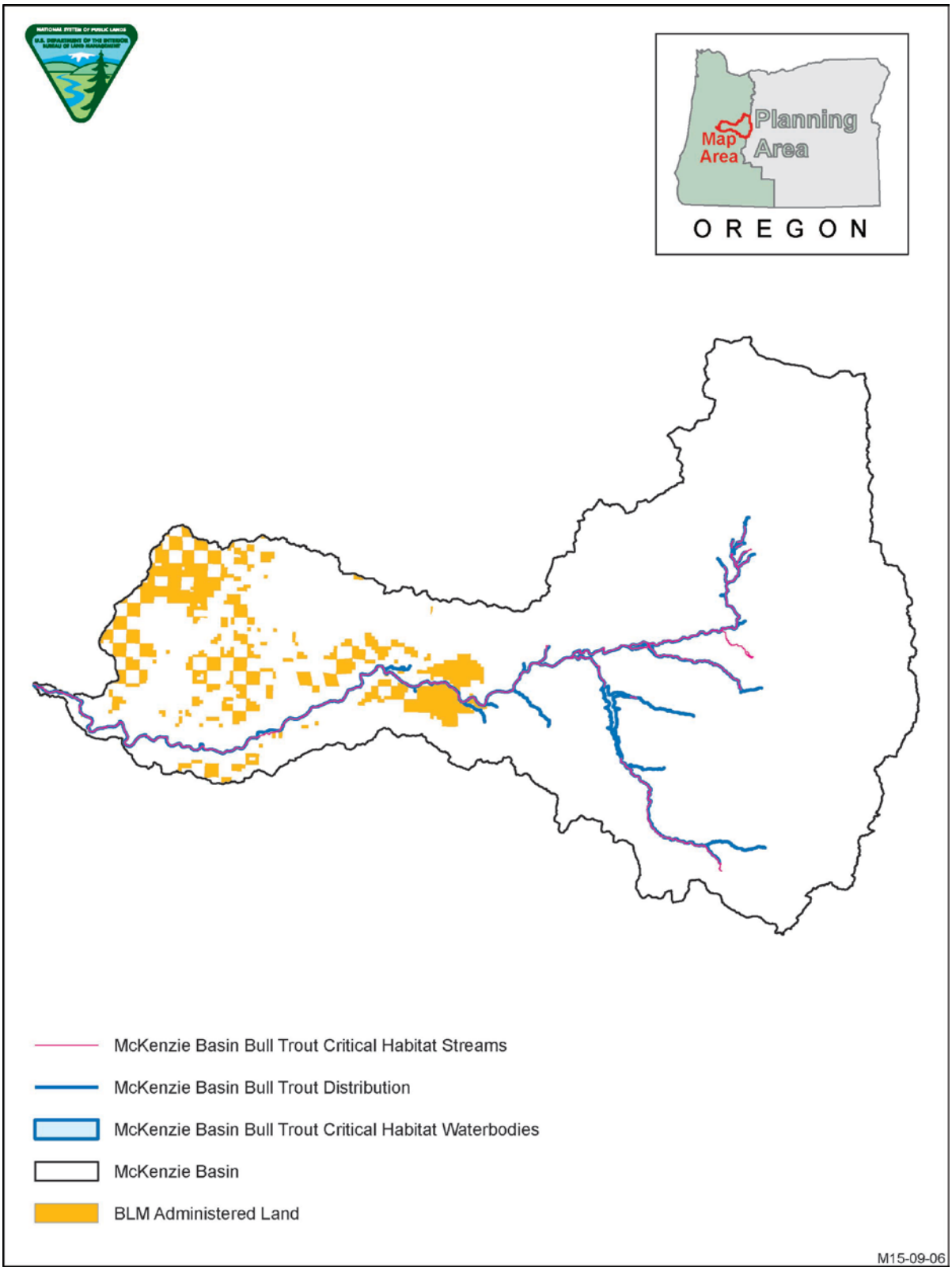


Figure 19. McKenzie River basin bull trout occupancy, designated critical habitat and BLM land ownership within the planning area.

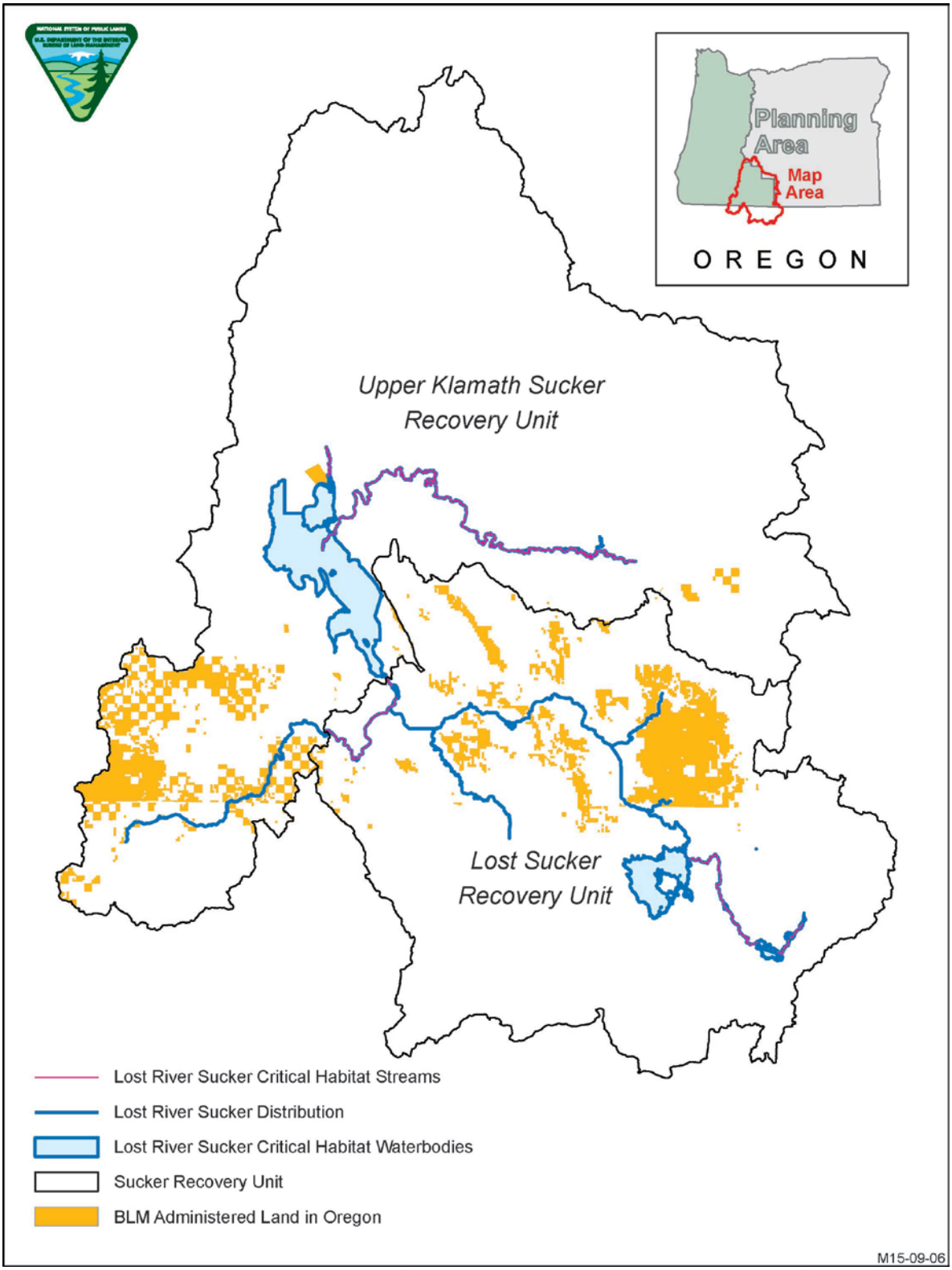


Figure 20. Lost River sucker occupancy, designated critical habitat and BLM land ownership in the Upper Klamath and Lost Recovery Units within the planning area.

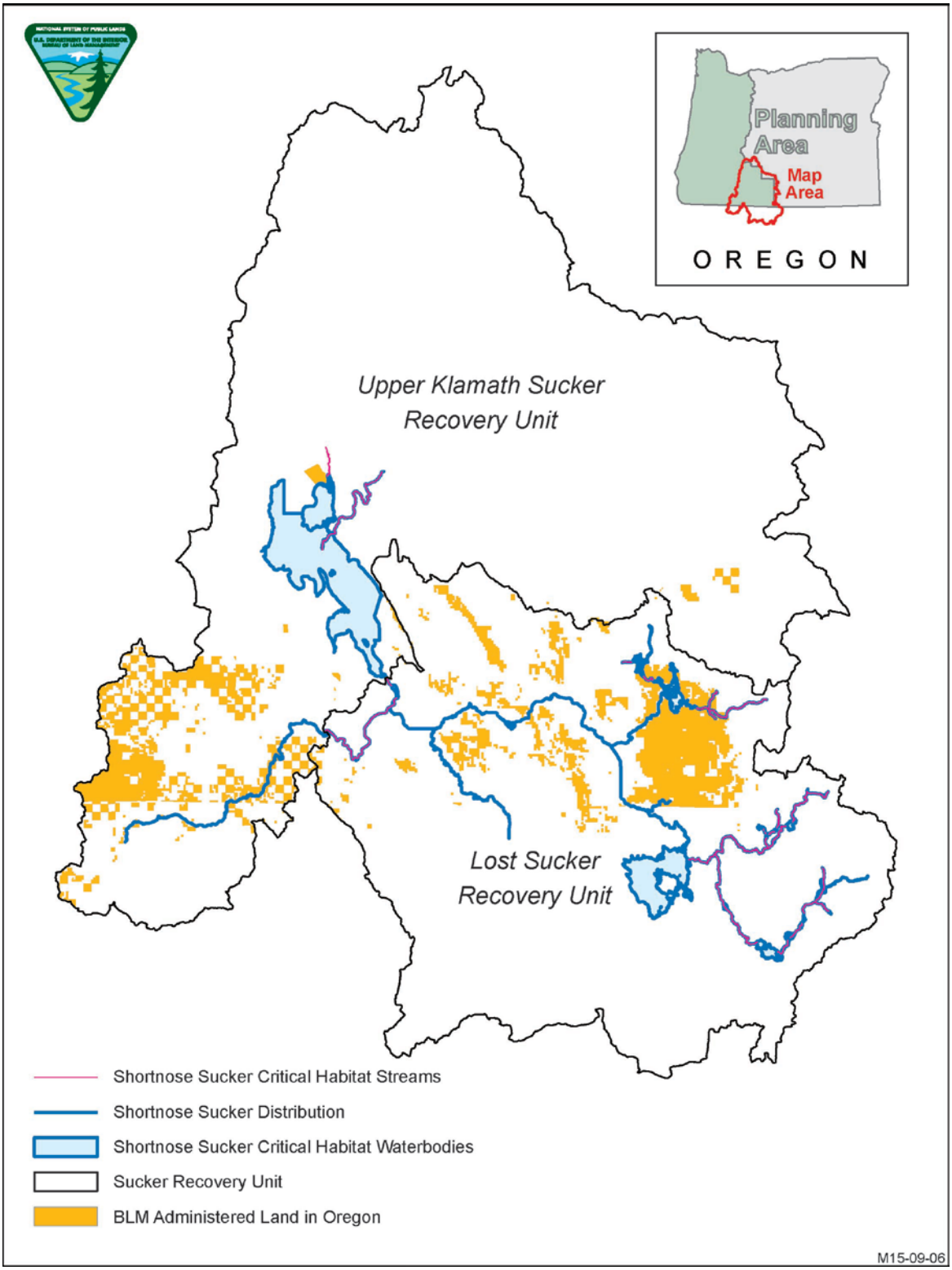


Figure 21. Shortnose sucker occupancy, designated critical habitat and BLM land ownership in the Upper Klamath and Lost Recovery Units within the planning area.

Statistics are presented below in Table 119 to Table 125 for BLM land ownership, miles of designated CH, and miles of fish distribution within the PRMP planning area at the population scale for ESA-listed Pacific salmon and steelhead. The trend at the scale of ESUs and DPSs shown above, that the BLM manages a small percentage of these features, is consistent with that at the population scale. Table 119 displays statistics for populations of the Lower Columbia River Chinook salmon ESU where there is BLM land ownership. The Big Creek, Upper Gorge Tributaries and Young's Bay fall-run populations of the Lower Columbia River Chinook salmon ESU have no BLM land ownership but are either partially or entirely within the PRMP planning area. For populations with BLM land ownership, four of five populations have 0 to 0.2 percent of the miles of designated CH and 0 percent of the miles of the Chinook salmon distribution. In the Sandy River population, the BLM manages land with 6.6 percent of the miles of designated CH and 4.4 or 4.5 percent of the miles of Chinook salmon distribution (depending upon the run). Maps displaying populations for ESA-listed salmon and steelhead and BLM land ownership within the planning area follow the tables (Figure 22 to Figure 30).

Table 119. Statistics for BLM land ownership, BLM miles of designated critical habitat and BLM miles of salmon distribution for populations of the Lower Columbia River Chinook salmon ESU.

Population Name	Run	BLM Acres	Percent of Total Acres	BLM Miles Designated CH	Percent of Total Miles Designated CH	BLM Miles of Chinook Salmon Distribution	Percent of Total Miles of Chinook Salmon Distribution
Clackamas River	Fall	14,333	2.1%	0.2	0.2%	0	0%
Clatskanie River	Fall	809	0.5%	0.1	0.2%	0	0%
L. Gorge Tribs	Fall	2	0%	0	0%	0	0%
Sandy River	Bright	14,723	5.1%	6.8	6.6%	2.7	4.5%
Sandy River	Fall	14,723	5.1%	6.8	6.6%	2.7	4.5%
Sandy River	Spring	14,723	5.1%	6.8	6.6%	4.3	4.4%
Scappoose River	Fall	6,262	3.7%	0	0%	0	0%

Table 120 displays statistics for populations of the Lower Columbia River coho salmon ESU where there is BLM land ownership. The Big Creek and Young's Bay populations of the Lower Columbia River coho salmon ESU have no BLM land ownership but are either partially or entirely within the PRMP planning area. For populations with BLM land ownership, three of five populations have 0 to 0.6 percent of the miles of designated CH and 0 to 0.5 percent of the miles of coho salmon distribution. In the Clackamas River population, the BLM manages land with 2.6 percent of the miles of designated CH and 2.3 percent of the miles of coho salmon distribution. In the Sandy River population, the BLM manages land with 4.8 percent of the miles of designated CH and 4.8 percent of the miles of coho salmon distribution.

Table 120. Statistics for BLM land ownership, BLM miles of designated critical habitat and BLM miles of salmon distribution for populations of the Lower Columbia River coho salmon ESU.

Population Name	BLM Acres	Percent of Total Acres	BLM Miles Designated CH	Percent of Total Miles Designated CH	BLM Miles of Coho Salmon Distribution	Percent of Total Miles of Coho Salmon Distribution
Clackamas River	14,333	2.1%	9.3	2.6%	9.3	2.3%
Clatskanie River	809	0.5%	0.8	0.6%	0.8	0.5%
Lower Gorge Tributaries	2	0%	0	0%	0	0%
Sandy River	14,723	5.1%	7.3	4.8%	7.2	4.8%
Scappoose River	6,262	3.7%	0.6	0.4%	0.6	0.4%

Table 121 displays statistics for populations of the Lower Columbia River steelhead DPS where there is BLM land ownership. The Big Creek and Young's Bay populations of the Lower Columbia River steelhead DPS have no BLM land ownership but are either partially or entirely within the PRMP planning area. In the Clackamas River population, the BLM manages land with 2.7 percent of the miles of designated CH and 2.9 percent of the miles of steelhead distribution. In the Sandy River population, the BLM manages land with 5.0 percent of the miles of designated CH and 3.7 percent of the miles of steelhead distribution.

Table 121. Statistics for BLM land ownership, BLM miles of designated critical habitat and BLM miles of steelhead distribution for populations of the Lower Columbia River steelhead DPS.

Population Name	Run	BLM Acres	Percent of Total Acres	BLM Miles Designated CH	Percent of Total Miles Designated CH	BLM Miles of Steelhead Distribution	Percent of Total Miles of Steelhead Distribution
Clackamas River	Winter	14,333	2.1%	9.1	2.7%	11.7	2.9%
Sandy River	Winter	14,723	5.1%	8.6	5.0%	5.0	3.7%

Table 122 displays statistics for populations of the Upper Willamette River Chinook salmon ESU where there is BLM land ownership. In four of five populations, the BLM manages land with 0.1 to 5.5 percent of the miles of designated CH and 0.4 to 5.7 percent of the miles of Chinook salmon distribution. The greatest percentages of miles of designated CH and miles of Chinook salmon distribution on lands managed by the BLM for any population of UWR Chinook salmon is for the Mollala River population. For that population, the BLM manages land with 11.8 percent of the miles of designated CH and 10.4 percent of the miles of Chinook salmon distribution.

Table 122. Statistics for BLM land ownership, BLM miles of designated critical habitat and BLM miles of Chinook salmon distribution for populations of the Upper Willamette River Chinook salmon DPS.

Population Name	Run	BLM Acres	Percent of Total Acres	BLM Miles Designated CH	Percent of Total Miles Designated CH	BLM Miles of Chinook Salmon Distribution	Percent of Total Miles of Chinook Salmon Distribution
Calapooia River	Spring	8,598	3.6%	0.1	0.1%	0.3	0.5%
Clackamas River	Spring	8,584	2.0%	3.2	2.8%	5.4	3.9%
McKenzie River	Spring	52,344	9.8%	4.2	2.5%	10.8	4.6%
Mollala River	Spring	53,991	9.2%	18.9	17.1%	30.6	10.4%
North Santiam River	Spring	20,479	10.8%	6.8	5.4%	7.7	5.7%
South Santiam River	Spring	35,624	7.3%	2.9	1.7%	5.4	2.2%
Middle Fork Willamette River	Spring	66,876	5.5%	2.6	1.0%	13.4	1.7%

Table 123 displays statistics for populations of the Upper Willamette River (UWR) steelhead DPS where there is BLM land ownership. In four of five populations, the BLM manages land with 0.1 to 5.5 percent of the miles of designated CH and 0.4 to 5.7 percent of the miles of steelhead distribution. The greatest percentages of miles of designated CH and miles of steelhead distribution for lands managed by the BLM for any population of UWR steelhead is for the Mollala River population. For that population, the BLM manages land with 11.8 percent of the miles of designated CH and 10.4 percent of the miles of steelhead distribution.

Table 123. Statistics for BLM land ownership, BLM miles of designated critical habitat and BLM miles of steelhead distribution for populations of the Upper Willamette River steelhead DPS.

Population Name	Run	BLM Acres	Percent of Total Acres	BLM Miles Designated CH	Percent of Total Miles Designated CH	BLM Miles of Steelhead Distribution	Percent of Total Miles of Steelhead Distribution
Calapooia River	Winter	8,598	3.6%	0.1	0.1%	0.3	0.4%
Mollala River	Winter	53,991	9.2%	27.3	11.8%	30.6	10.4%
North Santiam River	Winter	20,479	10.8%	7.6	5.5%	7.7	5.7%
South Santiam River	Winter	35,624	7.3%	5.2	2.3%	5.4	2.2%
Westside Tributaries	Winter	66,876	5.5%	1.9	0.6%	13.4	1.7%

Table 124 displays statistics for populations of the Oregon Coast coho salmon ESU where there is BLM land ownership. The following 35 populations of the Oregon Coast coho salmon ESU have no BLM land ownership but are either partially or entirely within the PRMP planning area: Alsea River, Arch Creek, Cape Creek, Berry Creek, Big Creek (near Alsea), Big Creek (near Siuslaw) Big Creek (near Yaquina), Bob Creek, Cape Creek, China Creek, Coal Creek, Cummins Creek, Devils Lake, Ecola Creek, Fogarty Creek, Johnson Creek, Moolack Creek, Necanicum Creek, Neskowin Creek, Netarts Creek, Rock Creek, Rocky Creek, Rover Creek, Sand Creek, Schoolhouse Creek, Short Sand Creek, Spencer Creek, Spring Creek, Tenmile Creek, Tenmile Lake, Threemile Creek, Twomile Creek, Vingie Creek, Wade Creek, and Watseco Creek.

For populations with BLM land ownership, 10 of 23 populations have 0 to 0.8 percent of the miles of designated CH and 0 to 0.5 percent of the miles of coho salmon distribution. Five of 23 populations have 3.2 to 7.4 percent of the miles of designated CH and 2.6 to 7.0 percent of the miles of coho salmon distribution. Seven of 23 populations have 10.0 to 19.1 percent of the miles of designated CH and 10.4 to 18.6 percent of the miles of coho salmon distribution. Among the OC coho salmon populations, the Lower Umpqua River population has the highest percentage of miles of designated CH and miles of OC coho salmon distribution on lands managed by the BLM. The percentages are 29.0 percent for designated CH and 29.3 percent for coho salmon distribution.

Table 124. Statistics for BlM land ownership, BLM miles of designated critical habitat and BLM miles of salmon distribution for populations of the Oregon Coast coho salmon ESU.

Population Name	BLM Acres	Percent of Total Acres	BLM Miles Designated CH	Percent of Total Miles Designated CH	BLM Miles of Coho Salmon Distribution	Percent of Total Miles of Coho Salmon Distribution
Alsea River	72,526	24.0%	38.1	10.0%	43.4	10.7%
Beaver Creek	57	0.3%	0	0%	0	0%
Coos River	36,869	9.6%	25.4	5.6%	29.6	6.3%
Coquille River	151,637	22.4%	69.3	12.7%	74.9	13.0%
Depoe Creek	38	1.3%	0	0%	0	0%
Floras/New River	4,354	5.3%	5.3	7.4%	5.3	7.0%
Nehalem River	4,650	0.9%	4.1	0.6%	4.2	0.6%

Nestucca River	36,636	17.9%	26.0	12.1%	27.1	12.1%
Salmon River	2,967	6.2%	0.2	0.3%	0.2	0.4%
Siletz River	16,435	7.0%	1.5	0.6%	1.6	0.6%
Siltcoos Lake	825	1.7%	0.3	0.3%	0.3	0.3%
Siuslaw River	130,317	26.3%	147.6	19.1%	151.3	18.6%
Sixes River	2,107	2.5%	2.4	4.1%	3.1	4.9%
Sutton (Mercer Lake)	183	1.7%	0	0%	0	0%
Tahkenitch Lake	313	1.3%	0.4	0.8%	0.4	0.8%
Theil Creek	282	10.2%	0.2	3.4%	0.1	2.6%
Tillamook Bay	15,741	4.4%	11.9	3.2%	12.7	3.2%
Lower Umpqua River	143,692	31.7%	161.8	29.0%	172.5	29.3%
Middle Umpqua River	115,354	22.4%	73.7	14.3%	76.1	14.0%
North Umpqua River	89,669	13.5%	22.0	12.4%	19.2	10.4%
South Umpqua River	262,333	22.8%	96.8	14.1%	100.5	14.1%
Yachats River	273	1.0%	0	0%	0	0%
Yaquina River	3,163	2.0%	0.7	0.3%	0.6	0.2%

Table 125 displays statistics for populations of the Southern Oregon / Northern California Coasts (SONCC) coho salmon ESU where there is BLM land ownership. The NMFS did not identify specific stream reaches when critical habitat for SONCC coho was designated. The BLM used steelhead distribution as a surrogate. The following populations of the SONCC coho salmon ESU have no BLM land ownership but are either partially or entirely within the PRMP planning area: Mid-Klamath River, Mill Creek, Smith River, and Winchuck River.

For populations with BLM land ownership, 10 of 13 populations have 0 to 2.5 percent of the miles of designated CH and 0 to 3.2 percent of the miles of coho salmon distribution. The BLM manages 7.7 percent and 12.7 percent of the miles of designated CH, and 9.5 percent and 12.0 percent of the miles of coho salmon distribution in the Illinois River and Upper Rogue River populations, respectively. Among the SONCC coho salmon populations, the Mid-Rogue and Applegate population has the highest percentage of miles of designated CH and miles of OC coho salmon distribution on lands managed by the BLM. The percentages are 19.6 percent for designated CH and 17.4 percent for coho salmon distribution.

Table 125. Statistics for BLM land ownership, BLM miles of designated critical habitat and BLM miles of salmon distribution for populations of the Southern Oregon / Northern California Coasts coho salmon ESU.

Population Name	BLM Acres	Percent of Total Acres	BLM Miles Designated CH[1]	Percent of Total Miles Designated CH	BLM Miles of Coho Salmon Distribution	Percent of Total Miles of Coho Salmon Distribution
Brush Creek	1,776	23.5%	0.2	2.5%	0.2	3.2%
Chetco River	10,724	4.7%	4.5	2.4%	2.3	2.4%
Elk River	765	1.3%	0.2	0.4%	0	0%
Euchre Creek	2,735	9.4%	0	0%	0	0%
Hubbard Creek	24	0.3%	0	0%	0	0%
Hunter Creek	3,686	13.0%	0.4	1.7%	0	0%
Illinois	66,635	10.5%	33.5	7.7%	29.5	9.5%
Lower Rogue	3,469	2.7%	0	0%	0	0%

Mussel Creek	208	2.3%	0	0%	0	0%
Pistol River	3,047	4.6%	0.4	0.9%	0	0%
Upper Klamath River	744	0.2%	0.5	2.1%	0	0%
Mid-Rogue and Applegate Rivers	370,392	37.1%	211.4	19.6%	66.7	17.4%
Upper Rogue River	268,440	23.7%	124.1	12.7%	39.8	12.0%

[1]The NMFS did not identify specific stream reaches when critical habitat for SONCC coho was designated. The BLM used steelhead distribution as a surrogate.

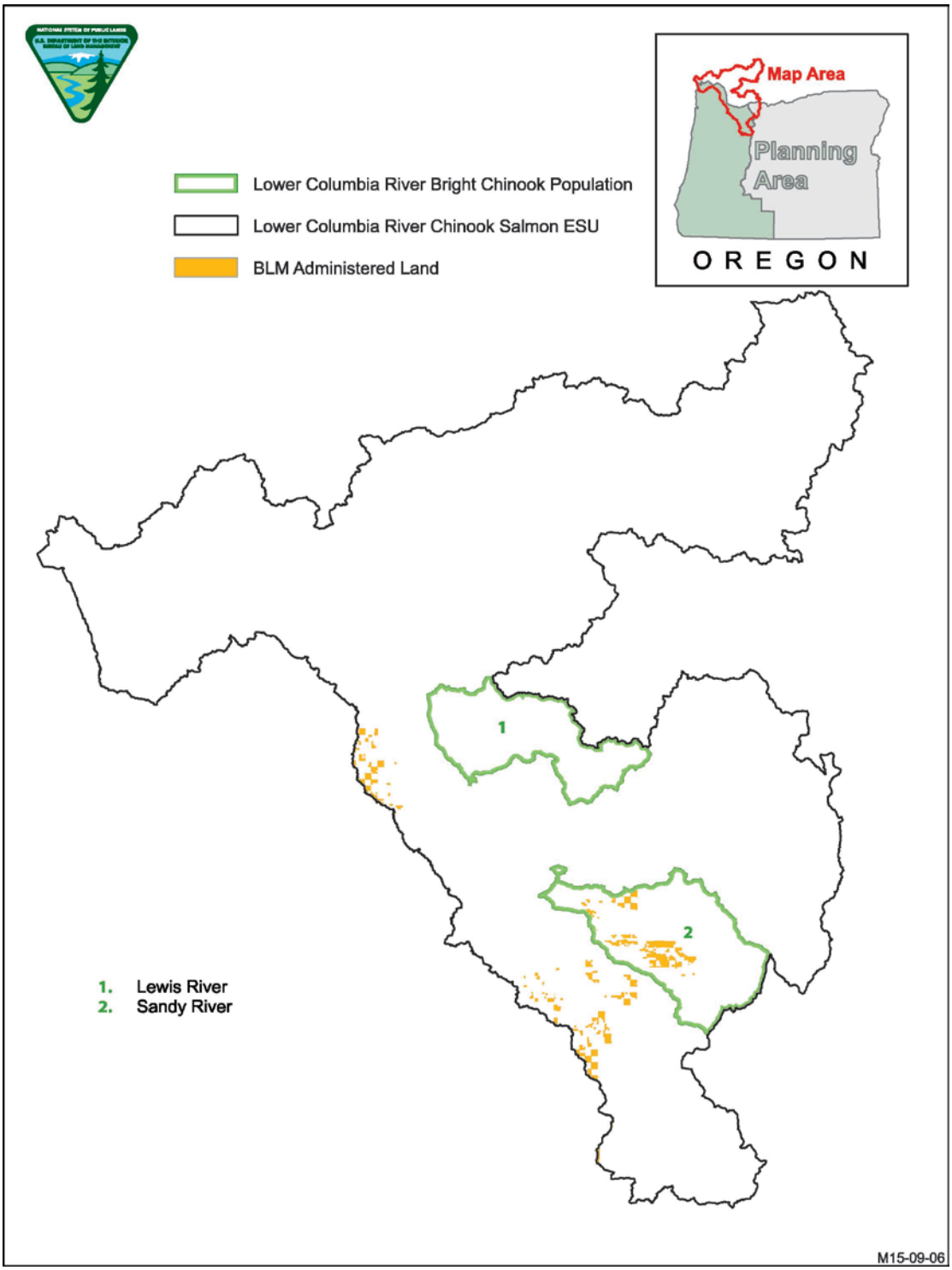


Figure 22. Lower Columbia River Chinook salmon ESU Bright populations and BLM land ownership with the planning area.

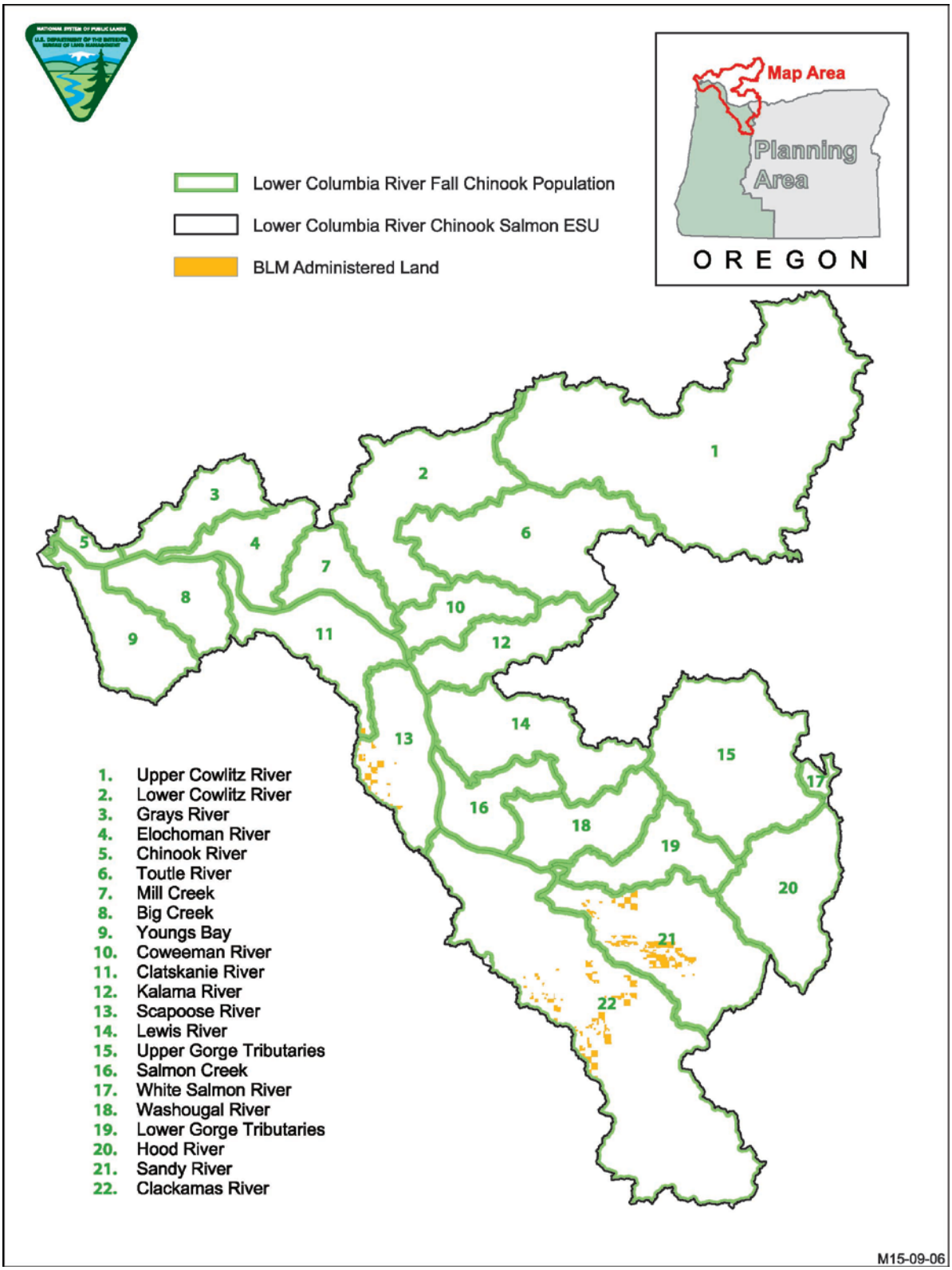


Figure 23. Lower Columbia River Chinook salmon ESU fall-run populations and BLM land ownership within the planning area.

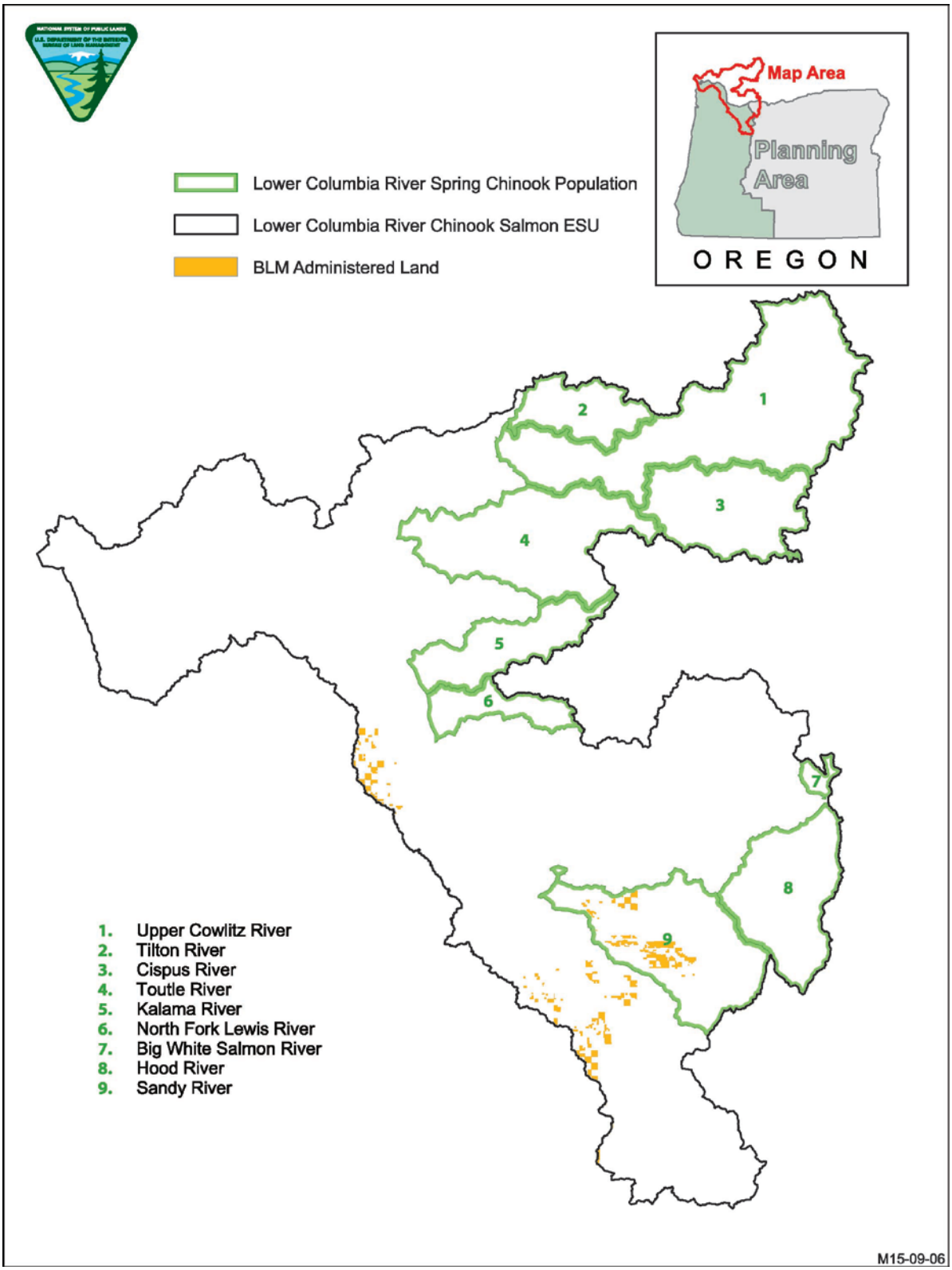


Figure 24. Lower Columbia River Chinook ESU spring-run salmon populations and BLM land ownership within the planning area.

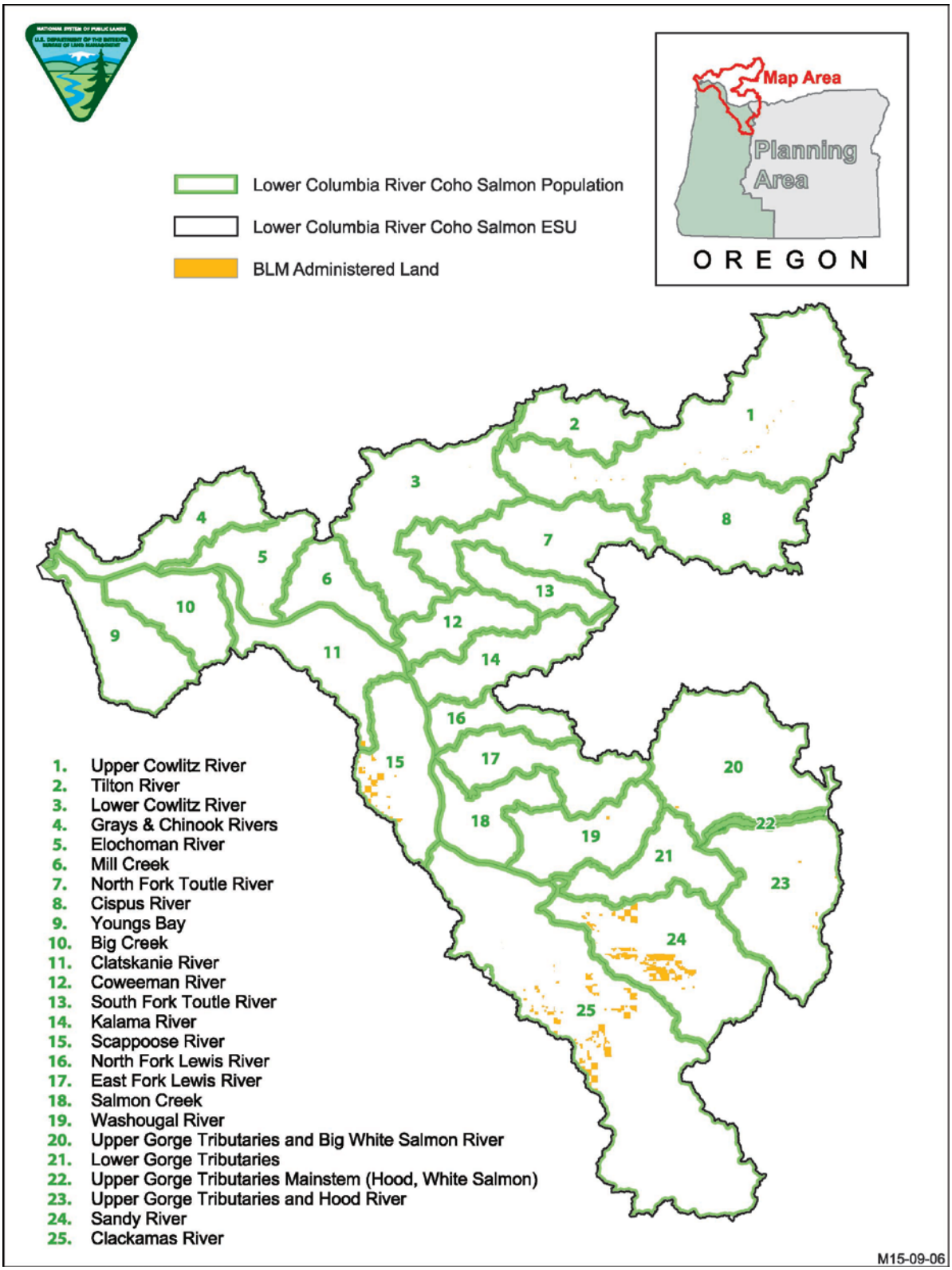


Figure 25. Lower Columbia River coho salmon populations and BLM land ownership within the planning area.

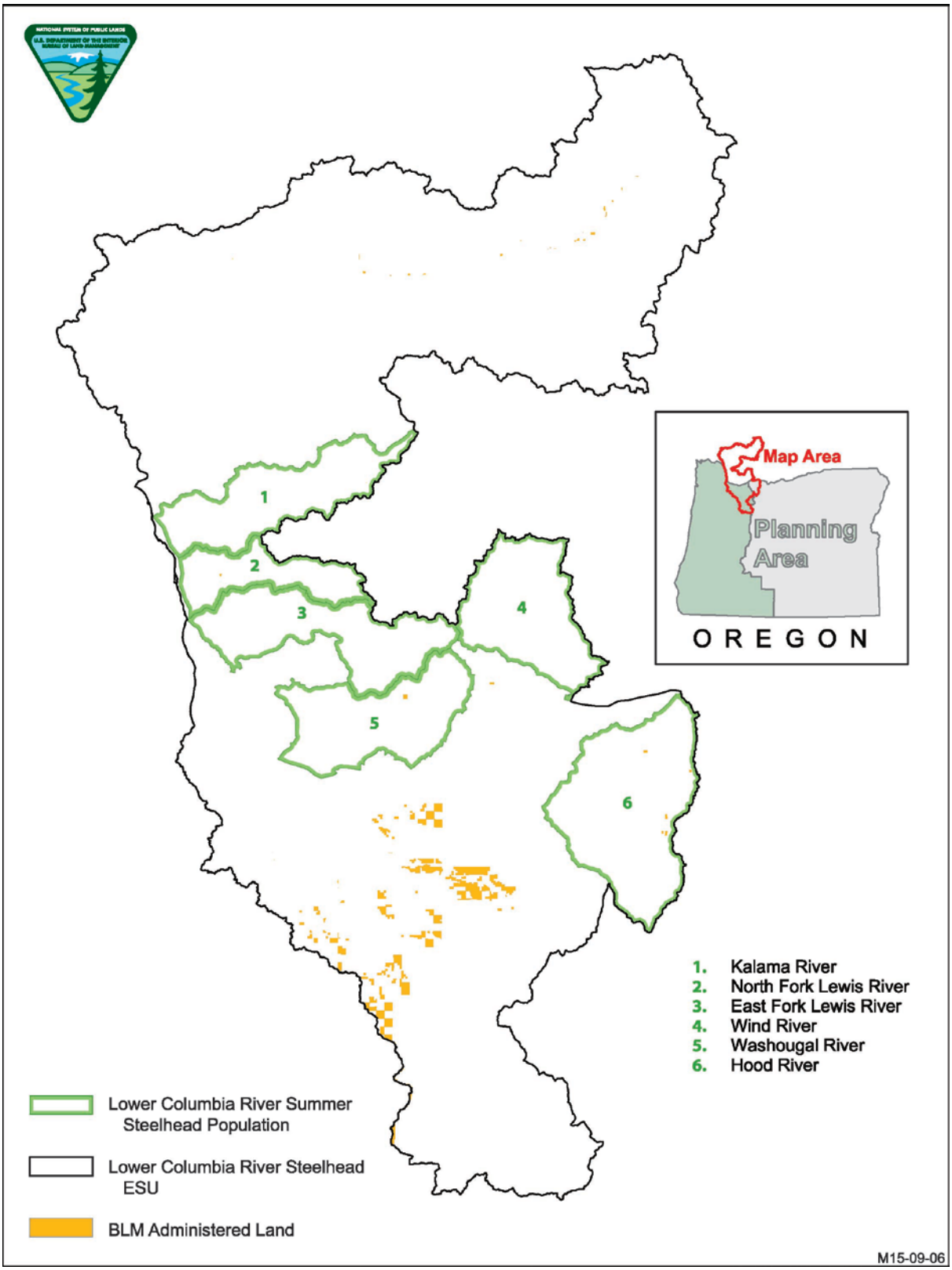


Figure 26. Lower Columbia River steelhead ESU summer run populations and BLM land ownership within the planning area.

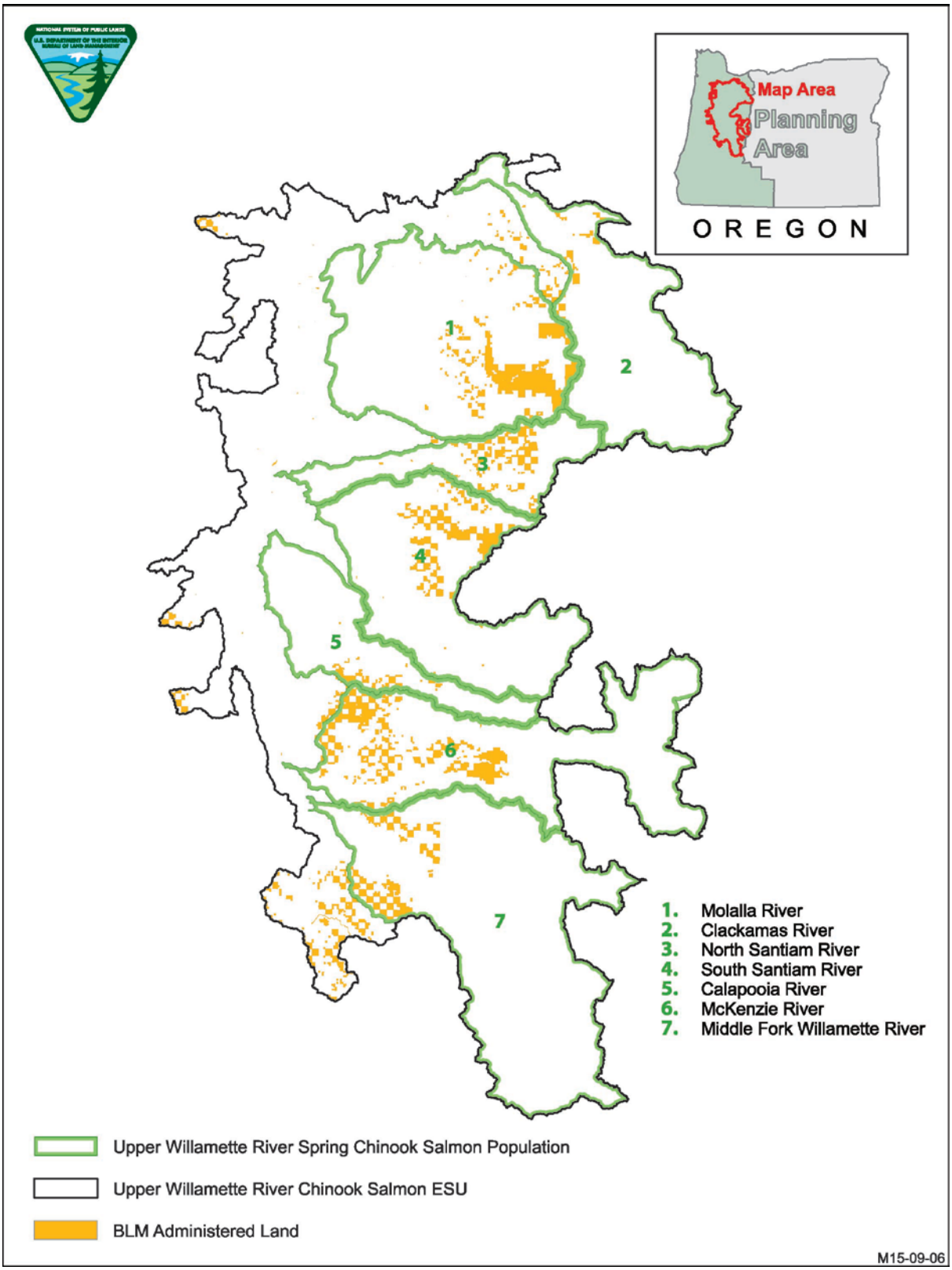


Figure 27. Upper Willamette River Chinook salmon ESU spring-run populations and BLM land ownership within the planning area.

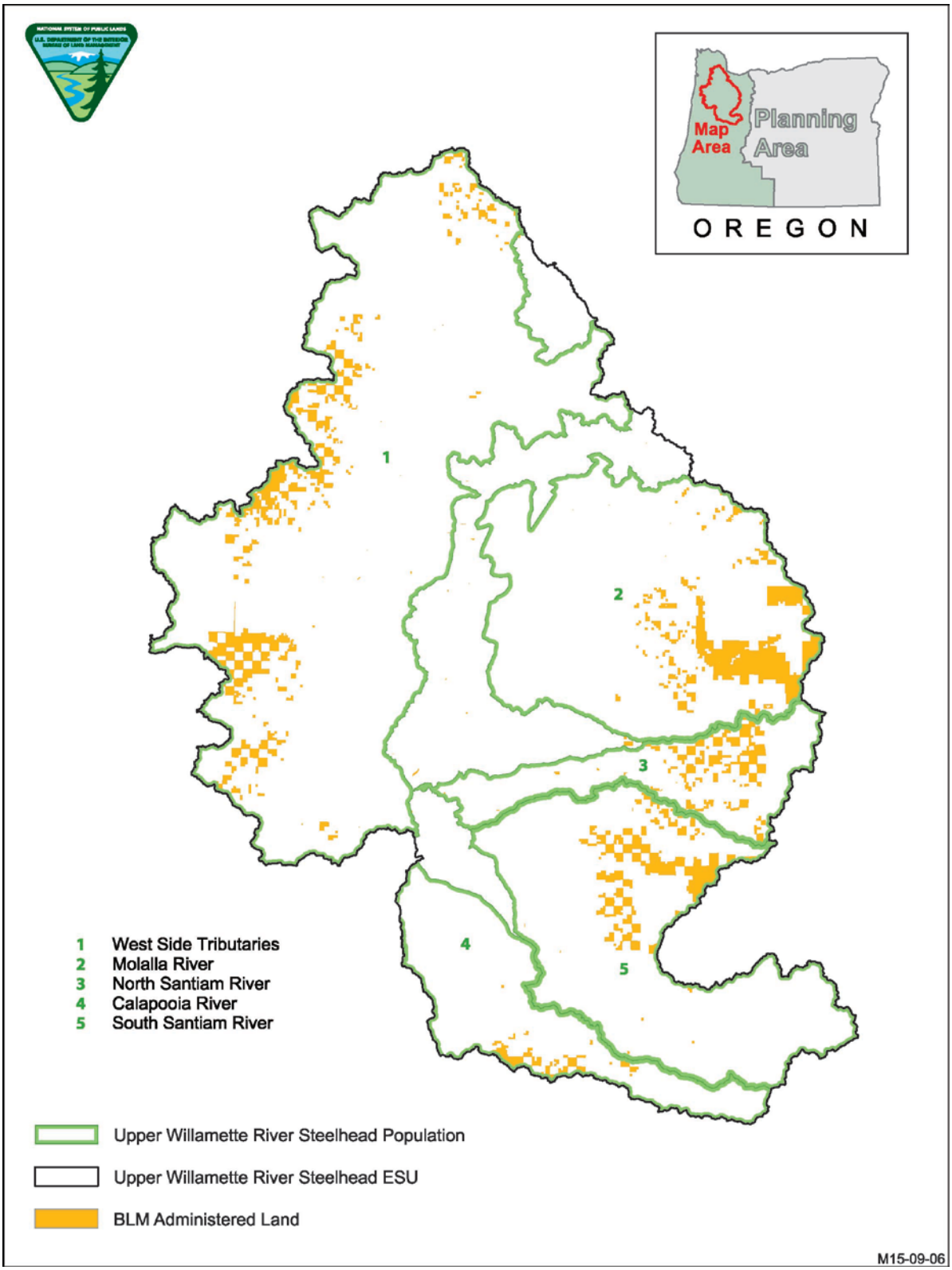


Figure 28. Upper Willamette River steelhead ESU populations and BLM land ownership within the planning area.

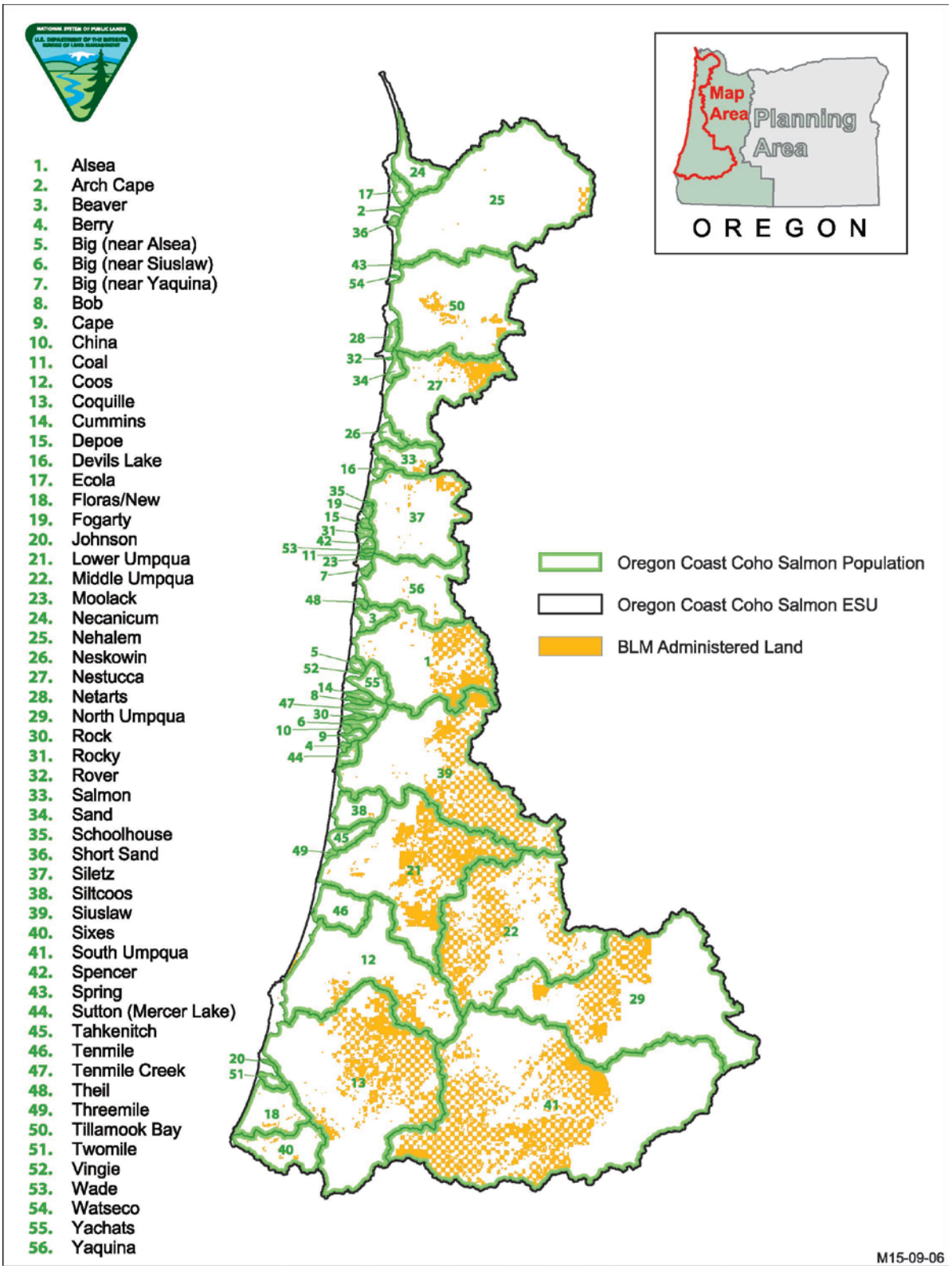


Figure 29. Oregon Coast coho salmon ESU populations and BLM land ownership within the planning area.

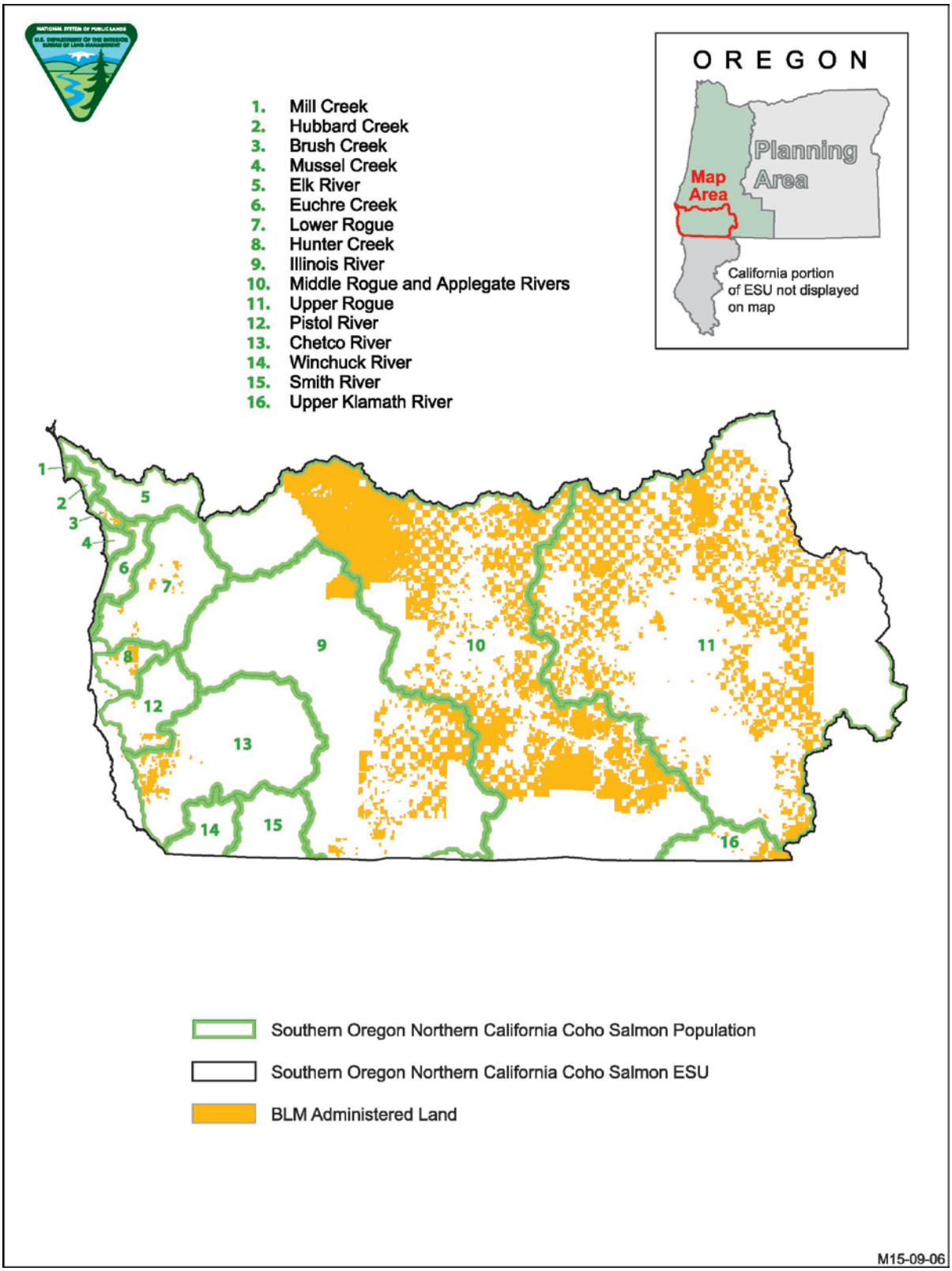


Figure 30. Southern Oregon / Northern California Coasts coho salmon ESU populations and BLM land ownership within the planning area.

C. General Habitat

The quality and quantity of fresh water habitat in much of Oregon has declined dramatically in the last 150 years. Land management activities that have degraded habitat of salmonids include water withdrawals, unscreened water diversions, hydropower development, road construction, timber harvest, stream cleaning of large wood, splash dams, mining, farming, livestock grazing, outdoor recreation, and urbanization (USDA FS and USDI BLM 1994, Lee et al. 1997, Spence et al. 1996). In many river basins, land management activities have: 1) reduced connectivity (i.e., the flow of energy, organisms, and materials) between streams, riparian areas, floodplains, and uplands; 2) elevated fine sediment yields, filling pools and reducing spawning and rearing habitat; 3) reduced instream and riparian large wood that traps sediment, stabilizes stream banks, and helps form pools; 4) reduced or eliminated vegetative canopy that minimizes temperature fluctuations; 5) caused streams to become straighter, wider, and shallower, which has the tendency to reduce spawning and rearing habitat and increase temperature fluctuations; 6) altered peak flow volume and timing, leading to channel changes and potentially altering fish migration behavior; 7) altered floodplain function, water tables and base flows, resulting in riparian wetland and stream dewatering; and 8) degraded water quality by adding heat, nutrients and toxicants (USFS and BLM 1994; Lee et al. 1997; McIntosh et al. 1994; Spence et al . 1996).

While there has been substantial habitat degradation across all land ownerships, habitat in many BLM and USFS headwater stream segments is generally in better condition than in the largely non-Federal lower portions of tributaries (Lee et al. 1997). Because Federal lands are generally forested and situated in upstream portions of watersheds, BLM and USFS lands now contain much of the highest quality salmon and steelhead habitat remaining in Oregon and Washington.

D. AREMP Monitoring

The Northwest Forest Plan (NWFP) Aquatic and Riparian Effectiveness Monitoring Program (AREMP) evaluates the environmental outcomes of management actions under the NWFP. AREMP assesses watershed condition status and trend at two different scales, stream and upslope/riparian. Stream condition is based on surveys in watersheds randomly selected from the NWFP area; it describes current condition for fish and other aquatic biota. Upslope/riparian condition is evaluated based on GIS and remote sensing data.

The AREMP work group prepared a report that analyzes monitoring results for the BLM PRMP planning area (USDA FS and USDI BLM AREMP 2015). Excerpts from that report are presented below and provide information to further inform environmental baseline conditions.

Stream Conditions Study Design

At the inception of the NWFP, 1,378 watersheds in the sixth-field watershed coverage with greater than 25% federal ownership were identified and 250 were randomly selected using a spatially balanced sampling method (Stevens and Olsen 2003, 2004). The original study design called for sampling 50 watersheds per year, with repeat visits to watersheds beginning on the sixth sampling year. Due to funding limitations this goal was not fully realized. The study design was altered to complete approximately 28 watersheds per year, with repeat visits beginning in the eight year of sampling. Each eight-year cycle of visits are referred to as a rotation. As of 2013, across the NWFP, a total of 214 watersheds were sample and the program is halfway through the second rotation; 191 watersheds were visited during the first rotation and 25 new

watersheds were added during the second rotation. Within the PRMP planning area, 44 watersheds were visited in the first rotation and 31 in the second.

Stream data were collected at multiple sites within each watershed. These sites were also selected using a spatially balanced procedure. Sample points were drawn from the 1:100K National Hydrological Data Layer (dated 2000), where points represent the downstream starting location for stream surveys. The length of the survey at each site was determined as 20 times the average bankfull width, with a minimum and maximum of 160 and 460 meters, respectively. Between 4 and 10 sites (median 5 sites) were selected in each watershed. Eleven transects were surveyed at each site.

Stream attributes were collected at each site. Data for each transect attribute were summarized together to the site scale. At each site, physical habitat condition (pool tail fines, large wood, substrate [Figure 31]; and macroinvertebrate score (observed to expected) were assessed. Water temperature, collected at the lowest point on federal lands within each watershed, was analyzed separate from the physical habitat and macroinvertebrates. These metrics allowed for increased comparability of scores across NWFP aquatic provinces and retains much of the framework for watershed condition defined through past provincial expert workshops. Ultimately, the attributes selected for inclusion in the overall model were those that were best able to detect a signal between minimally managed and most impaired sites (Al-Chokhacky et al., 2011).

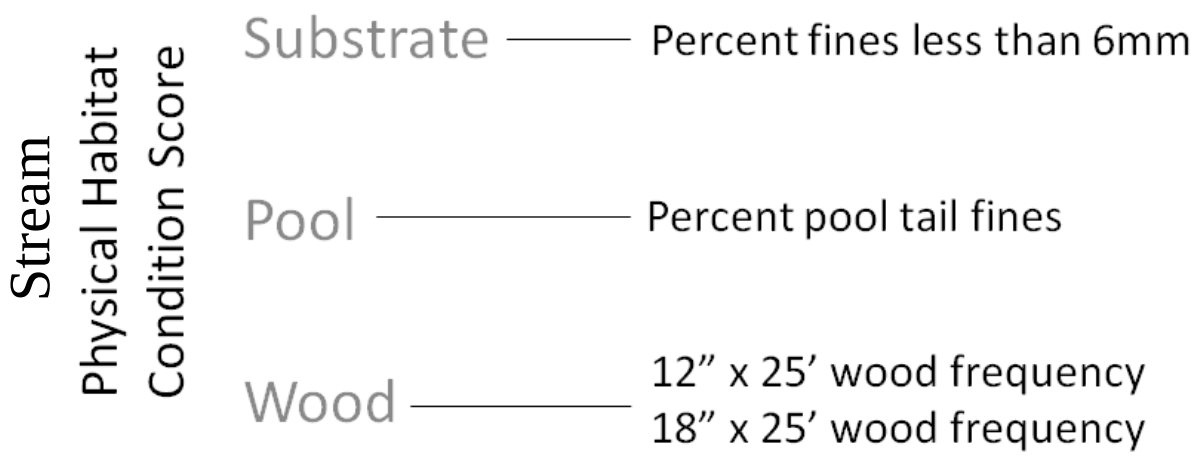


Figure 31. Unified stream physical habitat evaluation model structure.

A change from previous models was to evaluate macroinvertebrates separately from physical habitat. While macroinvertebrates are a useful indicator of degradation in a system, reliability on a single indicator can overly influence interpretation of health of a system (Barbour et al. 1999). Instead, AREMP chose to analyze macroinvertebrates separately using an observed to expected (O/E) index developed specifically for the AREMP sample frame (Miller, Miller, Vander Laan, and Hawkins, in prep). Macroinvertebrates along with physical habitat and temperature are assessed separately and used as multiple lines of evidence for the overall condition of the system.

Each physical habitat attribute was evaluated and scored using an updated approach from previous reports. Past evaluations relied on a decision support model with scoring thresholds taken directly from the literature, expert opinion, and data from other studies. However, we

found that some of these other studies used to define AREMP thresholds had sampling protocols that were not comparable to AREMP protocols. In addition, many threshold values did not encompass the range of values collected in the AREMP data and often the range was smaller than the measurement error of a given attribute. Rather than defining new thresholds, which would take information we do not currently have, we chose to use a reference condition approach for scoring.

The reference condition approach is frequently used by bioassessment programs that monitor ecological condition (Herlihy et. al. 2008, Whittier et al. 2008, Pollack et al. 2012). Reference condition is defined as areas with minimal management that characterize the range of natural variability across the region (Miller et al. submitted 2015). We used GIS and remote sensing data summarized at two spatial extents, watershed and 2km watershed, to quantify stressor and natural (intrinsic) variables. Over 5,000 candidate sites, compiled from 5 agencies, were used to define minimal management. Each watershed was characterized using the following suite of land-use and land-cover variables that quantified both anthropogenic stressors and natural characteristics:

- Road density (km/ km2)
- Road crossing density (count/ km2)
- Agriculture (percent)
- Developed open space (percent)
- Mines (percent)
- Gravel mines density (mines/km2)
- Canals (percent)
- Distance to Dam (km)

Reference was defined as sites that fell below the 25th percentile for all disturbance variables. Approximately 260 AREMP sites passed the screening process. The reference condition approach to scoring each attribute was based on the deviation of an attribute from an individual site to the expected value estimated from a network of minimally managed sites with similar natural gradients. Expected values of attributes will vary with natural gradients. For example, intrinsic variables such as gradient or elevation can strongly influence expectations for the values of attributes in minimally managed systems; as such, intrinsic variables must be accounted for when using a reference approach (Stoddard et al. 2008). AREMP used a nearest-neighbor approach (described by Bates Prins and Smith 2007) to account for intrinsic variables, where the "distance" between a site and reference was calculated based on intrinsic variables (Appendix A of Miller et al., 2015a) (Yates and Bailey 2010). Expected values of an attribute at an individual site were estimated from its reference network of minimally managed sites "nearest" that site based on intrinsic variables. The neighbors for a site are not necessarily close in space, but close in similarity based on natural gradients.

The nearest neighbor approach requires that both the number of neighbors that match a site and the intrinsic variables to match on are selected. These were selected for each attribute by finding the combination of the number of neighboring sites and a subset of intrinsic variables that minimized the mean squared error (MSE) of the reference network chosen as outlined above (Bates, Prins and Smith 2007). This procedure was performed separately for each attribute, so the number of neighbors and the intrinsic variables used varies among attributes (Appendix A of Miller et al., 2015a). Scores were calculated on a continuous scale from 0 to 10 based on the 90% prediction intervals around the expected value of an attribute for each site (see Stoddard et al. 2008, Al-Chokhacky et al, 2011).

Individual attribute scores were averaged within their respective metric (e.g. pools, substrate, wood, and macroinvertebrates). If an attribute was missing within a metric, only the non-missing attributes were used within that metric. If an entire metric was missing for a site, no metric score or final score was calculated. To determine the overall site condition, all physical habitat metrics were averaged together and the final scores scaled from 0 to 100. Watershed level Stream Physical Habitat Condition scores were calculated based on site level condition scores using the spsurvey package in R (2014). Graphical display of reference versus impaired sites for all attributes and metrics are located in Appendix B of the Miller et. al. (2015a) report.

Macroinvertebrates were assessed at the site level using an observed to expected index developed by the Center for Monitoring and Assessment of Freshwater Ecosystems. The O/E model compares the taxa at an observed site to similar reference sites (see Hawkins et al. 2000 for detail). Sites were grouped into classes based on macroinvertebrate assemblage composition similarity. The expected class membership was predicted using a number of intrinsic predictor attributes (similar to those used in the nearest neighbor analysis). All data were standardized to their appropriate operational taxonomic unit prior to analysis and re-sampled to a 300 fixed count. O/E scores are interpreted by the value 1 indicating that all expected species were found at a site, while a value of 0 indicates that no expected species were found. Watershed level macroinvertebrate O/E scores were calculated based on site level O/E scores using the spsurvey package in R (2014).

Water temperature loggers were deployed in early spring at the lowest point on federal lands within each watershed and data collected typically in late fall. Data were collected hourly and summarized at the seven-day maximum average. Temperature data summarized across watersheds using the spsurvey package and boxplots of yearly temperatures with associated statistics performed in R (2015).

This report was customized to provide summarized watershed level results at the PRMP planning area level. Results from the PRMP planning area level are compared to overall NWFP results to provide context at the larger landscape scale.

Stream Conditions Results

Physical Habitat Scores

Within the PRMP planning area, stream physical habitat condition status scores and the number of watersheds visited (denoted by n in each figure) varied each year (y-axis, Figure 32). Note: solid lines in all boxplots denote mean and asterisk is the median. AREMP is currently halfway done with the second rotation. Comparing the first rotation (2002-2009) to the first four years in

the second rotation (2010-2013) will give a general idea of the current patterns in watersheds within western Oregon. The second rotation and status within that rotation can be used to create baseline conditions for areas within the Western Oregon Resource Plan watersheds within NWFP area.

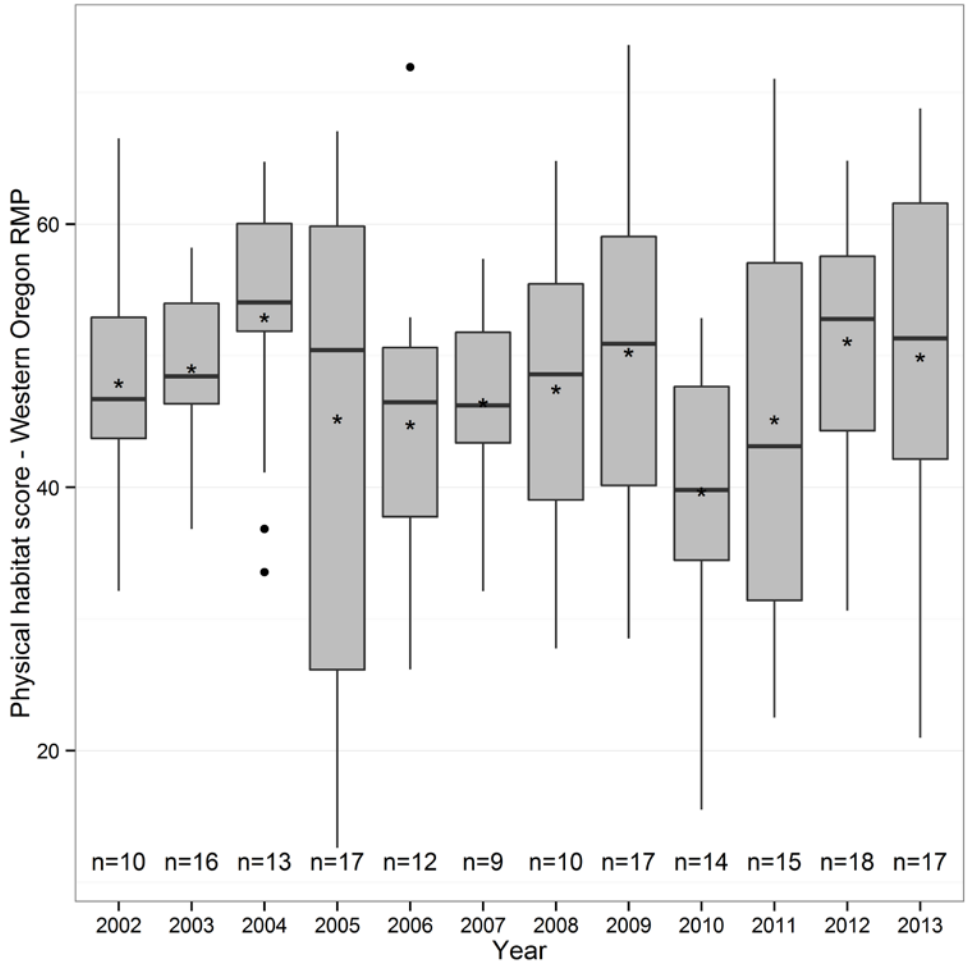


Figure 32. Boxplots of watershed condition status scores by year.

Generally, the expectation is that the scores should have a mean of 50 and an approximate range between 40 and 60 to be consistent with reference. Rotational changes, shown in density plots, should show a shift towards higher scores or lower temperatures to indicate “improvement”. Stream physical habitat scores within the PRMP planning area ranged from 12 to 71 with a mean score of 48 and a 95 percent confidence interval (CI) ranging 46.5 to 49.7 during the first rotation and a mean score of 46.9 (CI=44.9 to 48.9) during the second rotation (Figure 33, Figure 34). The majority of scores for both rotations fell between 40 and 60 (63 and 52 percent, respectively), and no watershed was above 73 during either rotation. Physical habitat scores were lower in the Oregon Coast area than elsewhere in the rest of the NWFP area (Miller et al. 2015b). There was no detectable linear trend in physical habitat status scores either across the NWFP area or within PRMP planning area lands (Figure 32).

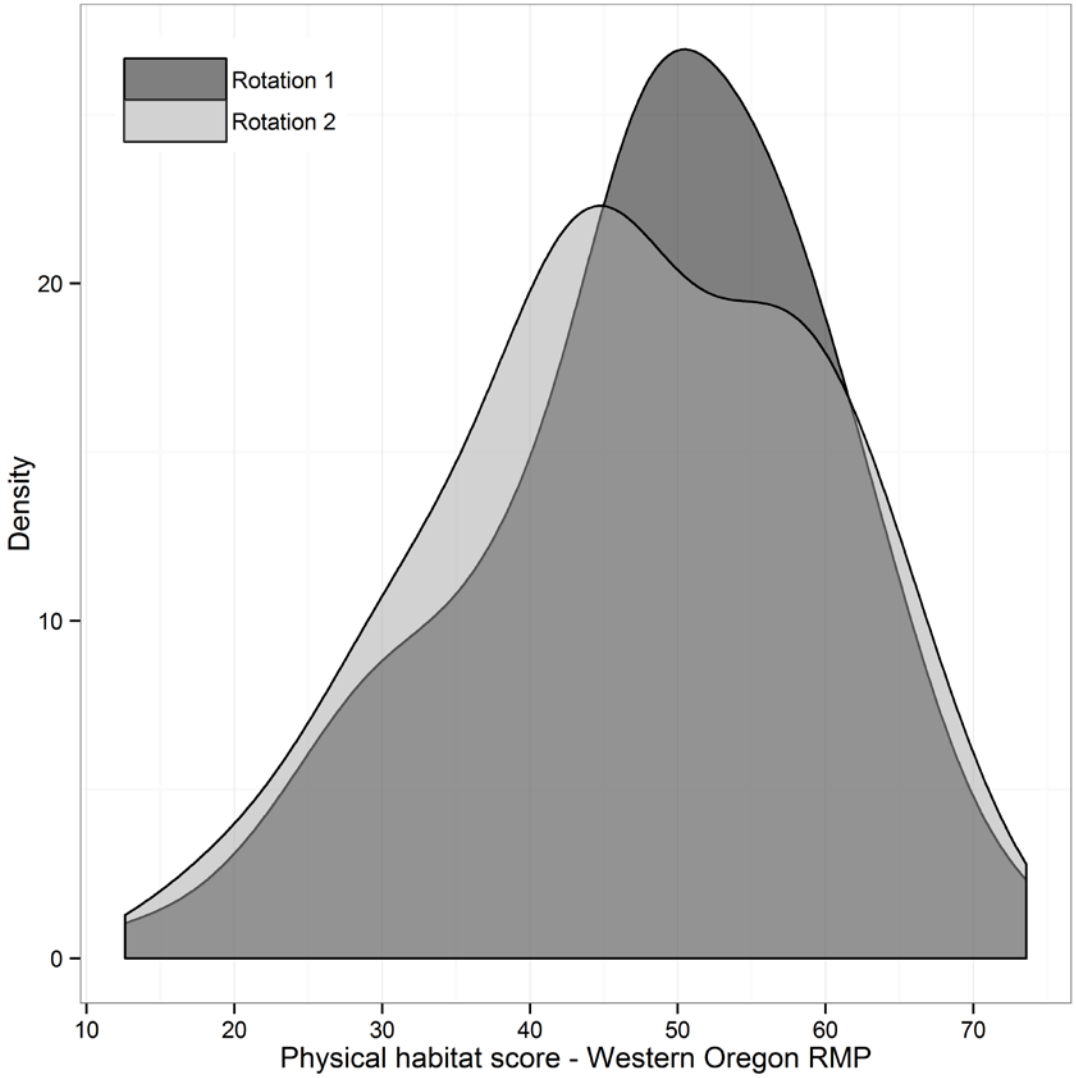


Figure 33. Density plot of Stream Physical Habitat condition status scores of watersheds by rotation.

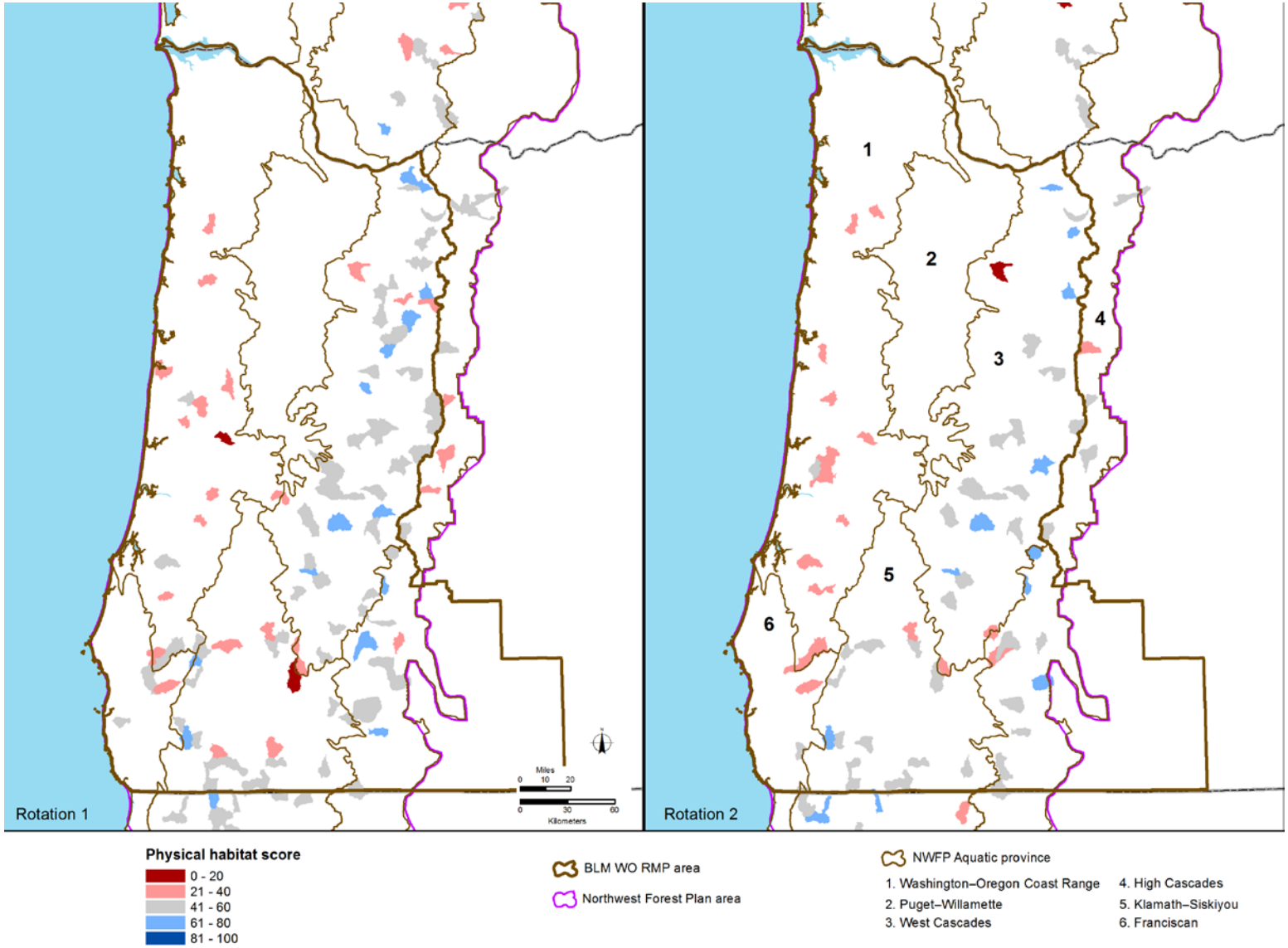
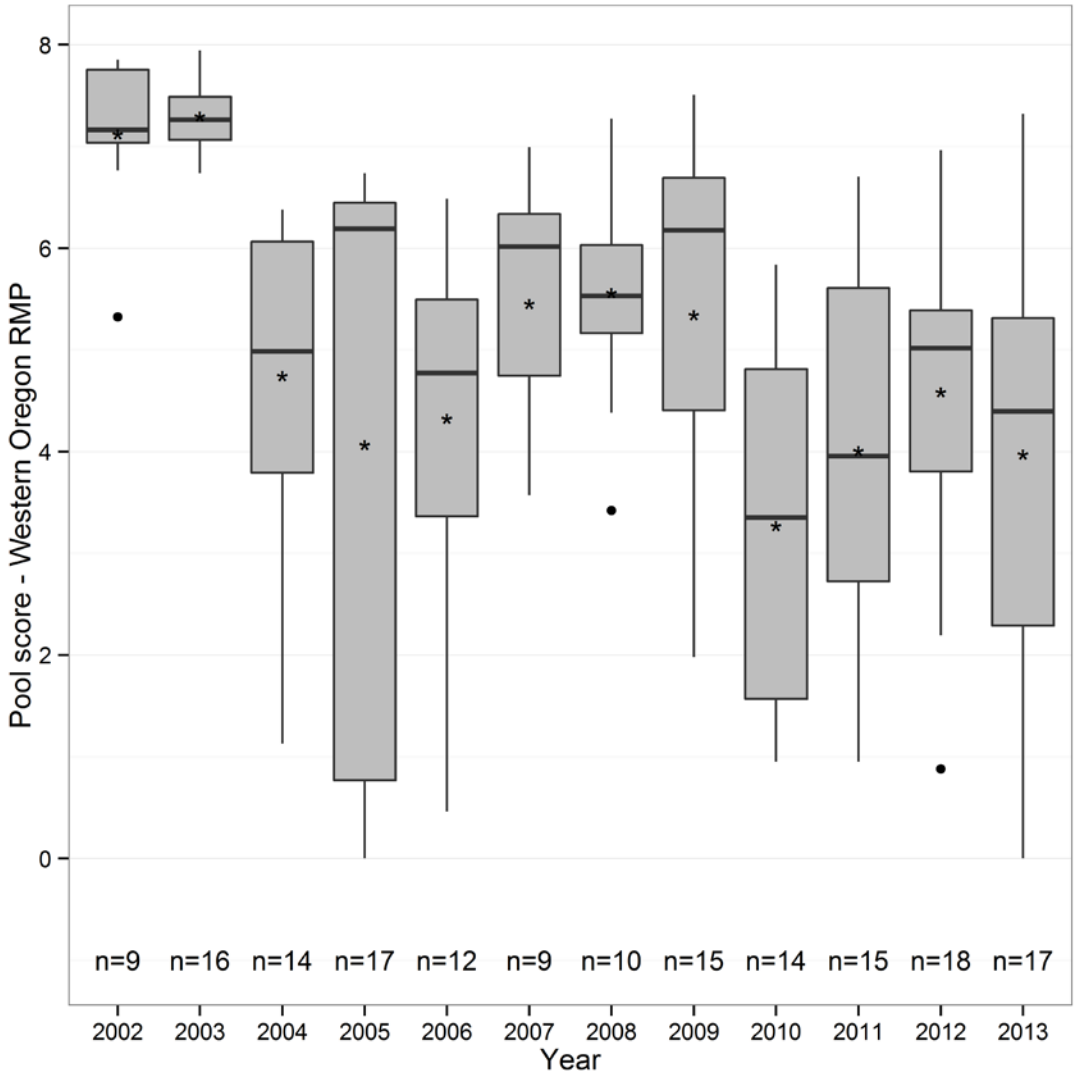
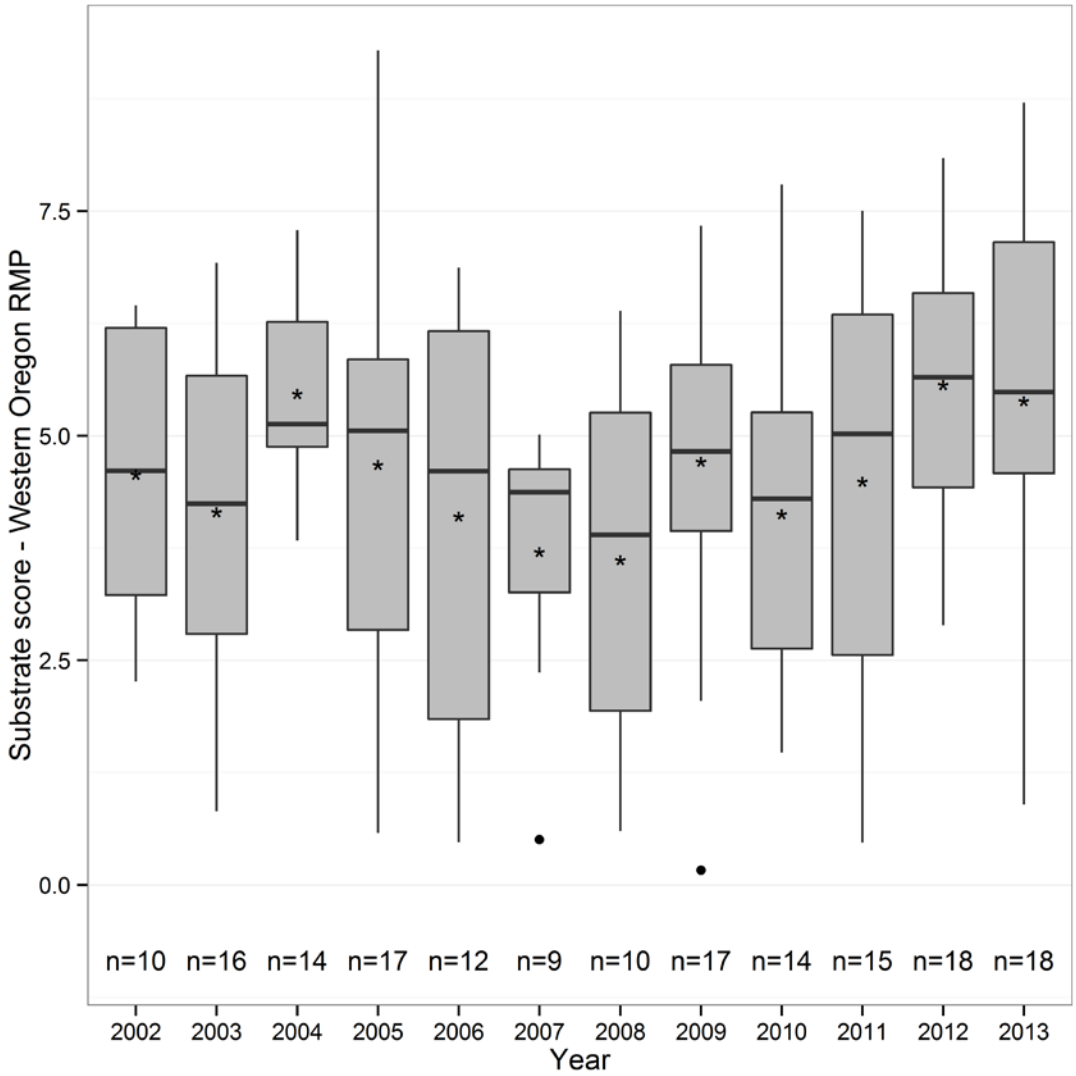


Figure 34. Spatial distribution of stream physical habitat scores for the Northwest Forest Plan (NWFP) and BLM Proposed Resource Management Plan (PRMP) planning areas for each rotation. Rotation 1 = 2002-2009 and Rotation 2 = 2010-2013.

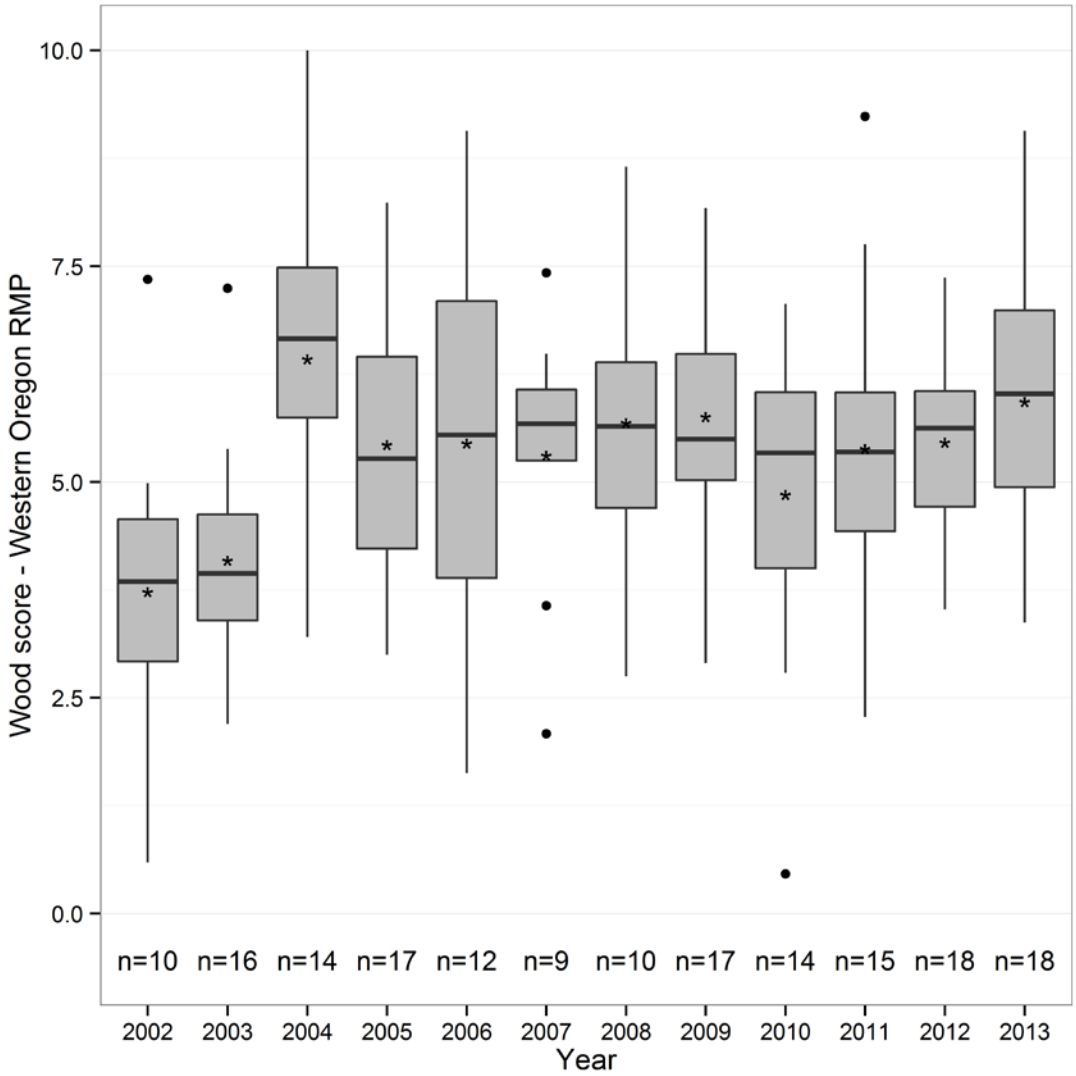
There was strong evidence that mean pool scores declined (Figure 35a) since the first rotation (t-test: $t_{102,64}$=4.68, p =0.0002, mean difference = 1.42) and status scores across year (Figure 34a) show a similar negative trend over time (F = 6.8, DF = 1, 9, p = 0.03). This result is consistent with regional patterns across the NWFP area where similar score declines were detected. Note that all metric scores were scored on a scale of 0 to 10 while the overall stream physical habitat score is on a scale of 0-100. The statistically detectable change between rotations in pool scores would indicate there were more pool tail fines than expected compared to their environmentally matched reference network. We found no evidence of a difference in mean substrate or wood scores between rotations or trend in status scores across years (Figure 35b, c). Across the NWFP area, substrate scores increased. However, no change in the mean PRMP planning area substrate score may suggest that conditions are maintained and that differences cannot yet be detected.



(a)


Substrate score - Western Oregon RMP
7.5
5.0
2.5
0.0
n=10
n=16
n=14
n=17
n=12
n=9
n=10
n=17
n=14
n=15
n=18
n=18
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Year

(b)



(c)

Figure 35. Boxplots of individual stream physical habitat metric (a) Pool, (b) Substrate, and (c) Wood status scores. The number of watersheds used in the analysis is represented by n at the bottom of the graph.

Water Temperature

The state of Oregon standard seven-day maximum average temperatures for core salmonid habitat is 16˚C and 12˚C for bull trout. National Marine Fisheries considers 10˚C for properly functional condition and 17.8˚C for not functioning condition for anadromous fishes. Seven-day average temperature values ranged from 13 to 28˚C over the 13 sample years and 92 watersheds in the first rotation and 80 during the second where temperature loggers were deployed in western Oregon (**Figure 36**). Mean seven-day maximum average temperatures in the PRMP planning area lands were slightly higher during the first rotation (18.3˚C CI = 17.9-18.8) and decreased during the second rotation (17.1˚C CI = 16.5-17.6); Here, the trend in status across years was marginally insignificant (p=0.06) and among mean rotation scores were detected. During the first rotation, maximum seven-day average temperatures in all watersheds were

greater than 16°C in 73% of the watersheds and even as high as 28.9°C. This decreased to 68% in the second rotation.

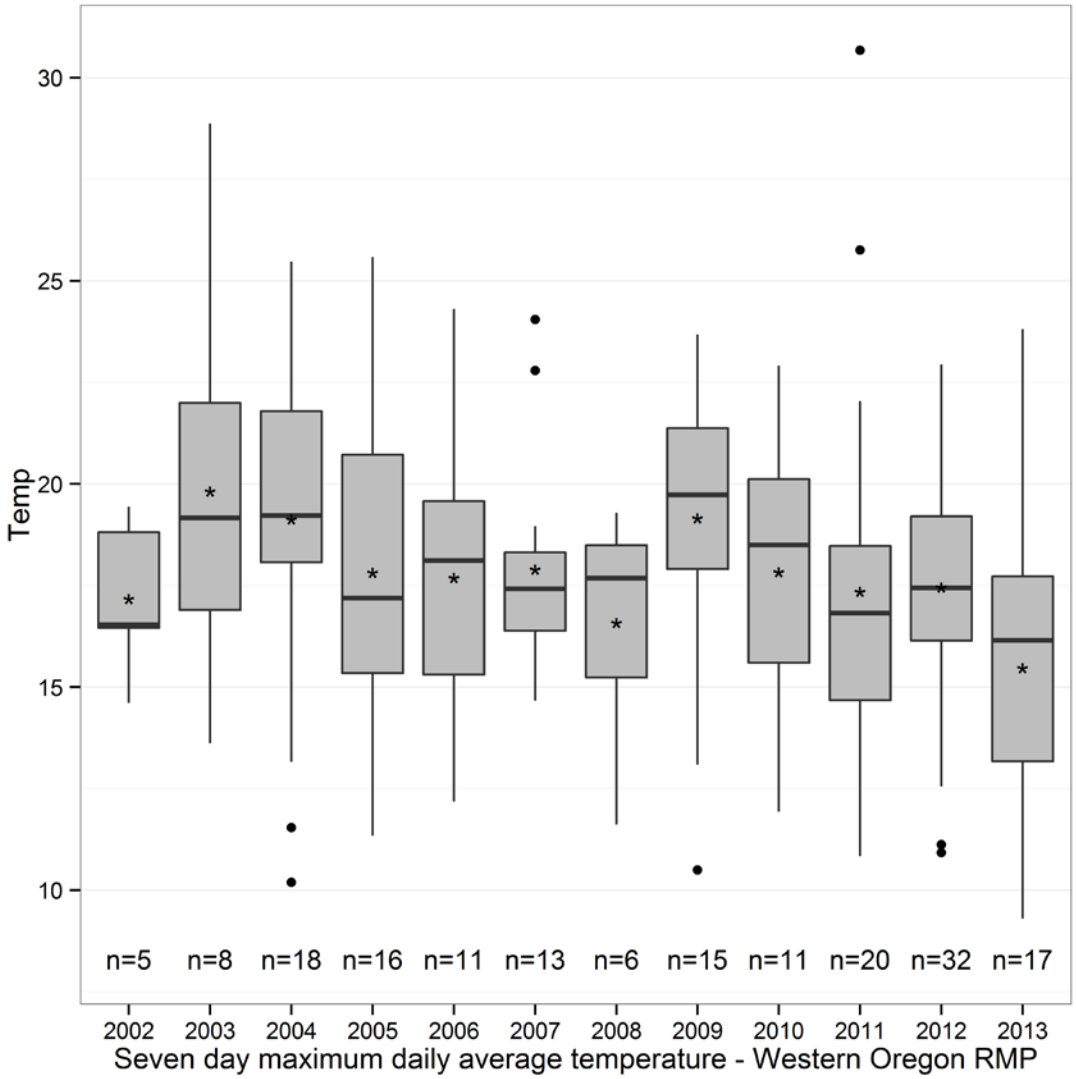


Figure 36. Boxplot of seven-day maximum average temperature by year in the Western Oregon RMP planning area. The number of watersheds used in the analysis is represented by n at the bottom of the graph.

Macroinvertebrate Observed to Expected Scores

Mean observed to expected macroinvertebrate scores had a slight detectable increase between the two rotations (t-test: $t_{46,29}$= -1.9, p = 0.05) and status scores across years (F = 7.6, df = 1,5, p = 0.4). Sixteen percent of the watersheds sampled had more biological composition than expected, as denoted by scores above 1 (**Figure 37**). At the same time, only two percent of the watersheds had scores below 0.6 that signifies a loss of 40% of the expected biological composition. A consistent pattern of a loss of 40% of biological diversity would signify that these systems have

not likely fully recovered from some disturbance(s). Note that this threshold differs from the physical habitat acceptable range given that different methods were used to establish observed to expected values. Very few watersheds in the Western Oregon RMP area fall into the below 0.6 category.

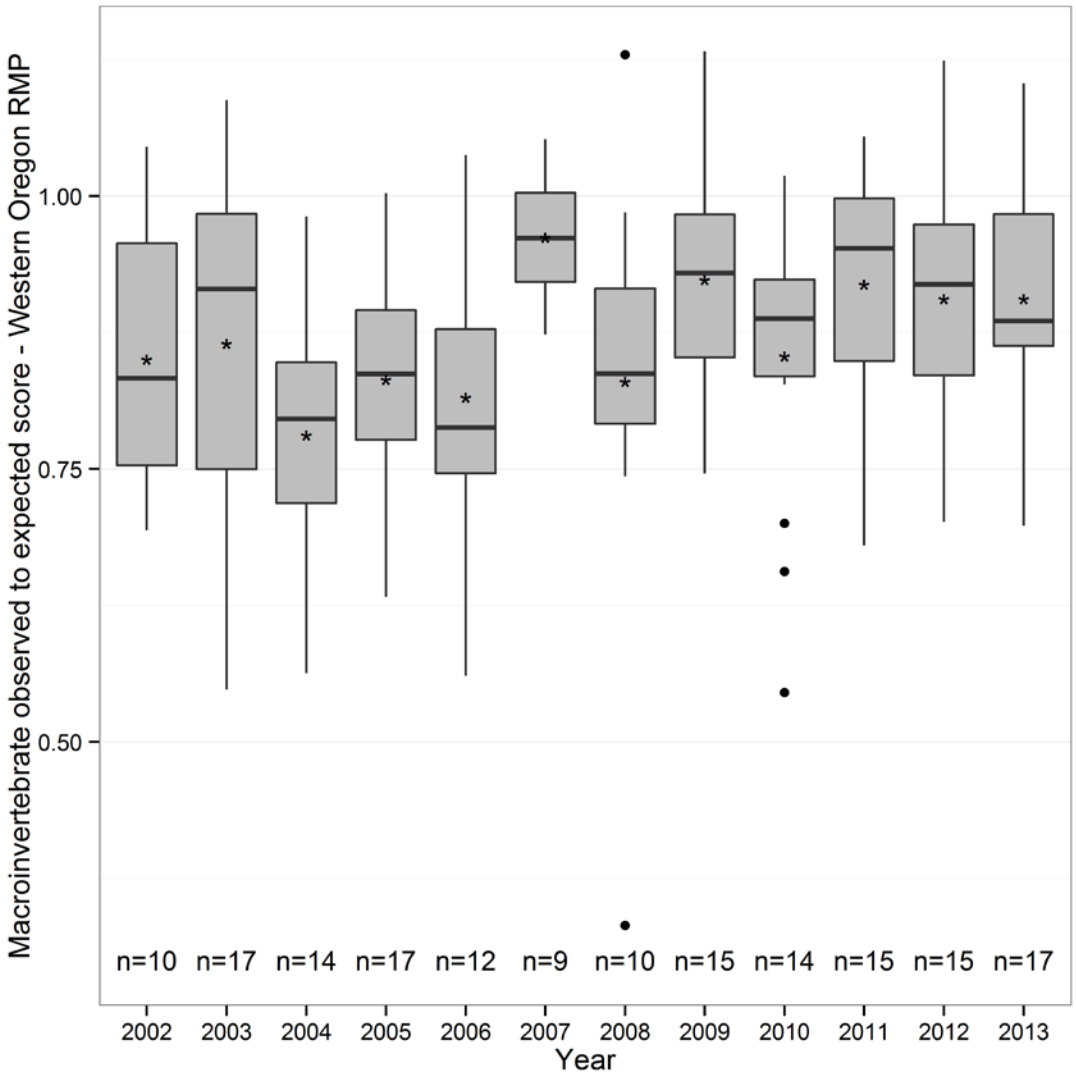


Figure 37. Boxplot of macroinvertebrate O/E scores by each year. The number of watersheds used in the analysis is represented by n at the bottom of each graph.

Upslope and Riparian Conditions Study Design

For the upslope/riparian assessment, AREMP only evaluated watersheds with at least 5% federal ownership. For this analysis, the scope of watersheds was further narrowed to include only those within the PRMP revision planning area boundary (n=785).

Indicators and Scoring

Upslope/riparian condition was based on mapped data: road density based on FS and BLM geographic information system road layers, and tree canopy cover and basal area-weighted mean diameter) derived from satellite imagery. Both riparian and watershed-wide attributes were calculated; riparian areas were delineated using a uniform 90 m buffer (~300 ft) on either side of the 1:100,000 stream layer.

Effects of these base attributes (roads, vegetation) on five aquatic processes were then estimated: sediment delivery, wood delivery, riparian habitat/shading, hydrology, and fish passage. Base attributes were scored relative to each relevant process using thresholds derived from the literature and then these scores averaged to derive a process indicator score. These standardized scores range from 0 (clearly impaired) to 100 (clearly properly functioning). The five process indicator scores were again averaged to obtain an overall upslope/riparian index score (**Figure 38**).

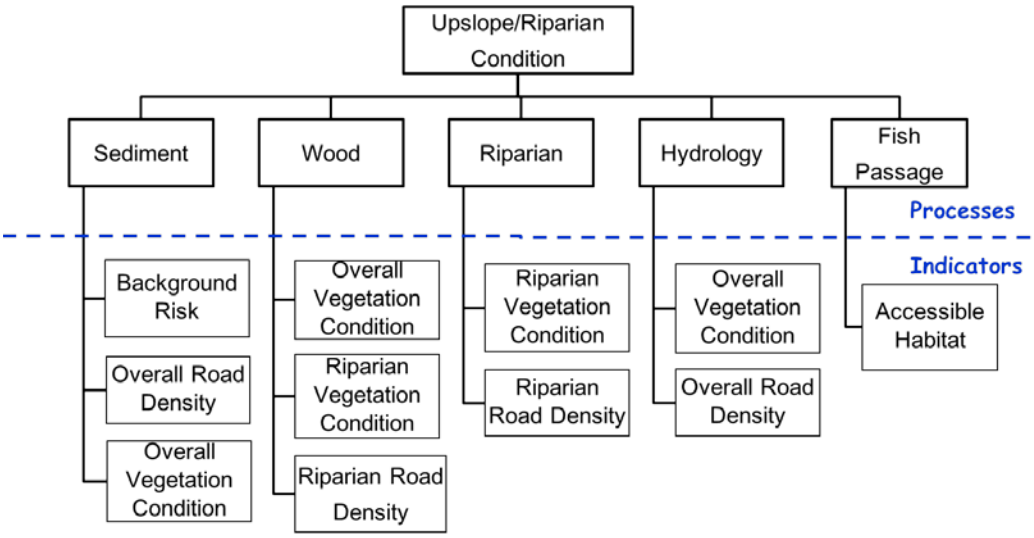


Figure 38—Overall upslope/riparian condition was based on the combination of five process indicators, which were in turn derived from a number of finer grained metrics.

Scores were calculated for 1993 and 2012, and the difference in these scores was used to represent trend. Because data on every watershed in the target population were analyzed, inferential statistics are not needed to test the reliability of generalizing results from a sample to a larger population. All differences are effectively statistically significant, so what remains for judgment is whether differences are meaningful in terms of biology or management. Further details about the indicators and scoring process are available in Miller et al. (2015b).

Upslope and Riparian Conditions Results

The overall index scores for upslope/riparian conditions (WSCOND) within the Western Oregon Resource Management Plan area ranged from 23 to 98 with a mean score of 64 (standard deviation = 13) in 1993 rising to 66 (sd=13) in 2012 (**Figure 39**). Spatial distribution of scores suggests that the areas with the lowest scores occur in the southwestern most region of the plan area (**Figure 40**). Approximately half of all scores for both years fell between 55 and 75. The upslope/riparian score mean for the Oregon Coast province (covering the majority of the Western Oregon Resource Management Plan area) was slightly lower than the mean for the NWFP area as a whole (66 vs. 69) (Miller et al. 2015b). Individual ESU and DPS species overall condition scores increased for all but SONCC coho salmon (**Table 126**).

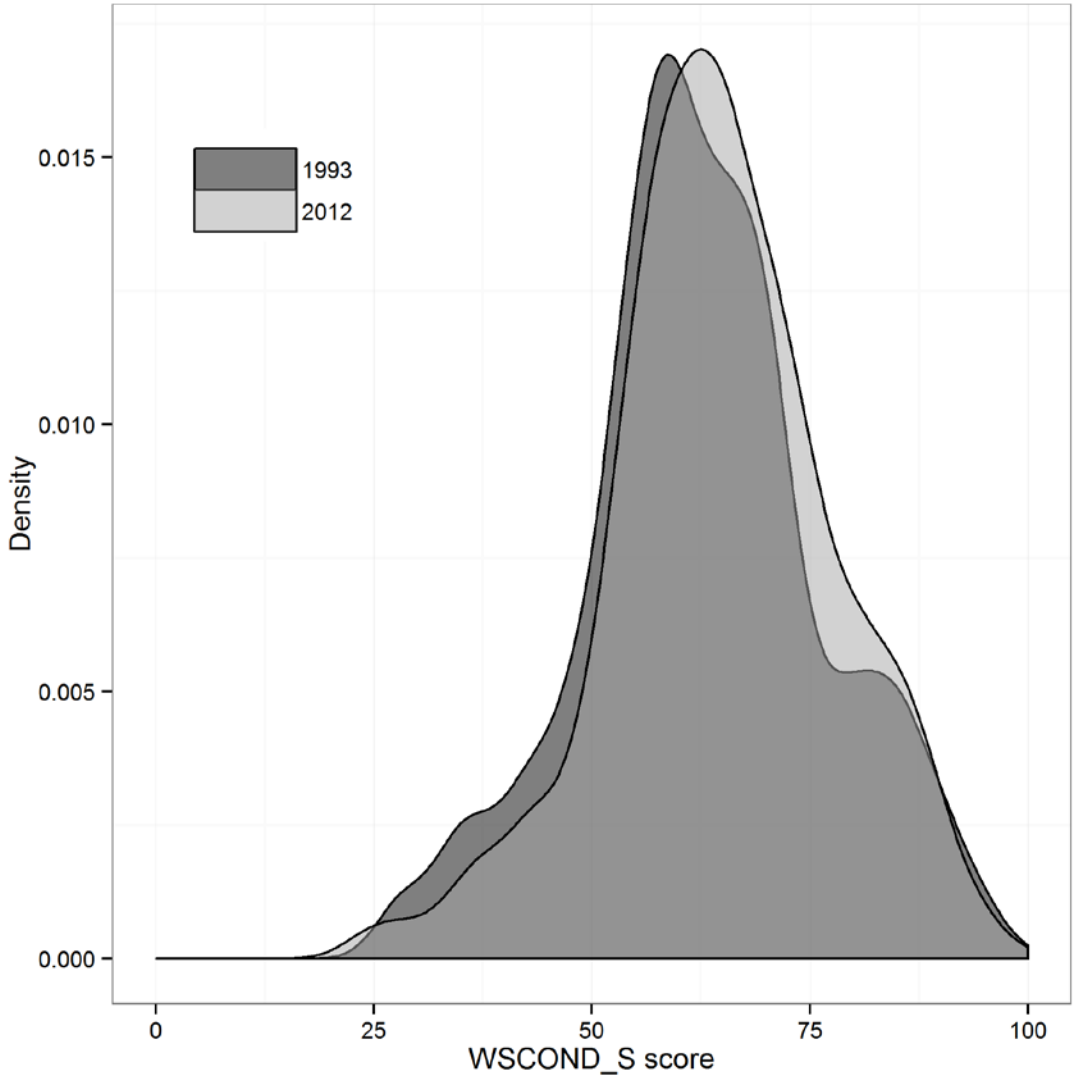


Figure 39—Density plot of upslope/riparian condition scores of watersheds by evaluation year.

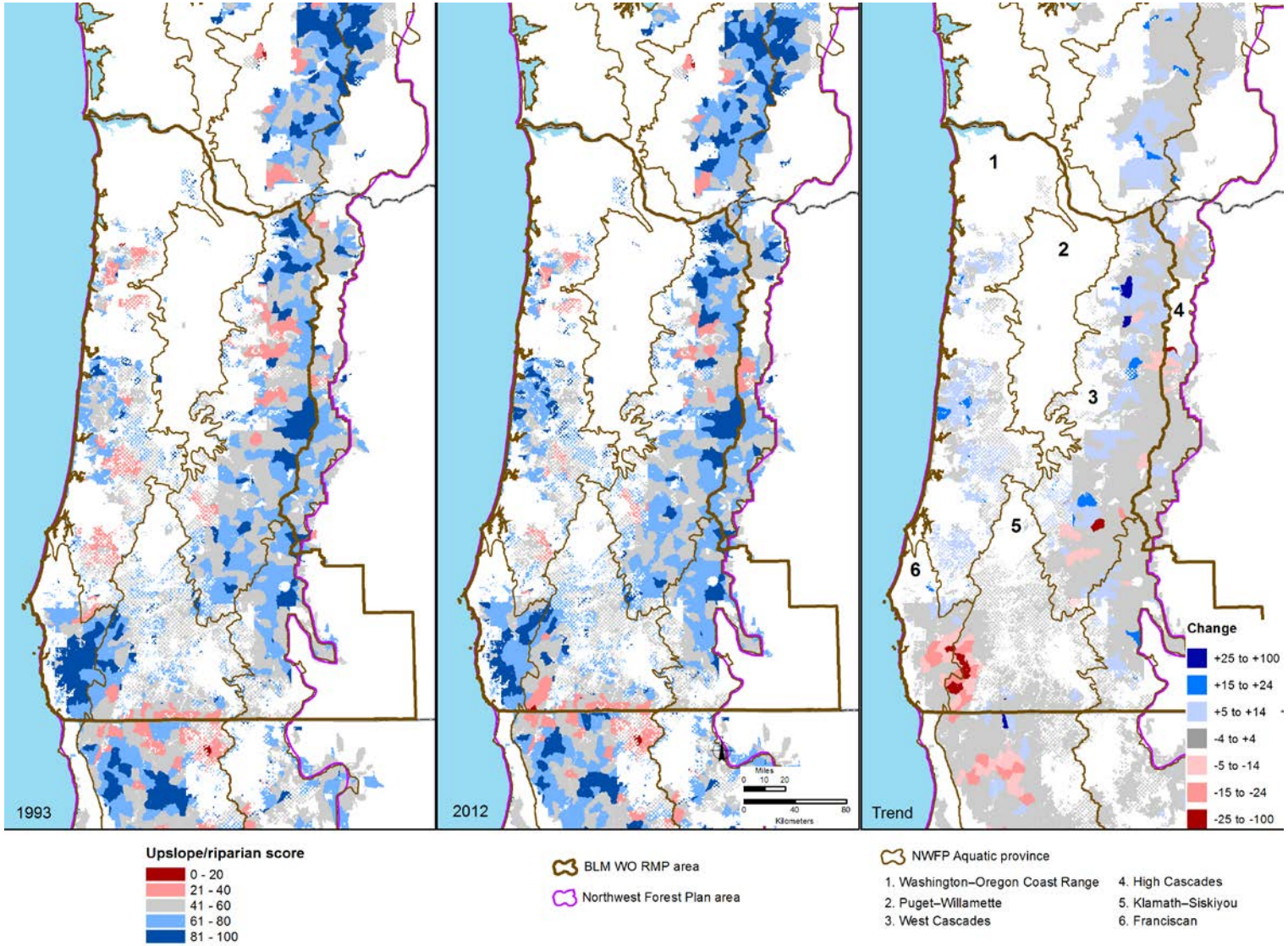


Figure 40—Map of the 1993 and 2012 upslope/riparian status scores and trend for the Western Oregon RMP revision planning area.

Process Indicator Scores

Statistics for the scores of the individual process indicators contributing to the overall upslope/riparian condition score are shown in **Table 126**. Sediment scores were generally high, with overall mean scores of 77/80 (for 1993/2012, respectively). Wood scores were moderate compared to the other indicators (mean 68/71). Riparian scores, a combination of riparian vegetation and riparian road indicators, averaged 52/55 across the planning area. Hydrology scores, derived from overall road density and vegetation condition, were the highest of the process indicators (81/86). Fish passage had the lowest mean scores and greatest variability of all the indicators (51±32/52±33).

Table 126. Indicator values for individual processes that contribute to the overall watershed condition score (WSCOND) for the Western Oregon Resource Management Plan revision planning area.

Indicator	Year	min	max	mean	Sd	median	q25	q75
WSCOND	1993	26	98	63	14	55	63	71
WSCOND	2012	23	98	66	13	58	66	74
SEDIMENT	1993	0	100	77	34	63	99	100
SEDIMENT	2012	0	100	80	32	69	99	100
WOOD	1993	14	92	68	9	62	68	74
WOOD	2012	10	93	71	11	67	73	77
RIPARIAN	1993	14	98	52	21	34	44	72
RIPARIAN	2012	16	98	55	20	37	48	74
HYDRO	1993	27	100	81	16	72	84	95
HYDRO	2012	37	100	86	13	78	89	98
PASSAGE	1993	0	100	51	32	25	51	79
PASSAGE	2012	0	100	52	33	25	52	80.5

Statistics for the scores of the individual process indicators contributing to the overall upslope/riparian condition score by ESA-listed fish geographic areas within the PRMP planning area are shown in **Table 127**.

Table 127. Indicator values for individual processes that contribute to the overall watershed condition score (WSCOND) for (a) Lower Columbia River Chinook salmon, and coho salmon and steelhead, (b) Oregon Coast coho salmon, (c) Southern Oregon / Northern California Coasts Coho Salmon, (d) Upper Willamette River Chinook salmon, (e) Upper Willamette River steelhead, (f) Lost River and shortnose suckers, (g) bull trout.

(a) Lower Columbia River Chinook salmon, coho salmon, and steelhead

Indicator	Year	min	max	mean	Sd	median	q25	q75
WSCOND	1993	46	94	70	14	69	60	83
WSCOND	2012	49	95	74	12	74	66	85
SEDIMENT	1993	0	100	82	28	97	75	100
SEDIMENT	2012	0	100	84	26	99	82	100
WOOD	1993	55	91	73	9	73	65	82
WOOD	2012	59	92	75	8	74	68	82
RIPARIAN	1993	31	95	66	21	67	45	86
RIPARIAN	2012	32	96	72	19	77	59	89
HYDRO	1993	45	100	82	18	90	65	98
HYDRO	2012	56	100	91	12	100	82	100
PASSAGE	1993	0	100	56	31	61	36	80
PASSAGE	2012	0	100	61	33	68	42	87

(b) Oregon Coast coho salmon

Indicator	Year	min	max	mean	Sd	median	q25	q75
WSCOND	1993	26	95	61	13	62	54	70
WSCOND	2012	31	92	66	12	66	59	74
SEDIMENT	1993	0	100	69	38	91	37	100
SEDIMENT	2012	0	100	75	35	97	56	100
WOOD	1993	14	88	67	10	67	62	73
WOOD	2012	18	87	72	9	73	69	77
RIPARIAN	1993	14	95	50	20	43	34	67

RIPARIAN	2012	16	92	54	20	48	37	71
HYDRO	1993	53	100	83	11	84	76	91
HYDRO	2012	41	100	88	10	90	82	96
PASSAGE	1993	0	100	52	32	53	28	79
PASSAGE	2012	0	100	54	32	56	29	81

(c) Southern Oregon / Northern California Coasts coho salmon

Indicator	Year	min	max	mean	Sd	median	q25	q75
WSCOND	1993	28	92	64	13	62	56	71
WSCOND	2012	23	91	63	13	63	56	71
SEDIMENT	1993	0	100	83	30	99	80	100
SEDIMENT	2012	0	100	80	34	99	80	100
WOOD	1993	40	85	68	9	70	63	74
WOOD	2012	10	85	67	14	71	61	76
RIPARIAN	1993	18	93	51	22	39	34	75
RIPARIAN	2012	18	93	52	21	43	35	72
HYDRO	1993	28	100	83	18	89	75	100
HYDRO	2012	42	100	86	15	90	78	100
PASSAGE	1993	0	100	49	34	47	19	80
PASSAGE	2012	0	100	50	34	48	19	82

(d) Upper Willamette River Chinook salmon

Indicator	Year	min	max	mean	sd	median	q25	q75
WSCOND	1993	27	98	63	15	62	55	72
WSCOND	2012	30	98	66	14	67	58	75
SEDIMENT	1993	0	100	75	34	96	56	100
SEDIMENT	2012	0	100	81	30	98	67	100

WOOD	1993	32	92	69	10	68	63	74
WOOD	2012	33	93	73	9	74	68	78
RIPARIAN	1993	16	98	53	21	48	36	68
RIPARIAN	2012	24	98	56	20	51	39	74
HYDRO	1993	27	100	77	17	78	65	90
HYDRO	2012	37	100	83	14	84	74	93
PASSAGE	1993	0	100	50	31	50	27	73
PASSAGE	2012	0	100	52	31	52	29	74

(e) Upper Willamette River steelhead

Indicator	Year	min	max	mean	sd	median	q25	q75
WSCOND	1993	27	92	60	17	61	46	71
WSCOND	2012	30	92	64	16	67	54	75
SEDIMENT	1993	0	100	61	40	78	23	100
SEDIMENT	2012	0	100	69	38	90	38	100
WOOD	1993	32	88	67	9	67	63	73
WOOD	2012	33	88	72	9	73	66	77
RIPARIAN	1993	19	94	52	22	43	34	75
RIPARIAN	2012	24	94	55	21	46	37	75
HYDRO	1993	27	100	77	17	78	65	91
HYDRO	2012	37	100	82	15	85	72	93
PASSAGE	1993	0	100	55	34	58	28	88
PASSAGE	2012	0	100	57	33	62	32	89

(f) Lost River and shortnose sucker

Indicator	Year	min	max	mean	sd	median	q25	q75
WSCOND	1993	45	89	64	11	61	56	72
WSCOND	2012	46	90	66	11	65	58	75
SEDIMENT	1993	69	100	98	6	100	99	100
SEDIMENT	2012	70	100	98	6	100	99	100
WOOD	1993	40	82	65	9	64	59	72
WOOD	2012	48	85	69	9	71	65	75
RIPARIAN	1993	22	87	42	18	33	29	52
RIPARIAN	2012	22	87	45	18	38	33	58
HYDRO	1993	28	100	68	23	68	46	86
HYDRO	2012	39	100	74	20	77	56	90
PASSAGE	1993	0	100	39	30	33	12	53
PASSAGE	2012	0	100	39	30	37	12	53

(g) Bull Trout

Indicator	Year	min	max	mean	sd	median	q25	q75
WSCOND	1993	28	98	69	16	69	60	80
WSCOND	2012	38	98	71	14	71	61	81
SEDIMENT	1993	3	100	82	26	97	69	100
SEDIMENT	2012	31	100	87	20	99	79	100
WOOD	1993	54	92	73	9	76	68	80
WOOD	2012	47	93	76	9	79	72	82
RIPARIAN	1993	37	98	61	20	60	42	79
RIPARIAN	2012	38	98	63	19	61	45	79
HYDRO	1993	50	100	88	13	90	77	100
HYDRO	2012	58	100	91	11	94	81	100
PASSAGE	1993	2	100	56	30	57	29	78
PASSAGE	2012	2	100	56	30	57	29	78

Discussion

Not all watersheds can be expected to be in good condition at any one time, as watersheds are naturally dynamic systems and individual watersheds will cycle through conditions of high and low habitat quality (Naiman et al. 1992, Reeves et al. 1995). So far, the patterns found suggest that the average stream condition physical habitat scores for the PRMP planning area have been largely maintained given that no trend in yearly status physical habitat condition was detected. In terms of upslope/riparian conditions, mean scores for this area have increased moderately since 1993. Both these results are consistent with the larger regional pattern across the entire NWFP area.

Similar to the NWFP results, low scores in the PRMP planning area were primarily driven by poor pool scores, particularly during the second rotation. Substrate and wood scores remained unchanged which is a slight deviation from the overall NWFP results that show an increasing trend in mean substrate distribution scores between rotations. Lower pool scores suggest that pool tail crests, an area important for spawning salmonids, have more fine sediment than expected based on environmentally similar reference condition. Levels of fine sediment can indicate a disturbance in the system, such as sediment delivery from riparian roads and landslides. Upslope/riparian processes that contribute the most to lower condition were riparian and fish passage. Both processes are largely dependent on inputs from roads, further suggesting that road impacts may be affecting streams here.

At the PRMP planning area level, macroinvertebrate observed to expected show positive changes in status across years. Here, macroinvertebrate scores increased suggesting higher levels of biological diversity in the second rotation. Less than 3% of watersheds had a score lower than 0.6 during the first rotation and only a single watershed during the second rotation. This was better than anticipated given the overall NWFP results where 25% of scores fell below 0.6. Seven-day maximum average temperatures show a marginally insignificant decrease in water temperature. These patterns could correspond to higher levels of shading in streams due to increases in vegetation along riparian reserves (Moore and Richardson 2012). Despite some improvement in stream temperatures, we found that some lower reaches within these watersheds do not meet desired conditions based on both NMFS and State of Oregon standards. While these standards are the current guidelines for evaluating stream temperature, it is important to recognize that a single threshold without environmental context is inadequate for assessment (Moore and Richardson 2012).

Endangered species ESUs and DPSs for several species occur within the PRMP planning area. Lower Columbia River Chinook salmon, coho salmon and steelhead were grouped together given that their spatial distribution largely overlaps. As such, the areas sampled and inference areas are similar. Sample sizes within years, for the stream survey component, are too few for adequate estimation of status and, instead, were assessed by rotation. Watershed level stream physical habitat scores showed no evidence of any trend between rotations. Observed to expected macroinvertebrate scores were greater than 0.7 and even improved during the second rotation suggesting that macroinvertebrate biodiversity is well within expectations. Seven-day maximum average water temperatures were generally within state and federal standards. In terms of upslope/riparian conditions, 44 watersheds were included in this unit and consist of a near complete census. Overall scores were above the area average (74 vs. 66) and showed a modest increase in the past 20 years (from 70 to 74).

Sampled watersheds in the OC coho salmon ESU were available at an adequate sampling level for stream status assessment. Here, stream physical habitat scores were maintained across years but mean estimates were lower than the NWFP area. This corresponds spatially to the NWFP Coastal Oregon province that had some of the lowest scores within the plan area. Observed to expected macroinvertebrate scores were variable but, on average, above 0.8 suggesting good diversity. Seven-day maximum average water temperatures were also quite variable and suggest some areas with higher temperature than the NMFS and ODEQ standards. However, given that this was assessed at the watershed level, it may not be reflective of individual stream habitat segments. Upslope/riparian conditions for the 278 watersheds were at the area average (66) and showed a modest increase in the past 20 years (61 to 65).

Sampled watersheds in the SONCC coho salmon ESU were also available at an adequate sampling level for stream status assessment. Again, stream physical habitat scores were maintained across years but have some of the lowest scoring watersheds within the NWFP area; some of these areas did show the greatest improvement in scores. Mean observed to expected macroinvertebrate scores were quite high (above 0.8) across years and below 0.6 only once during the first rotation; this was a significant increase between rotations and across years. Seven-day maximum average water temperature range varied considerably having some of the highest recorded temperatures during both rotations. Mean average temperatures at the lowest

downstream point on federal lands within watersheds suggest that some watersheds may not be at properly functioning conditions. Upslope/riparian conditions for the 204 watersheds in this unit were slightly below the area average (63 vs. 66) and showed a possible minor decline in the past 20 years (64 to 63). This is the only ESU that showed a decline warranting further investigation of the condition in this area.

Sampled watersheds in the Upper Willamette River Chinook salmon ESU were also available at an adequate sampling level for stream status assessment. Here, AREMP found some of the lowest and highest physical habitat scores, particularly during the second rotation. Given the variability, no trends were detected in physical condition across years or rotations. Macroinvertebrate scores were very high; even the lowest scores were above 0.8. Seven-day maximum average water temperatures were only slightly higher than standards once and within range for all other years; significant decreases in temperatures were seen between rotations and in status across years in these watersheds. Upslope/riparian conditions for the 173 watersheds were at the area average (66) and showed a minor increase in the past 20 years (from 63 to 65).

Stream survey sample sizes for watersheds within the Upper Willamette River steelhead ESU were too few for adequate estimation of yearly status and, instead, were assessed by rotation. Watershed-level physical habitat scores varied substantially between rotations and limited inference can be made here. With the limited data here, one can say that observed to expected macroinvertebrate lowest scores were still at least 0.7, suggesting a high correspondence to expectation. Seven-day maximum average water temperature indicates that some watersheds may warrant further temperature assessments. Upslope/riparian conditions for the 98 watersheds were near the area average (64) and showed a modest increase in the past 20 years (from 60 to 65).

Again, sample size within the combined Lost River and shortnose sucker Recovery Units were too few for adequate estimation of yearly stream status and, instead, were assessed by rotation. Watershed level physical habitat scores ranges were generally consistent with the overall variability within the corresponding NWFP aquatic province. Observed to expected macroinvertebrate scores in the first rotation had one low scoring watershed (0.56) that increased to 0.66 in the second rotation. Seven-day maximum average water temperatures were within acceptable ranges. Upslope/riparian conditions for the 50 watersheds were at the area average (66) and showed a minor increase in the past 20 years (from 64 to 66).

A single surveyed watershed was assessed for bull trout in the McKenzie River basin where the stream physical habitat score collected during the first rotation was 35.9. Seven-day maximum average water temperatures were generally cooler but did have occasional temperatures that would indicate not properly functioning. However, this may be due to temperatures being taken in a part of the watershed that is outside of bull trout habitat. As such, further site level investigation should be considered. In terms of upslope/riparian conditions, bull trout had the fewest watersheds (37) in the area. Overall scores were above the area average (71 vs 66) and showed a minor increase in the past 20 years (from 69 to 71).

Within the PRMP planning area, stream physical habitat and upslope/riparian scores were some of the lowest seen in the NWFP area. This is not surprising given the land-use history prevalent to this area prior to the NWFP ACS. Initially, the ACS was developed to halt damage in the

short-term (0-20 years) and over the span of several decades (20-100 years), restore ecological process (Reeves et al. 2004). Given the diversity of federal entities, public and private landowners as well as the multiple use mandates of land management agencies, it should be considered successful that these areas have maintained condition. So far, the patterns found suggest that the average stream condition physical habitat scores for the PRMP planning area have been largely maintained given that we did not detect a trend in yearly status physical habitat condition. Further, increases in macroinvertebrate diversity and decreases in water temperatures suggest that we are seeing improvements in these areas. Of the seven aquatic provinces in the NWFP, the WA/OR Coast province showed the largest increase in mean upslope/riparian score over the past 20 years (from 61 to 66). The PRMP planning area results are generally consistent with the larger regional pattern across the entire NWFP area.

E. Narratives by Evolutionarily Significant Unit or Distinct Population Segment

1. Lower Columbia River Chinook Salmon, Coho Salmon and Steelhead

An analysis of miles of streams with High Intrinsic Potential (HIP) within the PRMP planning area was performed for LCR Chinook salmon (**Table 128**), coho salmon (Table 129) and steelhead (Table 130). A score of 0.75 or greater was considered HIP. The BLM manages a minority of HIP stream miles in each ESU/DPS. The range is 1.0 percent to 4.4 percent of those portions of the ESUs that are within the PRMP planning area.

Table 128. Miles and percentages of high intrinsic potential habitat by ownership for the Lower Columbia River Chinook salmon ESU within the PRMP planning area.

Land Ownership	Miles High Intrinsic Potential Habitat	Percentage
Total	**148.4**	**100%**
Other Ownership	141.8	95.6%
BLM	6.6	4.4%

Table 129. Miles and percentages of high intrinsic potential habitat by ownership for the Lower Columbia River coho salmon ESU within the PRMP planning area.

Land Ownership	Miles High Intrinsic Potential Habitat	Percentage
Total	**356.6**	**100.0%**
Other Ownership	353.2	99.0%
BLM	3.4	1.0%

Table 130. Miles and percentages of high intrinsic potential habitat by ownership for the Lower Columbia River steelhead DPS within the PRMP planning area.

Land Ownership	Miles High Intrinsic Potential Habitat	Percentage
Total	**216.7**	**100.0%**
Other Ownership	207.7	95.9%
BLM	9.0	4.1%

The two salmon ESUs and the steelhead DPS are within the Willamette-Lower Columbia (WLC) Recovery Domain. The description of the environmental baseline that follows is from NMFS (2015).

Critical habitat was designated in the WLC recovery domain for Upper Willamette River (UWR) Chinook salmon, Lower Columbia River (LCR) Chinook salmon, LCR steelhead, UWR steelhead, Columbia River (CR) chum salmon, southern green sturgeon, and eulachon, and has been proposed for LCR coho salmon. In addition to the Willamette and Columbia River mainstems, important tributaries on the Oregon side of the WLC include Youngs Bay, Big Creek, Clatskanie River, and Scappoose River in the Oregon Coast subbasin; Hood River in the Gorge; and the Sandy, Clackamas, Molalla, North and South Santiam, Calapooia, McKenzie, and Middle Fork Willamette rivers in the West Cascades subbasin.

Land management activities have severely degraded stream habitat conditions in the Willamette River mainstem above Willamette Falls and in associated subbasins. The construction of 37 dams in the basin blocked access to more than 435 miles of stream and river spawning habitat. The dams alter the temperature regime of the Willamette River and its tributaries, affecting the timing and development of naturally-spawned eggs and fry. The complexity of the mainstem river and extent of riparian forest have both been reduced by 80% (PNERC 2002). About 75% of what was formerly prairie and 60% of what was wetland have been converted to agricultural purposes. These actions, combined with urban development, bank stabilization, and in-river and nearshore gravel mining, have resulted in a loss of floodplain connectivity and off-channel habitat (PNERC 2002). Habitat loss has fragmented habitat and human density increase has created additional loads of pollutants and contaminants within the Columbia River estuary (Anderson *et al.* 2007).

The mainstem Willamette River has been channelized and stripped of large wood. Development began to encroach on the riparian forest beginning in the 1870s (Sedell and Froggatt 1984). The total area of river channels and islands in the Willamette River decreased from 41,000 to 23,000 acres, and the total length of all channels decreased from 355 miles to 264 miles, between 1895 and 1995 (Gregory *et al.* 2002a).

The banks of the Willamette River have more than 96 miles of revetments; approximately half were constructed by the USACE. Generally, the revetments were placed in the vicinity of roads or on the outside bank of river bends, so that while only 26% of the total length is revetted, 65% of the meander bends are revetted (Gregory *et al.* 2002b). The majority of dynamic sections

have been armored, reducing adjustments in channel bed and sediment storage by the river, and thereby diminishing both the complexity and productivity of aquatic habitats (Gregory *et al.* 2002b).

Riparian forests have diminished considerably in the lower reaches of the Willamette River (Gregory *et al.* 2002c). Sedell and Froggatt (1984) noted that agriculture and cutting of streamside trees were major agents of change for riparian vegetation, along with snagging of large wood in the channel. The reduced shoreline, fewer and smaller snags, and reduced riparian forest comprise large functional losses to the river, reducing structural features, inputs of wood and litter, shade, entrained allochthonous materials, and flood flow filtering capacity. Extensive changes began before the major dams were built, with navigational and agricultural demands dominating the early use of the river. The once expansive forests of the Willamette River floodplain provided valuable nutrients and organic matter during flood pulses, food sources for macroinvertebrates, and slow-water refugia for fish during flood events. These forests also cooled river temperatures as the river flowed through its many channels.

Hyporheic flow in the Willamette River has been examined through discharge measurements and is significant in some areas, particularly those with gravel deposits (Wentz *et al.* 1998; Fernald *et al.* 2001). The loss of channel complexity and meandering that fosters creations of gravel deposits decreases the potential for hyporheic flows, as does gravel mining. Hyporheic flow processes water and affects its quality on reemerging into the main channel, stabilizing variations in physical and chemical water characteristics. Hyporheic flow is important for ecological functions, some aspects of water quality (such as temperature and dissolved oxygen), and some benthic invertebrate life stages. Alcove habitat, which has been limited by channelization, combines low hydraulic stress and high food availability with the potential for hyporheic flows across the steep hydraulic gradients in the gravel separating them from the main channel (Fernald *et al.* 2001).

On the mainstem of the Columbia River, hydropower projects, including the Federal Columbia River Hydropower System (FCRPS), have significantly degraded salmon and steelhead habitats (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011e; NMFS 2013a). The series of dams and reservoirs that make up the FCRPS block an estimated 12 million cubic yards of debris and sediment that would otherwise naturally flow down the Columbia River and replenish shorelines along the Washington and Oregon coasts.

Industrial harbor and port development are also significant influences on the Lower Willamette and Lower Columbia rivers (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011e; NMFS 2013a). Since 1878, 100 miles of river channel within the mainstem Columbia River, its estuary, and Oregon's Willamette River have been dredged as a navigation channel by the USACE. Originally dredged to a 20-foot minimum depth, the Federal navigation channel of the Lower Columbia River is now maintained at a depth of 43 feet and a width of 600 feet. The Lower Columbia River supports five ports on the Washington State side: Kalama, Longview, Skamania County, Woodland, and Vancouver. In addition to loss of riparian habitat, and disruption of benthic habitat due to dredging, high levels of several sediment chemicals, such as arsenic and polycyclic aromatic hydrocarbons (PAHs), have been identified in Lower Columbia River watersheds in the vicinity of the ports and associated industrial facilities.

The most extensive urban development in the Lower Columbia River subbasin has occurred in the Portland/Vancouver area. Outside of this major urban area, the majority of residences and businesses rely on septic systems. Common water quality issues with urban development and residential septic systems include higher water temperatures, lowered dissolved oxygen, increased fecal coliform bacteria, and increased chemicals associated with pesticides and urban runoff.

The Columbia River estuary has lost a significant amount of the tidal marsh and tidal swamp habitats that are critical to juvenile salmon and steelhead, particularly small or ocean-type species (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011e; NMFS 2013a). Edges of marsh areas provide sheltered habitats for juvenile salmon and steelhead where food, in the form of amphipods or other small invertebrates which feed on marsh detritus, is plentiful, and larger predatory fish can be avoided. Historically, floodwaters of the Columbia River inundated the margins and floodplains along the estuary, allowing juvenile salmon and steelhead access to a wide expanse of low-velocity marshland and tidal channel habitats. In general, the riverbanks were gently sloping, with riparian and wetland vegetation at the higher elevations of the river floodplain becoming habitat for salmon and steelhead during flooding river discharges or flood tides. Sherwood *et al.* (1990) estimated that the Columbia River estuary lost 20,000 acres of tidal swamps, 10,000 acres of tidal marshes, and 3,000 acres of tidal flats between 1870 and 1970. This study further estimated an 80% reduction in emergent vegetation production and a 15% decline in benthic algal production.

Habitat and food-web changes within the estuary, and other factors affecting salmon population structure and life histories, have altered the estuary's capacity to support juvenile salmon (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011e; NMFS 2013a). Diking and filling have reduced the tidal prism and eliminate emergent and forested wetlands and floodplain habitats. These changes have likely reduced the estuary's salmon-rearing capacity. Moreover, water and sediment in the Lower Columbia River and its tributaries have toxic contaminants that are harmful to aquatic resources (Lower Columbia River Estuary Partnership 2007). Contaminants of concern include dioxins and furans, heavy metals, polychlorinated biphenyls (PCBs) and organochlorine pesticides such as DDT. Simplification of the population structure and life-history diversity of salmon possibly is yet another important factor affecting juvenile salmon viability. Restoration of estuarine habitats, particularly diked emergent and forested wetlands, reduction of avian predation by terns, and flow manipulations to restore historical flow patterns have likely begun to enhance the estuary's productive capacity for salmon, although historical changes in population structure and salmon life histories may prevent salmon from making full use of the productive capacity of estuarine habitats.

2. Upper Willamette River Chinook Salmon and Steelhead

An analysis of miles of streams with High Intrinsic Potential (HIP) within the PRMP planning area was performed for UWR Chinook salmon (Table 131) and UWR steelhead (Table 132). A score of 0.75 or greater was considered HIP. The BLM manages a minority of HIP stream miles in each ESU. It is 3.0 percent and 9.5 percent for those portions of the Upper Willamette River Chinook salmon ESU and Upper Willamette River steelhead DPS, respectively, within the PRMP planning area.

Table 131. Miles and percentages of high intrinsic potential habitat by ownership for the Upper Willamette River Chinook salmon ESU within the PRMP planning area.

Land Ownership	Miles High Intrinsic Potential Habitat	Percentage
Total	**539.2**	**100.0%**
Other Ownership	523.0	97.0%
BLM	16.2	3.0%

Table 132. Miles and percentages of high intrinsic potential habitat by ownership for the Upper Willamette River steelhead DPS within the PRMP planning area.

Land Ownership	Miles High Intrinsic Potential Habitat	Percentage
Total	**320.2**	**100.0%**
Other Ownership	289.9	90.5%
BLM	30.3	9.5%

The UWR Chinook salmon ESU and steelhead DPS are also within the WLC Recovery Domain. Please see the Environmental Baseline description for the Lower Columbia River anadromous fish species presented immediately above that is from NMFS (2015).

3. Oregon Coast Coho Salmon

An analysis of miles of streams with High Intrinsic Potential (HIP) within the PRMP planning area was performed for the Oregon Coast coho salmon ESU (Table 133). A score of 0.75 or greater was considered HIP. The BLM manages a minority of HIP stream miles at 4.1 percent of the ESU. The ESU is wholly contained within the PRMP planning area.

Table 133. Miles and percentages of high intrinsic potential habitat by ownership for the Oregon Coast coho salmon ESU within the PRMP planning area.

Land Ownership	Miles High Intrinsic Potential Habitat	Percentage
Total	**216.7**	**100.0%**
Other Ownership	207.7	95.9%
BLM	9.0	4.1%

This ESU is within the Oregon Coast Recovery Domain. There has not been a CHART convened to evaluate the current quality and restoration potential of PCEs by 5th field watersheds. The description of the environmental baseline that follows is from NMFS (2015).

The historical disturbance regime in the central Oregon Coast Range was dominated by a mixture of high and low-severity fires, with a natural rotation of approximately 271 years. Old-growth forest coverage in the Oregon Coast Range varied from 25 to 75% during the past 3,000 years, with a mean of 47%, and never fell below 5% (Wimberly *et al.* 2000). Currently, the Coast Range has approximately 5% old-growth, almost all of it on Federal lands. The dominant disturbance now is logging on a cycle of approximately 30 to 100 years, with fires suppressed.

The State of Oregon (2005) completed an assessment of habitat conditions in the range of OC coho in 2005. Oregon's assessment mapped how streams with high intrinsic potential for coho salmon rearing are distributed by land ownership categories. Agricultural lands and private industrial forests have by far the highest percentage of land ownership in high intrinsic potential areas and along all coho stream miles. Federal lands have only about 20% of coho stream miles and 10% of high intrinsic potential stream reaches. Because of this distribution, activities in lowland agricultural areas are particularly important to the conservation of Oregon coastal coho salmon.

The coho salmon assessment concluded that at the scale of the entire domain, pools are generally abundant, although slow-water and off-channel habitat (which are important refugia for coho during high winter flows) are limited in the majority of streams when compared to reference streams in minimally-disturbed areas. Amounts of large wood in streams are low in all four ODFW monitoring areas and land-use types relative to reference conditions. Amounts of fine sediment are high in three of the four monitoring areas, and were comparable to reference conditions only on public lands. Approximately 62 to 91% of tidal wetland acres (depending on estimation procedures) have been lost for functionally and potentially independent populations of coho.

As part of the coastal coho assessment, the Oregon Department of Environmental Quality (ODEQ) analyzed the status and trends of water quality in the range of OC coho using the Oregon water quality index, which is based on a combination of temperature, dissolved oxygen, biological oxygen demand, pH, total solids, nitrogen, total phosphates, and bacteria. Using the index at the species scale, 42% of monitored sites had excellent to good water quality, and 29% show poor to very poor water quality. Within the four monitoring areas, the North Coast had the best overall conditions (three sites in excellent or good condition out of nine sites), and the Mid-South coast had the poorest conditions (no excellent condition sites, and only two out of eight sites in good condition). For the 10-year period monitored between 1992 and 2002, no sites showed a declining trend in water quality. The area with the most improving trends was the North Coast, where 66% of the sites (six out of nine) had a significant improvement in index scores. The Umpqua River basin, with one out of nine sites (11%) showing an improving trend, had the lowest number of improving sites.

One of the primary reasons behind the decline of many salmon stocks in the Pacific Northwest was overharvest of returning adult fish. Up until recently, commercial and recreational harvest of adult coho salmon had been prohibited due to their protected status under the ESA. Recent changes to fishing regulations, however, have resulted in the harvest of wild adult ESA-listed Oregon Coast Coho salmon. Average harvest of wild adult coho from 2012-2014 has ranged from 14% to 18% of the returning population of adult fish (ODFW 2014). For perspective, these figures equate to 21,844 fish harvested in 2012, and roughly 58,817 fish harvested in 2014. If

these regulation changes persist, they will result in the continued harvest of a substantial portion of the returning wild adult coho salmon. Reduced inputs of salmon-derived organic matter and nutrients (SDN) may limit freshwater production and thus establish a negative feedback loop affecting future generations of fish (Compton et al. 2006). More carcasses generally translate into higher densities and elevated growth rates of invertebrates, and juvenile salmonids may grow faster by directly consuming salmon tissue or consuming invertebrates that have been scavenging salmon carcasses (Johnson and Ringler, 1979; Bilby et al. 1996, 1998; Wipfli et al. 1998, 1999, Chaloner and Wipfli 2002).

Therefore, management or restoration actions that increase the number of spawning adults or mimic their enrichment and physical effects may improve the individual and population growth of a variety of organisms, including juvenile salmon, in tributaries with low adult returns (Kiffney et al. 2014). Continued harvest of wild adult fish where populations are already depressed runs the risk of perpetuating the negative feedback loop that impacts the recovery of ESA-listed salmon.

4. Southern Oregon / Northern California Coasts Coho Salmon

An analysis of miles of streams with High Intrinsic Potential (HIP) within the PRMP planning area was performed for the Oregon Coast coho salmon ESU (Table 134). A score of 0.75 or greater was considered HIP. The BLM manages a minority of HIP stream miles in the ESU at 7.2 percent of that portion of the ESU that is within the PRMP planning area.

Table 134. Miles and percentages of high intrinsic potential habitat by ownership for the Southern Oregon / Northern California Coasts coho salmon ESU within the PRMP planning area.

Land Ownership	Miles High Intrinsic Potential Habitat	Percentage
Total	**476.7**	**100.0%**
Other Ownership	442.2	92.8%
BLM	34.4	7.2%

This ESU is within the Southern Oregon/Northern California Coast Recovery Domain. There has not been a CHART convened to evaluate the current quality and restoration potential of PCEs by 5th field watersheds. The description of the environmental baseline that follows is from NMFS (2015).

Many large and small rivers supporting significant populations of coho salmon flow through this area, including the Elk, Rogue, Chetco, Smith and Klamath. Historical logging, mining, and road building have degraded stream and riparian habitats in the Elk River basin. Limiting factors identified for salmon and steelhead production in this basin include sparse riparian cover, especially in the lower reaches, excessive fine sediment, high water temperatures, and noxious weed invasions (Maguire 2001).

The Rogue River estuary has been modified from its historical condition. Jetties were built by the Corps in 1960, which stabilized and deepened the mouth of the river. A dike that extends from the south shore near Highway 101 to the south jetty was completed in 1973. This dike created a backwater for the large shallow area that existed here, which has been developed into a boat basin and marina, eliminating most of the tidal marsh.

The quantity of estuary habitat is naturally limited in the Rogue River. The Rogue River has a drainage area of 5,160 square miles, but the estuary at 1,880 acres is one of the smallest in Oregon. Between 1960 and 1972, approximately 13 acres of intertidal and 14 acres of subtidal land were filled in to build the boat basin dike, the marina, north shore riprap and the other north shore developments (Hicks 2005). Jetties constructed in 1960 to stabilize the mouth of the river and prevent shoaling have altered the Rogue River, which historically formed a sill during summer months (Hicks 2005).

The Lower Rogue Watershed Council's watershed analysis (Hicks 2005) lists factors limiting fish production in tributaries to Lower Rogue River watershed. The list includes water temperatures, low stream flows, riparian forest conditions, fish passage and over-wintering habitat. Limiting factors identified for the Upper Rogue River basin include fish passage barriers, high water temperatures, insufficient water quantity, lack of large wood, low habitat complexity, and excessive fine sediment (Rogue Basin Coordinating Council 2006).

The Chetco River estuary has been significantly modified from its historical condition. Jetties were constructed by the Corps in 1957, which stabilized and deepened the mouth of the river. These jetties have greatly altered the mouth of the Chetco River and how the estuary functions as habitat for salmon migrating to the ocean. A boat basin and marina built in the late 1950s eliminated most of the tidal marsh. The structures eliminated shallow water and vegetation in favor of banks stabilized with riprap. Since then, nearly all remaining bank habitat in the estuary has been stabilized with riprap. The factors limiting fish production in the Chetco River appear to be high water temperature caused by lack of shade, especially in tributaries; high rates of sedimentation due to roads; poor over-wintering habitat due to a lack of large wood in tributaries and the mainstem; and poor quality estuary habitat (Maguire 2001).

A detailed description of the environmental baseline by 5th field watershed for the Oregon part of the ESU, using the indicators of NMFS (1996), is presented in the Biological Assessment for Suction Dredging and High Banking Operations for Notices of Intent on National Forest System lands within the Rogue River-Siskiyou National Forest (USFS 2015). It is incorporated herein by reference.

5. Green Sturgeon (Southern DPS)

The DPS is within the Willamette-Lower Columbia, Southern Oregon/Northern California Coast and Oregon Coast Recovery Domains. A description of current habitat conditions is presented in the Status of Critical Habitat section (section III.A.2) earlier in this document.

A Critical Habitat Review Team (CHRT) was convened to evaluate CH for the southern DPS. The CHRT assigned a conservation value of low, medium or high to geographic areas containing southern DPS green sturgeon CH. Results for the ESA action area for this BA are presented in Table 135 (adapted from Table 7 in NMFS 2009).

Table 135. CHRT conservation value ratings for Southern DPS green sturgeon geographic areas within the ESA action area.

Bays and Estuaries, Including Areas to the Head of Tide	Conservation Value Rating	Comments
Rogue River	Low	Little data on green sturgeon use. Data suggest that green sturgeon use of the estuary is low. Southern DPS presence likely.
Coos Bay	Medium	Little data on green sturgeon use. Data suggest that green sturgeon use of the estuary is low. Southern DPS presence likely.
Winchester Bay	Medium	Identified as an important area for summer rearing of Southern DPS subadults and adults that may support feeding and holding. The CHRT rated this area to be of greater importance relative to Coos Bay, but less than the Columbia R. estuary, Willapa Bay, and Grays Harbor to the north.
Siuslaw River	Low	Little data on green sturgeon use. Data suggest that green sturgeon use of the estuary is low. Southern DPS presence likely.
Alsea River	Low	Little data on green sturgeon use. Data suggest that green sturgeon use of the estuary is low. Southern DPS presence likely.
Yaquina River	Low	Little data on green sturgeon use. Data suggest this bay is not a significant holding or feeding area. Use by green sturgeon is greater than in the Siuslaw or Alsea. Southern DPS presence confirmed.
Tillamook Bay	Medium	From 1986 to 2007, a total of 279 green sturgeon were caught in the sport fishery, second highest only to catch in Winchester Bay. Suitable depths are available at mean low tide throughout approximately 50% of bay. Southern DPS presence likely.
Nehalem Bay	Medium	Relatively high numbers of green sturgeon observed (a total of 254 green sturgeon were caught in the sport fishery from 1986 to 2007). Contains suitable habitat for green sturgeon. Southern DPS presence likely.

6. Pacific Eulachon (Southern DPS)

The DPS is within the Willamette-Lower Columbia and Oregon Coast Recovery Domains. A description of current habitat conditions is presented in the Status of Critical Habitat section

(section III.A.2) earlier in this document. Population trends are presented in the Status of the Species section (section III.A.1) earlier in this document.

7. Lost River and Shortnose Suckers

The description of the environmental baseline with respect to Lost River and shortnose suckers that follows is from USFWS (2015).

Lost River and shortnose suckers and their habitat occur within the Upper Klamath River Basin. The above Status and Distribution include ongoing effects from the USBR Klamath Project. The USBR operates the Klamath Project's numerous dams, canals, diversion channels, drains, and reservoirs to store and deliver irrigation water to variety of agricultural water users and irrigation districts in southern central Oregon and northern California.

Klamath Project operations are described geographically as westside and eastside operations and encompass most Lost River and shortnose sucker critical habitat. Westside operations affect water elevations in the Upper Klamath Basin, specifically Agency Lake, Upper Klamath Lake, Keno Reservoir (also called Lake Ewauna), and discharge volumes through the Link and Klamath Rivers. Eastside operations affect water elevations in the Lost River drainage including Clear Lake, Gerber Reservoir, and discharge volumes in the Lost River including Miller Creek. The primary affects to Lost River and shortnose suckers are entrainment of larval, juveniles, and adults through Klamath Project facilities (dams, fish screens, canals) and the manipulation of water elevations that can impact access to spawning and water quality refugial areas.

In 1991, 1992, and 1993, the USFWS issued a BO on the effects of the USBR's Klamath Project operations on listed species, and concluded that the proposed Klamath Project operations would likely jeopardize the continued existence of the Lost River sucker and the shortnose sucker. Again, in 2001, the USFWS issued a BiOp on the effects of USBR's Klamath Project operations and concluded that the proposed Klamath Project operations would likely jeopardize the continued existence of the Lost River sucker and shortnose sucker. In March 2002, USBR finalized a new BA that covered Klamath Project operations from May 31, 2002, to March 31, 2012, and requested consultation with the USFWS. The USFWS issued a BiOp (finalized in May 2002) that USBR's implementation of this new proposal was likely to jeopardize the continued existence of the Lost River sucker and the shortnose sucker. In 2007, USBR reinitiated consultation with the NMFS and the USFWS on its ongoing operations of the Klamath Project. The USFWS completed a non-jeopardy BiOp on the Klamath Project for the Lost River sucker and the shortnose sucker in 2008. In 2010, the need to re-consult was identified when the issuance of NMFS's 2010 jeopardy BiOp with a Reasonable and Prudent Alternative combined with Klamath Project water use resulted in Upper Klamath Lake water levels that were lower than analyzed by the USFWS in its 2008 BiOp on the Klamath Project. USBR, NMFS and USFWS agreed that under certain hydrologic conditions, USBR was unable to meet the water needs of the Klamath Project and the NMFS and USFWS BiOps, resulting in conflicting requirements that were difficult for USBR to meet with actions under its discretion. Because there was a need to have coordinated BiOps for the Klamath Project, the USFWS Pacific Southwest Regional Director, the NMFS Southwest Regional Administrator and USBR's Mid Pacific Regional Director met in November 2010 with their respective field office

managers and directed them to develop a new proposed action and joint BiOp. Most recently, the USFWS completed a non-jeopardy BiOp on the Klamath Project for the Lost River sucker and the shortnose sucker in May 2013.

Lost River and shortnose sucker Critical Habitats within the action area

Lost River sucker and shortnose sucker critical habitat include two critical habitat units. Unit 1 occurs completely in Oregon for both species. Unit 2 has a small amount of habitat within Oregon for the shortnose sucker: East Fork Willow Creek in Oregon. The previous sections: The Primary Constituent Elements and Identification of the potential effects of water temperature levels to alteration of the PCEs under Status of Lost River and Shortnose Suckers Critical Habitat are incorporated by reference.

Lost River and shortnose suckers Water Quality within the action area

Lost River and shortnose suckers are relatively tolerant of degraded water quality conditions in comparison to species like trout and salmon. Suckers tolerate higher pH, temperature, and un-ionized ammonia concentrations, and lower dissolved oxygen concentrations than many other fishes (Saiki et al. 1999, pp. 41-43; Meyer and Hansen 2002, entire; NRC 2004, p. 200). Nevertheless, both species are regularly adversely affected by poor summer water quality in Upper Klamath Lake, Keno Reservoir, Lost River sub-basin, and the hydropower reservoirs downstream in the Klamath River (NRC 2004, pp. 201-202). Adverse water-quality conditions, which have primarily occurred in summer, have caused multiple incidents of mass adult mortality (Perkins et al. 2000b, pp. 6-23).

The primary cause of water-quality-related mortality appears to be caused by hypoxia (i.e., low levels of dissolved oxygen), although high concentrations of un-ionized ammonia resulting from elevated total ammonia concentrations and high pH, could also be a contributing factor (Perkins et al. 2000b, pp. 26-27. Additionally, in the fish die-offs that occurred in Upper Klamath Lake in the 1990s, disease outbreaks contributed to mortality and continued to affect suckers after the adverse water conditions had abated (Perkins et al. 2000b, pp. 28-29; NRC 2004, p. 238).

Adverse water quality conditions in Upper Klamath Lake are attributed to high nutrient loading, especially phosphorus, and the presence of the blue-green algae, *Aphanizomenon flos-aquae*. This alga (actually categorized as a “cyanobacterium”) now dominates the algal community from June to November, and because of the high concentrations of nutrients available, especially phosphorus, is able to reach seasonally high biomass levels that can lead to highly degraded water quality (Boyd et al. 2002, p. 31; NRC 2004, pp. 5-6; Wood et al. 2006, p. 46; Morace 2007, pp. 9, 39). These conditions affect Lost River and shortnose suckers because rapid algal decay depletes dissolved oxygen levels and can create toxic conditions for suckers, especially when water temperatures are high and wind speeds low (Perkins et al. 2000b, p. 19; Boyd et al. 2002, p. 135; NRC 2004, p. 6; Wood et al. 2006, p. 47; Morace 2007, pp. 44-49). Since 2001, the abundance of Lost River suckers has declined by at least 40 percent in Upper Klamath Lake and the abundance of shortnose suckers may have declined more than 80 percent in Upper Klamath Lake (USGS 2014, pp. 15-16). Given the history of mass mortality events and population trends since 2001, it's reasonable to assume poor water quality will continue to adversely affect sucker survival.

Water quality remains one of the most important, if not *the* most important, proximate factor threatening sucker existence; however, the uncertainty surrounding many of the potential ultimate factors (i.e., the complex interactions of factors causing poor water quality), including wetland reduction, natural nutrient loads, nonpoint sources, and water management, also make it one of the most difficult threats to address.

The Sprague River, the primary spawning habitat for suckers in Upper Klamath Lake and the largest tributary to the Williamson River, is listed as water quality impaired for nutrients, temperature, sediment, and dissolved oxygen under Section 303(d) of the Clean Water Act. In 2002, ODEQ completed a TMDL process for the Sprague River and Upper Klamath Lake (Boyd et al. 2002. entire), and in 2010 it was followed by a TMDL for the Lost and Klamath Rivers in Oregon (Kirk et al. 2010, entire). Water quality management plans were developed which provide targets and guidance on improving water quality in the Sprague River and Upper Klamath Lake. Many wetland and riparian restoration projects are now designed to address TMDL issues.

8. Bull Trout

The description of the environmental baseline for bull trout that follows is from USFWS (2015). Bull trout within the action area occur within the McKenzie River basin portion of the Columbia River IRU.

The Oregon portion of the Columbia River IRU contains 18 core areas and 68 local populations. Three of the 18 core areas in this IRU extend into adjacent states; the Walla Walla and Lookingglass/Wenaha core areas extend into Washington, and the Pine, Indian, Wildhorse Core Area extends into Idaho. This section contains only information for core areas and portions of core areas within the ESA action area for this consultation in Oregon. There are several mainstem river reaches that border Oregon and Washington, and Oregon and Idaho (e.g., Columbia and Snake rivers) that are not associated with a particular core area but are important to the migratory life history form of bull trout and thus they are included as part of the proposed action.

Willamette River Basin

Upper Willamette River Core Area: The Upper Willamette River Core Area is located in the southern portion of the Willamette River Basin in northwestern Oregon and includes the McKenzie and Middle Fork Willamette rivers and a short section of the Willamette River. The Upper Willamette River core area contains four local populations, Trail Bridge, McKenzie River, and South Fork McKenzie, and Middle Fork Willamette River. The Middle Fork Willamette River local population occurs upstream of Hills Creek Dam, and includes Hills Creek Reservoir, the Middle Fork Willamette River, and numerous tributaries and springs.

The Trail Bridge, South Fork McKenzie River, and Middle Fork Willamette River local populations are isolated above dams without safe fish passage, thereby interrupting what was believed to be a historical fluvial (migratory) life history pattern. As a result, bull trout in these local populations now express an adfluvial life history pattern. Entrainment through Hills Creek Dam has likely resulted in a small number of bull trout residing in the Middle Fork Willamette River down to Lookout Point Reservoir. Although there is little documentation of current

occupancy below Hills Creek Dam, the Upper Willamette River Core Area working group has determined that connectivity between the McKenzie and Middle Fork Willamette river subbasins, which includes a short section of the mainstem Willamette River, was likely prior to dam construction, and is important for the recovery of bull trout in this core area. Long term redd counts for local populations in the McKenzie River subbasin are favorable, showing a stable or increasing trend (census count of 158 redds in 2010). In the Middle Fork Willamette River, bull trout spawning was first documented in 2005. Redd counts have slowly climbed, reaching 15 in 2009 before dropping to 11 in 2010.

Clackamas River Core Area: Bull trout have been extirpated from the Clackamas River since the 1960s (Shively et al. 2007, p. 9). A reintroduction under Section 10(j) of the ESA was initiated in 2011 and continues today with spawning being documented each year since the reintroduction began (Hudson et al 2015, p. 19). Because of the experimental non-essential designation under 10(j) of the ESA, Section 7 consultation requirements are different. Populations under 10(j) are treated as "proposed" (listing status) for the purposes of consultation so no conference is required unless an action under consultation is "likely to jeopardize" as determined in an action agency's biological assessment. For this reason the Clackamas River Core Area is not included in this consultation and will not be referred to further in this document.

Bull Trout Critical Habitat within the Action Area

The ESA action area in Oregon encompasses the Columbia River IRU. It contains the Lower Columbia River Mainstem CHU and the Upper Willamette River CHU.

Lower Columbia River Mainstem CHU

The Lower Columbia River Mainstem CHU, which includes the entire reach from the Columbia River mouth to John Day Dam, is considered essential to bull trout conservation because (1) it is presently or could potentially be used for foraging, overwintering, and migration by bull trout from tributaries; (2) quality habitat containing several primary constituent elements exists during the foraging, overwintering, and migration period for bull trout; and (3) inclusion of this area in critical habitat reflects the following two Recovery Objectives: maintaining stable or increasing trends in abundance (indirectly by providing for the needs of migratory forms) and restoring and maintaining suitable habitat conditions for bull trout life history stages. Critical habitat includes the free flowing reaches of the Columbia River and the reservoirs to the ordinary high water elevations and normal operating pool elevations, respectively. This unit includes two Federal dams, Bonneville and The Dalles, between the mouth and John Day Dam. They are operated by the Army Corps of Engineers and form reservoirs in the Columbia River. River flows in the Columbia River upstream and downstream from the dams are affected by operations for hydropower, navigation, flood control, and anadromous fish migration. The Columbia River is free flowing downstream from Bonneville Dam and is tidally influenced. Downstream passage for juvenile anadromous fish is provided by fish passage facilities, by spilling water over dam spillways, or traveling through the powerhouse. Bonneville and John Day dams have fish screen and bypass facilities for juvenile anadromous salmonids. During the summer, fish that are collected at juvenile fish facilities at McNary Dam are transported by barge or truck and released at a site downstream from Bonneville Dam.

The Lower Columbia River Mainstem CHU provides essential FMO habitat for extant tributary populations of bull trout in the Lewis, Hood, Klickitat, and Deschutes rivers and connectivity between these core areas, as well as facilitating the potential reestablishment of a population within the White Salmon River. The connectivity from the Pacific Ocean and upriver allows for the opportunity for amphidromy and fluvial life history expressions and genetic exchange and diversity which is essential to the recovery unit. Historically, the mainstem Columbia River was likely a migration corridor, overwintering habitat, and foraging area for fluvial bull trout that spawned in the major tributary systems. Presently, bull trout are known to occur in the Columbia River and most likely use the mainstem for foraging, overwintering and migration (Brown 1992, p. 52; BioAnalysts 2002, p. 37). Restoring and maintaining connectivity between remaining populations of bull trout is important for the persistence of the species (Rieman and McIntyre 1993, p.7). Migration and spawning between populations also increases genetic variability and strengthens population variability (Rieman and McIntyre 1993, p. 11).

Upper Willamette River CHU

The Upper Willamette CHU is essential to bull trout conservation because it provides significant opportunity for genetic diversity and ensures sufficient redundancy in local populations. The local populations that comprise the Upper Willamette Core Area are part of the Coastal Recovery Unit (evolutionary lineage). Based on genetic data, Spruell et al (2003, p. 21) suggested that among Coastal lineage populations there is a wide amount of variation relative to that observed among other major evolutionary lineages (Snake and Upper Columbia). This may suggest populations (or core areas) within the Coastal Recovery Unit may offer greater opportunities for conserving genetic diversity than other recovery units, namely the Snake and Upper Columbia Recovery Units.

Bull trout in the Upper Willamette Core Area were likely fluvial historically but now include several local populations that have adopted an adfluvial life history strategy due to the presence of impassable dams and large reservoirs. The one remaining fluvial local population is the mainstem McKenzie local population. There is no evidence that there was a historical resident life history expression by bull trout in the core area, nor was there a natural adfluvial life history expression. Fish passage actions over the next decade are expected to provide opportunities for each local population to express its historical fluvial life history form in the future.

Bull trout that comprise the Upper Willamette Core Area represent the southern and western extreme of the bull trout's range. Habitats at the edge of a species range are often marginal. While some habitat within the core area is highly suitable for bull trout (e.g., the McKenzie River and its cold groundwater dominated tributaries) other habitats are less suitable and may prove marginal habitat given degradation and impending climate change (e.g., Middle Fork Willamette River).

The Willamette River CHU encompasses the majority of the McKenzie and Middle Fork Willamette rivers that are deemed suitable for bull trout spawning, rearing, foraging, migrating, connecting, and overwintering. The four local populations in the McKenzie and Middle Fork Willamette rivers have been isolated from each other due to the construction and operation of impassable dams. Provided connectivity is restored in the near future, the habitat contained in the proposed rule is likely sufficient to support population viability in the Upper Willamette

Core Area. The proposed critical habitat designation connects each of these local populations emphasizing the importance of (future) connectivity for long-term persistence. Connectivity between local populations in the McKenzie River Subbasin is expected over the next decade due to fish passage modifications planned for Trail Bridge Dam (mainstem McKenzie River) and Cougar Dam (South Fork McKenzie River).

V. Effects of the Action

The PRMP will provide general direction for the management of natural resources on BLM lands. The environmental consequences found in Chapter 3 of the FEIS contain an analysis of the effects of implementing the proposed management direction, management objectives, land use allocations and other components of the PRMP. The FEIS analysis for the PRMP forms the basis to describe the effects to ESA-listed fish species and to designated CH in this BA. The analysis in this BA does not provide the level of detail regarding effects that a site-specific analysis would typically include. The FEIS is a programmatic planning effort and many of the BLM programs evaluated for effects in this BA have actions widely scattered across the planning area. Effects may differ between individual actions for the same program, based upon site-specific conditions.

Potential site-specific effects from the future implementation of the proposed RMPs on the ESA-listed fish species and designated CH will be evaluated in subsequent project NEPA analyses at the time such actions are proposed and will be consulted on, as appropriate. Future consultation/conferencing at the project level will be conducted in accordance with 50 CFR Section (§)7(a)(2) regulations of the Endangered Species Act.

Chapter V is organized as follows. First each PRMP resource program that was determined to “May Affect” ESA-listed fish species found within the planning area is evaluated to determine its effect on the environmental baseline. For each program (or grouped programs with similar effects) effects to key habitat indicators are described, followed by direct effects to the species. This is done in subsection A. Then effects to the Primary Constituent Elements (PCE) of designated CH are described in subsection B. Based upon the analyses of effects to the species and to the PCEs of designated CH in Chapter V, overall ESA effect determinations for implementing the PRMP to the species and to designated CH are made in Chapter VI.

The extent to which potential environmental impacts constitute adverse effects to ESA-listed fish species or designated CH is dependent upon the proximity, magnitude and duration of the effects, the specific site and watershed characteristics for a proposed action and the design of the action itself. Not all negative environmental impacts result in adverse effects to ESA-listed fish species or their designated CH. Consequently, the ESA effect determination for any specific on-the-ground action may span the range of potential ESA effect determinations: “No Effect” (NE), “May Affect, Not Likely to Adversely Affect” (NLAA) and “May Affect, Likely to Adversely Affect” (LAA).

However, the ESA effect determination for a RMP is based upon the highest degree of effect anticipated for any subsequent on-the-ground actions that are implemented. For example, some

actions will be upslope from Riparian Reserves and will have no probability or a discountable probability of negative environmental impacts that would reach streams containing ESA-listed fish species or designated CH. A sub-set of actions will be within Riparian Reserves of streams containing ESA-listed fish species and designated CH. For a further sub-set of actions within Riparian Reserves, it is reasonably certain that there will be measurable effects to water quality from sediment reaching streams that would constitute an adverse effect to the species and several PCE of designated CH. Consequently, the overall ESA effect determination for the entire RMP would be LAA to the ESA-listed fish species and its designated CH, notwithstanding that many or most individual projects would be NE or NLAA.

The distribution of the potential adverse effects among the ESUs/DPSs/RUs of the ESA-listed fish species and their respective designated CH is implied by the locations of miles of occupied stream and designated CH on BLM lands in each ESU/DPS/RU (see tables in Environmental Baseline section). The BLM recognizes that the effects of BLM activities are not restricted to only those stream reaches immediately adjacent to the activity. Effects may be transmitted downstream for some distance from the site, depending upon site-specific circumstances and the type of activity.

Adverse effects to ESA-listed fish species occur from direct effects to the species (harm or harassment) and indirect effects (those occurring later in time that are reasonably certain to occur) from impacts to habitat quality. Examples of common impacts to habitat quality from natural resource programs include:

- Removal of shade vegetation may increase water temperature
- Disturbance of soil within riparian areas may cause erosion, resulting in increased turbidity in streams and fine sediment in streambeds
- Removal of riparian vegetation may reduce potential future functional pieces of small or large wood in stream channels
- Increased sediment loading to stream channels from road construction, maintenance and winter haul

The potential adverse effects described in this section to ESA-listed fish and their respective designated CH found within the planning area, at the site-scale and across the landscape, will be minimized for all activities for the following reasons:

- Implementing the BMPs and Management Direction will reduce, minimize and in some cases eliminate, negative environmental impacts to water quality, in-channel habitat, and riparian vegetation.
- The Management Objectives and Management Direction of the Riparian Reserve LUA, as well as its design (distances), will minimize or eliminate negative impacts from upland areas or from within the Riparian Reserve, from reaching water bodies.

The extent of these adverse effects at the ESA-listed fish population/ESU/DPS/RU scale would be limited since:

- BLM-administered lands typically comprise a small percentage of designated CH and areas of verified presence of ESA-listed fish species for any population/ESU/DPS/ RU within the planning area.
- Actions would generally be distributed in time and space.

In general, the extent of impacts to aquatic habitat resulting from actions authorized under the PRMP will be similar or less than have occurred over the last 20 years since implementation of the Northwest Forest Plan. This prediction is based on the following rationale:

- The one site potential tree distance of Riparian Reserves for fish-bearing and perennial streams encompasses 90 percent or higher of the cumulative effectiveness of the following riparian ecological functions: litter fall; root strength; shading; and large wood debris delivery to streams (FEMAT Figure V-12)
- Riparian Reserve management is more conservative (NWFP does not specify no-thin buffers; the PRMP does)
- AREMP monitoring trends indicate slight improvement in aquatic habitat condition on federal lands over the last 20 years. This indicates that aquatic protective elements were working as intended (improvements in water temperature, LWD and riparian vegetation)
- The total amounts of lands in reserve status are similar
- Levels of aquatic restoration are expected to be similar
- The new plan places increased emphasis on road restoration with management direction to reduce or eliminate aquatic impacts stemming from roads.

Habitat Indicators Used for the Effects Analysis

The effects analysis utilizes the following indicators. These indicators were chosen based on their overall importance to key riparian and aquatic processes. A list of some of the key process interactions is provided below each indicator. Narrative descriptions of these key process interactions, with references, are provided below. Effects to fish habitat and to fish from impacts to the indicator are also described. Narrative excerpts are largely from the programmatic biological assessment for fish habitat restoration activities, known as ARBA II (USFS et al. 2013), unless otherwise cited.

1. **Large and small wood**

On the forest floor adjacent to streams:

- Traps fine sediment and contributes key nutrients to riparian soils

In the stream channel, physical effects include:

- Pool formation (number and depth)
- Creation of off-channel habitat
- Connectivity of stream channels with floodplains
- Cover for fish and other organisms
    - Creates space for additional territories for juvenile fish
- Channel form (dissipates stream energy and limits downcutting/bank erosion)

- Substrate sorting and accumulation from bedload, thereby influencing hyporheic flow
- Larger wood pieces often trap and retain smaller wood pieces, and other organic materials

Biological effects include:

- Provides cover for fish and other organisms through a range of flow conditions
- Creates space for additional territories for juvenile fish
- Serves as substrate for aquatic algae and macroinvertebrates
- Contributes to nutrient cycling as it decomposes in stream channels
- Contributes to nutrient cycling by increasing a stream's ability to retain salmon carcasses and smaller organic detritus, important sources of stream nutrients.

"Large wood in streams is an important roughness element influencing channel morphology, sediment distribution, and water routing (Swanson and Lienkaemper 1978; Bisson et al. 1987). Common sources of large wood include falling of dead trees, wind-throw and breakage, and landslides (Johnston et al. 2011). Latterell and Naiman (2007) observed that the primary source of in-stream wood on the Queets River in Washington was from channel meandering and bank erosion through riparian areas. Large wood influences channel gradient by creating step pools and dissipating energy (Heede 1985), lengthens streams by increasing sinuosity (Swanston 1991), and serves as an important agent in pool formation (Montgomery et al.1995; Reeves et al. 2011). In low order streams, in particular, LW collects sediment and larger substrates during high flow events (Keller et al. 1985) and can account for 50% of the sediment/substrate storage sites (Megahan 1982). Further, LW is instrumental in nutrient retention by capturing and storing salmon carcasses (Cederholm and Peterson 1985; Strobel et al. 2009) and allochthonous materials, a primary energy source for smaller rivers and streams (Gregory et al. 1991). The resulting effect of LW on fish habitat is significant. Crispin et al. (1993) noted increased salmon spawning activity in an area where gravels accumulated behind LW. Bjornn and Reiser (1991) cited several studies that documented an increase in fish densities with higher levels of LW, and Fausch and Northcote (1992) documented that Coho salmon and cutthroat trout production was greater in LW-dominated streams, where pools, sinuosity, and overhead cover were greatest. The role of LW decreases as streams become larger, because greater currents will carry LW out of the active channel and onto the banks (Murphy and Meehan 1991)."

2. **Sediment/Turbidity/Substrate**

- Stream channels develop with natural sediment loads and adjust in width and depth to changed sediment loads
- Aquatic organisms evolved to utilize substrates and suspended sediment within certain ranges at specific seasons of the year
- Excess fine sediments fill in interstitial spaces between coarse substrate particles, limiting physical living space for aquatic macroinvertebrates, amphibians, and small (and juvenile life stages) of fish
    - Loss of cover as a result of reduced interstitial spaces may result in increased predation

- Fine sediments deposited on gravel can negatively affect the quality of spawning substrate
- Suspended sediments added to existing loads, and unseasonal suspended sediment, stress aquatic organisms, including fish
- Pools can be filled by sediment and degraded or lost.

"Increased levels of sedimentation often have adverse effects on fish habitats and riparian ecosystems. Fine sediment deposited in spawning gravels can reduce egg survival and developing alevins (Everest et al. 1987; Hicks et al. 1991) by reducing the availability of dissolved oxygen in the gravel. Primary production, benthic invertebrate abundance, and thus, food availability for fish may be reduced as sediment levels increase (Cordone and Kelley 1961; Loyd et al. 1987) due to reductions in photosynthesis within murky waters. Social (Berg and Northcoate 1985) and feeding behavior (Noggle 1978) can be disrupted by increased levels of suspended sediment. Pools, which are an essential habitat type, can be filled by sediment and degraded or lost (Kelsey et al. 1981; Megahan 1982). Robichaud et al. (2010) documented that sediment influxes into streams, which create turbidity, were lower in natural (undisturbed) forests relative to disturbed sites created by land management activities. Reeves et al. (1995) describe that sediment influxes and resulting turbidity occurs through naturaly occurring landslides in western Oregon."

"The NMFS (1996) notes that rearing capacity of salmon habitat decreases as cobble embeddedness levels increase, resulting from increased sedimentation. Furthermore, over wintering rearing habitat within substrate may be a limiting factor to fish production and survival, and the loss of this over wintering habitat may result in increased levels of mortality during rearing life stages. Likewise, when the percent of fine sediments in the substrate was relatively high, rearing bull trout were also less abundant."

3. Water temperature

- Aquatic organisms are adapted to specific temperature ranges.
- Water temperatures above tolerances result in avoidance behavior, negatively impact metabolism and reduce growth, reduce disease resistance and can result in mortality.
- Increase in water temperature can lead to increased distribution of non-native fish, as well as native fish, that are both competitors and predators to listed salmonids.

"Water temperatures affect the survival and production of fish throughout all life stages. For instance, a study of Chinook salmon survival from fertilization to hatching demonstrated that those eggs incubated at 15.0˚C had a 23% survival rate while those incubated at 9.9 and 11.4˚C had a 49 and 50% survival rate, respectively (Garling and Masterson 1985). In Chum salmon, embryo survival was demonstrated to be highest at 11˚C (Murry and McPhail 1988), hatching success of rainbow trout reaches its maximum at 10-12˚C (McCullough 1999), and preferred temperatures for bull trout ranges are 2-4˚C (McPhail and Murray 1979). Next, changing water temperatures affect juvenile fish. Cairns et al. (2005) documented that increased temperatures in an Oregon stream resulted in higher neacus-type trematode infestations of juvenile

salmonids. Further, juvenile (fry, fingerling, parr) Chinook demonstrate optimum growth between 10.0-15.6˚C (Armour 1990), while growth drastically declines or ceases at 19.1˚C (Armour 1990) and is accompanied by decreased feeding, increased stress, and warm water diseases. Juvenile bull trout are usually found in water temperatures below 12˚C (Goetz 1994). Finally, at a certain point, temperatures become lethal for all fish. McCullough (1999), citing numerous studies, stated that temperatures above 21˚C equal orexceed incipient lethal temperatures for Columbia River Chinook stocks and steelhead stocks migrating during the summer season. The best bull trout habitat in Oregon streams seldom exceeded 15˚C (Buckman et al. 1992; Ratliff 1992; Ziller 1992)."

4. Peak/base flows

- Channel form, bank stability, instream wood distribution and substrates are affected by peak flow magnitude and frequency, to different degrees dependent upon the type of stream channel, confinement and bed.
- Increases in peak flows resulting from natural events or anthropogenic activities (such as forest fires, removing forest cover via timber harvest, or increasing concentration of flows due to road/stream intersections) can impact these processes.
- Base flows can also be impacted by such activities, with both increases and decreases to base flows being possible. Lower base flows could result in reduced physical living space and warmer stream temperatures. Increased base flows would have the opposite effect.

Grant et al. (2008) reviewed existing studies on peak flow effects from forest harvest activities. Peak flow increases in small catchments (<10 km^2) had the greatest number of studies. Response curves constructed using existing study data determined that in the rain zone, the maximum response line reaches the 10-percent detection limit at approximately 29 percent harvested. This suggests that if less than 29 percent of the watershed is harvested, there are no data supporting a resultant increase in peak flow. The first detectable reported value occurs at 40 percent. However, study data could not be disentangled from the amount of roads within each harvested watershed.

For the rain on snow zone, a maximum response line for studies with less than 2 percent roads was constructed. The line reaches the detection limit at approximately 15 percent harvested. The mean response line, which includes a few basins with roads, crosses the detection limit at a slightly higher value of 19 percent harvested.

Grant et al. (2008) stated that the data suggest that peak flow effects on channels, if any, should be confined to channel gradients less than approximately 0.02. These are primarily gravel-bed rivers and streams in forested landscapes in western Oregon and Washington. Peak flow effects on channel morphology can be confidently excluded in high-gradient (slopes >0.10) and bedrock reaches, and are likely to be minor in most step-pool systems. On the other hand, if

channels have beds of fine gravel or sand, a much closer hydrologic and geomorphic analysis seems warranted.

The 2008 RMP/EIS provided a summary of the potential effects of stream flow and peak flows on fish habitat. That discussion is incorporated here by reference (USDI BLM 2008, pp. 390, 800-801) and summarized below:

> "Scour from peak flows is an annual natural process. However, changes in the frequency or magnitude of peak flows can result in stream instability and increased scour. Scour and entrainment of eggs in gravel has frequently been documented (Schuett-Hames et al. 1996, McNeil 1966 in Schuett-Hames et al. 1996, Duncan and Ward 1985, Tripp and Poulin 1986, Lisle 1989, Nawa et al. 1993, Kondolf et al. 1991, and Schuett-Hames et al. 2000). Loss of eggs due to gravel movement occurred frequently in southeast Alaska pink and chum salmon spawning streams. Mortality often exceeded 50% and ranged as high as 90% (McNeil 1966). In the Queen Charlotte Islands of British Columbia, estimated mortality of chum and coho salmon eggs from scour was 80-90% (Tripp and Poulin 1986). Disturbance of more than 75% of the chinook redds was estimated in a southwest Oregon stream due to scour (Nawa et al. 1990)."

Based upon the conclusion by Grant et al. (2008) above regarding channel types and gradients likely to be affected by peak flow scour, streambed scour that would result in egg mortality would generally occur in lower gradient stream channels with gravel and sand-bed substrates, and would not typically occur within cascade and step-pool stream types.

A literature review by Moore and Wondzell (2005) suggests that logging can result in increases in summer base flows in rain-dominated small watersheds following logging: "The majority of rain dominated catchments had less extreme low flows for at least the first few years after harvest, based on studies in northern California, the Oregon Cascades and Coast Range, and Vancouver Island…" The review was based on studies of catchments smaller than 100 hectares and with stream channels less than 2 – 3 m wide. The authors characterized the duration of the increases as "at least the first few years after harvest." In one of the reviewed studies (Hicks et al., 1991), a clearcut watershed in the H.J. Andrews forest in Oregon had higher flows in August for 8 years after logging, and a 25 percent partial cut watershed nearby had increased August water yield for 16 years post-logging. However, base flows in some instances were lower than pre-harvest after the initial few years of being greater than pre-harvest. It was hypothesized that the reduction in base flow increases over time was attributable to increased evapotranspiration from deciduous and young conifer trees.

5. Riparian Reserve function and vegetation diversity

The species composition, root strength, duff layer and structural diversity of plant communities in riparian areas serve to:

- Buffer water temperature fluctuations by providing shade and cool micro-climates
- Moderate the routing of nutrients from upland disturbance

- Filter sediments eroded from uplands and reduce surface erosion, influencing the quality of pools, channel width to depth ratios, water quality (suspended sediments), streambed substrate, and spawning gravel
- Moderate bank erosion and builds streambanks, influencing floodplain connectivity
- Regulate channel migration
- Provide woody material to stream channels of various sizes (see large and small woody material discussion, above)
- Provide leaf / needle drop for nutrient cycling in streams, affecting the food web
- Provide habitat for terrestrial insects that serve as a food source for fish
- Moderate impacts of fire (patchy distribution of burnt areas due to humidity and damp soils)

"The following discussion was adapted from FEMAT (1993). Riparian areas are those portions of watersheds that are directly coupled to streams and rivers, the portions of watersheds required for maintaining hydrologic, geomorphic, and ecological processes that directly affect streams, stream processes, and fish habitats. The network of Riparian Reserves—comprised of all stream orders both intermittent and perennial—allow for connectivity of the aquatic ecosystem within a watershed. Riparian areas are shaped by disturbances characteristic of upland ecosystems, such as fire and windthrow, as well as disturbance processes unique to stream systems, such as lateral channel erosion, peakflows, deposition by floods and debris flows. The near-stream riparian areas—floodplains—may contain an increased diversity of plant species and extensive hydrologic nutrient cycling interactions between groundwater and riparian vegetation. This vegetation, ranging from conifers to deciduous hardwoods, provides allochthonous (organic debris) to stream channels and associated aquatic invertebrate communities. Further, riparian vegetation moderates light levels and stream temperature, helps armor stream banks with extensive root systems, and contributes large wood into the stream channel."

6. Chemical contamination/nutrients

Human-caused introduction of chemicals or nutrients (petroleum products, phosphorous / nitrogen fertilizers) at certain concentrations in streams can negatively influence the aquatic ecosystem. Likewise, changes to forest structure and tree species diversity (via forest fires or timber harvest) may also result in changes to nutrient availability and cycling in the aquatic system. These changes may result in:

- Unanticipated increases or decreases in stream productivity
- Sub-lethal reactions of macroinvertebrates and fish, including avoidance behavior and respiratory stress
- Developmental abnormalities in developing embryos for fish
- Bioaccumulation in tissues
- Mortality

“Aquatic ecosystem perturbations related to chemical contamination include thermal pollution, toxicity due to organic compounds and heavy metals, organic wastes and resulting changes in dissolved oxygen, acidification, and increased eutrophication.”

7. **Roads within Riparian Reserves**

There is no natural analogue for a road. As a result, roads can impact riparian processes when located in riparian areas (potentially impacting many of the functions described in the Riparian Reserve discussion, item 5 above).

- Existing roads that cross fish-bearing streams may have culverts that fully or partially block fish passage to important habitats upstream
- Roads connected to the stream network via drainage ditches (whether located in or out of Riparian Reserves) and stream crossing culverts also directly influence fine sediment delivery to stream channels, and peak/base flows
- Culvert crossings tend to pile wood rather than allow the wood to function downstream

“Wemple et al. (1996) documented that 57% of a road system within a watershed, located in the western Cascades of Oregon, was hydrologically connected to the stream network by roadside ditches draining directly into streams and roadside ditches draining into relief culverts with gullies below their outlets. Thus, an increase in road densities led to an associated increase in drainage density by up to 50%. High-density road systems have been linked to changes in the hydrograph or magnitude and timing of flow events. For instance, in an Oregon Coast Range watershed, Harr et al. (1975) showed that peak flows increased significantly after road building converted at least 12% of the area to road prisms. The causal effects were attributed to increased surface compaction, which reduces water infiltration, resulting in excess water being carried down the road, drainage ditches, and relief culverts into the stream network. Jones and Grant (1996) documented that peak flows increased by 50% in a watershed within a five year period following road construction and logging. The longevity of the hydrologic changes are as permanent as the roads, and until a road is removed and natural drainage patterns are restored, the road will continue to affect the routing of water through a watershed.”

“Human constructed physical barriers within the stream channel, such as culverts, headcuts, irrigation weirs, and dams can impair sediment and debris transport, migration routes, life history patterns, and population viability. First and second order streams, which generally include permanently flowing non-fish bearing streams and seasonally flowing or intermittent streams, often comprise over 70 percent of the cumulative channel length in mountain watersheds in the Pacific Northwest (Benda et al. 1992). These streams are the sources of water, nutrients, wood, and other vegetative material for streams inhabited by fish and other aquatic organisms (Swanson et al. 1982; Benda and Zhanag 1990). Decoupling the stream network (through physical barriers) can result in the disruption and loss of functions and processes necessary for creating and maintaining fish habitat. Further, physical barriers prevent the movement of fish in their fulfillment of life history functions. Culverts, for instance, prevent juvenile fish from reaching rearing habitats (Furniss et al. 1991) and have blocked significant amounts of historical anadromous salmonid habitat (Roni et al. 2002; Sheer and Steel 2006). Even more, barriers restrict the expression of various life history forms within a species. Migratory movements of fluvial or adfluvial forms of bull trout, for example, can be restricted

or prevented, and such a loss of life history forms restricts the full potential of fish production. Finally, strong populations rely on unimpeded access between watershed reserves, those areas of high quality habitat occupied by viable subpopulations, for dispersion and genetic interchange (Noss et al. 1997)."

Bull Trout Population Indicators Used for the Effects Analysis

USFWS (1998) includes a set of four indicators used to describe the effects of an action to characteristics of bull trout populations. They are:

1. Subpopulation Size
2. Growth and Survival
3. Life History Diversity and Isolation
4. Persistence and Genetic Integrity

An effect to a population indicator is based upon the totality of effects to habitat indicators and whether or not harm or harassment to the species may occur. For these reasons, the effects of the entire action to the four population indicators is done at the end of the indicator and direct effects to the species section (section V.A.), and not by individual program.

A. Effects to the Species

1. Cultural and Paleontological Resources

Archaeological data in western Oregon shows that past human activity most often took place on flat ground and near freshwater sources. This suggests that cultural resource program activities (inventories, site-testing/excavation, and appropriate rehabilitation or stabilization techniques) are likely to occur in or near Riparian Reserves.

Cultural resource surveys are walking surveys, where the surface duff layer is removed to mineral soil. The disturbed areas are typically 1 x 1 meter in size and occur every 20-30 meters. Because it is not desirable to let the public know the location of cultural resources, the surveyor will restore each disturbed area to the extent practicable so that it looks like the surrounding ground surface. This serves to minimize erosion potential at the site. Little to no vegetation is removed. Excavation at a site with known cultural resources is performed to determine the boundaries and depth of the site. In recent memory, the largest excavation for this purpose in the decision area was 3 x 3 meters in size and to a depth of approximately 2 meters. The hole was filled and the surface restored to look like the surrounding area (Ulrich, pers. com. 2015).

The provisions in 43 CFR 8365.1-5 describe the reasonable amounts of paleontological specimens that can be collected. Specimens are small samples that are easily carried and transportable by hand. Specimens can only be collected from the surface or with the use of non-powered hand-tools. Casual collecting activities may not cause disturbance to the surface that would have impacts on other natural or cultural resources. Ulrich (Ulrich pers. com. 2015) explained that the collection of common fossils for personal use is opportunistic in nature. For example, people may notice a fossil in a bare soil area, such as a road cutbank or a streambank, and collect it.

Effects to Environmental Baseline

Large and Small Wood

A subset of cultural and paleontological activities under the PRMP would occur within Riparian Reserves. The potential to affect large and small wood recruitment to stream channels is extremely limited. Site excavations typically have a small footprint and rarely impact vegetation. Vegetation that may be affected would primarily be low growing vegetation such as grasses, shrubs and forbs. Effects to small and large wood recruitment would be extremely unlikely to occur. Therefore, there would be a discountable negative effect to the indicator.

Summary of effects to large and small wood

The effect to the indicator would be discountable because it is extremely unlikely that any trees would be damaged or removed by site excavation.

Sediment/Turbidity/Substrate

A subset of cultural and paleontological activities under the PRMP would occur within Riparian Reserves. Site excavation is the only mechanism with potential effects to the indicator. The potential to affect fine sediment delivery to stream channels, with consequent increases in fines within spawning gravel or interstitial spaces between cobbles used for rearing habitat is extremely limited. As described above, site excavations typically have a small footprint. Those done for cultural resources and for paleontological resources under permit, would have site rehabilitation that would minimize or eliminate any off-site movement of disturbed soil. The amount of fine sediment reaching stream channels occupied by ESA-listed fish species is likely to not result in measurable effects to the indicator. Consequently, there will be an insignificant effect to the indicator.

Summary of effects to sediment/turbidity/substrate

The effect to the indicator would be insignificant because site excavations are typically very small in area and the amount of fine sediment reaching stream channels occupied by ESA-listed fish would not be meaningfully measured.

Water Temperature

A subset of cultural and paleontological activities under the PRMP would occur within Riparian Reserves. Site excavation is the only mechanism with potential effects to the indicator. The potential to affect water temperature is extremely limited. Site excavations typically have a small footprint, and little to no vegetation that provides shade to stream channels would be removed. At most, there would not be meaningfully measurable effects to water temperature. Consequently, there will be an insignificant negative effect to the indicator.

Summary of effects to water temperature

The effect to the indicator would be insignificant because site excavations are typically very small in area and little to no shade vegetation would be removed along any streams occupied by ESA-listed fish. Effects would not be meaningfully measured.

Peak and Base Flows

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows are also affected by concentration of flows associated with increases in road connectivity to stream channels. Cultural and Paleontological program actions do not include road construction or other flow-concentrating mechanisms. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected. This results in a discountable negative effect to the indicator.

Summary of effects to peak and base flows

The effect to the indicator would be discountable because site excavations are typically small in area and do not impact much vegetation, and therefore it is extremely unlikely that peak/base flows would be affected.

Riparian Reserve Function and Vegetation Diversity

Many functions of Riparian Reserves are addressed by other indicators used for this effects analysis. The effects to the Large and Small wood indicator, the Sediment/Turbidity/Substrate indicator, and the Water Temperature indicator have been determined to be discountable negative, or insignificant negative. There is no mechanism to affect the Chemical Contamination and Nutrients indicator or the Roads within Riparian Reserves indicator, as described below.

Because sediment delivery to stream channels would be extremely limited, there is no mechanism to affect the quality of pools, cause changes to width-depth ratio, affect streambank stability, or change the connectivity of the stream with its floodplain. The diversity of low-growing riparian vegetation may be reduced in the short-term, but the effects would be insignificant.

Summary of effects to riparian reserve function and vegetation diversity

There will be a mix of insignificant, discountable and no effects to several functions of Riparian Reserves. Consequently, there will be an overall insignificant negative effect to the indicator.

Chemical Contamination and Nutrients

There is no mechanism to affect the indicator. Neither program utilizes chemicals or adds nutrients. There will be no effect to the indicator.

Summary of effects to chemical contamination and nutrients

There will be no effect to the indicator because there is no mechanism to affect it.

Roads within Riparian Reserves

There is no mechanism to affect the indicator. Neither program affects the quantity or quality of roads. There will be no effect to the indicator.

Summary of effects to roads within riparian reserves

There will be no effect to the indicator because there is no mechanism to affect it.

Direct Effects to the Species from the Cultural and Paleontological Resources Programs

There is no mechanism of the Cultural and Paleontological programs that would result in direct effects to the species. No activities occur within streams, and any collection activity that would occur near a streambank occupied by ESA-listed fish would not result in harassment.

Summary

The indicator analysis results are summarized in Table 136.

Table 136. Summary of indicator analysis results for the Cultural and Paleontological resources programs.

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Discountable
Sediment/turbidity/substrate	Insignificant negative
Water temperature	Insignificant negative
Peak/base flows	Discountable
Riparian Reserve function and vegetation diversity	Insignificant negative
Chemical contamination / nutrients	No effect
Roads within Riparian Reserves	No effect

There will be no activities that result in harm or harassment to the species.

2. Fire and Fuels

The potential causal mechanisms for effects to ESA-listed fish species by wildfire suppression and non-timber harvest fuels treatments have common elements, and the effects for both types of actions are addressed in this section.

Effects to Environmental Baseline

Large and Small Wood

A subset of wildfire suppression and fuels treatment activities under the PRMP would affect potential large and small wood recruitment to stream channels. Specifically, those within a site-potential tree distance of stream channels. Should back burns used for fire suppression enter into Riparian Reserves, there would be a short-term increase in primarily small woody debris recruitment from the dead trees that result. Some of these may be directionally felled towards the stream channel if there is site preparation for tree planting at a later date.

There may be a similar, but lesser effect to wood recruitment from controlled burn fuel reduction projects within Riparian Reserves. Controlled burn activities typically take place when fuels are relatively moist (such as spring time). Studies of the effects of controlled burns to riparian areas are limited. The ARBO II documents that the Joint Fire Science Program (2009) concluded that a prescribed fire in the spring on the Payette National Forest in Idaho resulted in riparian forest burn severity and extent that was lower than after wildfire. In addition, a study conducted in the Sierra Nevada Mountains of California, Bêche et al. (2005) concluded that low to moderate intensity prescribed fire that was actively ignited in the riparian area had minimal effects on a small stream and its riparian zone during the first year post-fire. Mortality of trees in the riparian zone was low, at 4.4 percent.

Mechanical mastication and other forms of fuel reduction that physically remove small diameter trees would reduce potential for wood debris delivery to streams. However, this is mitigated by management direction that does not allow ground-based equipment for fuels reduction projects within 50 feet of streams unless it is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.

PRMP management direction would limit the magnitude of adverse effects to the small and large wood indicator, because trees may not be removed near streams for thinning fuel treatments and larger trees may not be cut. For example, within the inner zone of (0-120 feet) of fish-bearing and perennial streams of the Riparian Reserve (west of Highway 97) – Moist, management direction prohibits thinning fuel treatments within 60 feet of such streams, and does not allow cutting trees >12 DBH. This is for all three classes of subwatersheds. The same requirements apply to the 0-50 feet inner zone of non-fish-bearing intermittent streams (50 feet is the entire Riparian Reserve width for Class III subwatersheds).

For the Riparian Reserve (west of Highway 97) – Dry, there are several examples of management direction that would limit the magnitude of adverse effects to the small and large wood indicator because a minimum number of trees must be retained or thinning is prohibited entirely. In the outer zone (120 feet to one-site potential tree height) management direction requires retaining at least 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. For intermittent, non-fish bearing streams in Class I and II subwatersheds, management direction for the middle and outer zones, 50-120 feet and 120-one site potential tree height distance respectively, requires retaining at least 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. For intermittent, non-fish bearing streams in Class III subwatersheds, no thinning is allowed in the 50 feet wide Riparian Reserve.

BMPs for Fire and Fuels management that would minimize the magnitude of impacts to existing or potential future small and large wood in stream channels are presented below and in Appendix C. For some BMPs, only that part of the text of the BMP that applies is displayed. These BMPs limit the numbers of trees killed by burns for fuel treatments, limit consumption by controlled burns of existing LWD, reduce the removal of trees by fire line construction, prevent cutting of down wood that extends into stream channels, increase the numbers of LWD/SWD by directional falling of snags during fire suppression, and avoids killing or suppressing trees by prohibiting the placement of fire incident activity centers within 200 feet of any waterbody.

- F1. Keep broadcast burns and jackpot burns out of Riparian Reserve inner zone, unless prescribed for restoration purposes (e.g., sudden oak death sanitation, improve species composition, invigorate deciduous trees). Locate ignition lines above large open meadows associated with stream channels, unless prescribed for restoration.

- F3. Avoid direct ignition or ignition by a backing-in fire of large woody material that is touching the high water mark of a water body or that may be affected by high flows.

- F5. Limit fire lines inside Riparian Reserve. Construct fire lines by hand on all slopes greater than 35% and inside the Riparian Reserve inner zone.

- F10. Prevent mechanical fuel reduction equipment within the Riparian Reserve inner zone, unless prescribed for restoration.

- F13. Limit firelines inside Riparian Reserve.

- F14. Prevent cutting of logs or woody material if any portion of that material extends into the stream channel, unless for restoration. Fall snags in the Riparian Reserve towards the stream channel when felling is necessary for safety or fire suppression activities.

- F15. Avoid locating incident bases, camps, helibases, staging areas, constructed helispots, and other centers for incident activities in Riparian Reserve or within 200 feet of any waterbody, floodplain, or wetland.

In the long-term, fuel reduction projects within Riparian Reserves would reduce the risk of catastrophic wildfire, encourage growth of remaining trees as a result of reduced competition, and maintain late-seral (old-growth trees) which serve as sources of LWD to streams.

The NMFS ARBO II (NMFS 2013) and the USWFS ARBO II (USFWS 2013) both state that the category of Riparian Vegetation Treatment (controlled burns) would result in minor reductions in LWD recruitment, but in some cases LWD levels will increase due to prescribed fire (Chan 1998).

Summary of effects to large and small wood

For a subset of fire suppression and fuels management projects, primarily those within Riparian Reserves proximal to ESA-listed fish, there would be both negative and positive effects to large and small wood recruitment to stream channels. Fire suppression and controlled burn fuels reduction projects in Riparian Reserves may result in dead, small diameter trees, potentially increasing short-term recruitment of SWD. Longer-term recruitment of SWD would be reduced, however. Fuel treatments within Riparian Reserves would retain live larger diameter trees and reduce competition from younger trees, maintaining and enhancing future LWD recruitment. Because these outcomes cannot be meaningfully measured, effects to this indicator are considered insignificant.

Sediment/Turbidity/Substrate

Potential sources of fine sediment to stream channels from the Fire and Fuels programs include fire lines and bare soil as a result of under burns, back burns or burning of piles. All fire lines, whether constructed by hand or by heavy equipment, are water-barred after the fire is out. The patchy distribution of bare soils within Riparian Reserves resulting from under-burns, back-burns and pile-burning treatments for fuels reduction, maintains duff and vegetation to capture fine sediment. This reduces the potential for fine sediment delivery to stream channels.

In addition, use of mechanical equipment for fuel mastication and machine piling within Riparian Reserves may result in areas of disturbed soils. However, management direction does not allow ground-based equipment for fuels reduction projects within 50 feet of streams unless it is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream. There is also a prohibition of use of ground-based machinery for fuels reduction projects on slopes >35 percent, which would reduce erosion potential. Mechanical harvesting equipment with tracks (e.g., excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet).

A subset of wildfire and fuels treatment activities would occur within Riparian Reserves of streams proximal to the distribution of ESA-listed fish species. Use of BMPs, Program Direction, and PDC from ARBA II would minimize fine sediment delivery to stream channels and the water column. Management direction cited above that excludes fuels thinning treatments within 60 feet of fish-bearing and perennial streams in the Riparian Reserve (west of Highway 97 – Moist, would reduce soil disturbance immediately adjacent to stream channels, thereby limiting sediment delivery. Several of the BMPs cited above in the section evaluating effects to small and large wood recruitment also would reduce the amount of sediment reaching stream channels. Specifically, BMPs F1, F3, F5, F10, F13, and F15 would limit the amount of bare soil in riparian areas that may be delivered to streams. Additional BMPs (and parts of BMPs) that would limit creation of bare soil areas that may erode sediment into streams (or reduce creation of hydrophobic soils that would increase overland flow contributing to erosion and turbid run-off in the case of BMP F6) include:

- F5: Use erosion control techniques such as tilling, waterbarring, or debris placement on fire lines when there is potential for soil erosion and delivery to water bodies, floodplains, and wetlands. Space the waterbars as shown in Table I-5. Avoid placement of any fire line where water would be directed into water bodies, floodplains, wetlands, headwalls, or areas of instability.

- F6. In broadcast burning, consume only the upper horizon organic materials and allow no more than 15% of the burned area mineral soil surface to change to a reddish color.

- F7. Avoid burning piles within 35 feet of a stream channel.

- F8. Avoid creating piles greater than 16 feet in height or diameter. Pile smaller diameter materials and leave larger >12 inch pieces within the unit. Reduce burn time and smoldering of piles by extinguishment with water and tool use.

- F10. Limit mechanical fuel reduction equipment to slopes less than 35%. Restrict non-track mechanized equipment (e.g., feller bunchers, horizontal bar masticators) to slopes less than 20%.

- F11. Use temporary stream crossings if necessary to access the opposite side with any equipment or vehicles (including public motorized travel). Follow Temporary Stream Crossing practices under Roads section.

- F12. Place residual slash on severely burned areas, where there is potential for sediment delivery into water bodies, floodplains and wetlands.

- F13. Limit firelines inside Riparian Reserve. Where hand constructed firelines are necessary in Riparian Reserve, angle the approach, where feasible, rather than have it perpendicular to the Riparian Reserve.
    - Limit heavy equipment to slopes less than 35%.
    - Locate fire lines to minimize directing water into water bodies, wetlands, headwalls, or areas of instability.
    - Use erosion control techniques such as tilling, waterbarring, or debris placement on fire lines when there is potential for soil erosion and delivery to water bodies, floodplains, and wetlands. Space waterbars as shown in Table I-5. Block dozer lines and roads or landing intersections with an approved barricade or scattered slash to preclude public motorized travel use.

- F18. Implement emergency fire stabilization or rehabilitation treatments to accomplish erosion control as quickly as possible and before the wet season. Soil and water conservation practices may include, but are not restricted to:
    - Seeding or planting native vegetation for short-term cover development and long-term recovery, unless not available in quantities necessary for the emergency response.

- Mulching with straw, wood chips, or other suitable material. To avoid introducing noxious weeds when mulching, use certified weed-free straw mulch or rice straw where available.
- Placing straw wattles on the contour at adequate spacing between each row to capture eroded material without overflowing. Embed to the surface of the soil in slight trench to prevent undermining.
- Placing and anchoring log erosion barriers similarly to straw wattles.
- Spreading available cut vegetation or slash on bare soils.
- Placing channel sediment retention or stabilization structures.
- Placing trash racks for debris above road drainage structures.
- Installing drainage structures, such as
    - waterbars or drainage dips, on fire lines, fire roads, and other cleared areas according to guidelines in Table I-5 (Waterbar spacing by gradient and erosion class).
- Repairing damaged road drainage facilities, such as flattened or ripped culvert ends, or burned out plastic pipes, or cleaning ditch lines of materials that impede natural flow.
- Blocking or decommissioning roads and trails.

- F19. (Post Fire Road Repair). Implement emergency fire rehabilitation treatments to accomplish erosion control as quickly as possible and before the wet season.
    - Soil and water conservation practices may include, but are not restricted to:
    - Reducing road system hydrologic conductivity though proper grading, culvert spacing, and installing drivable dips.
    - Replacing culverts to increase peak flow capacity of stream crossing culverts to accommodate the 100-year design flood.
    - Preventing culvert plugging.
    - Correcting stream diversions.

However, even with the implementation of the above Management Direction and BMPs, the BLM anticipates that some fine sediment would enter stream channels as a result of these activities and affect habitat for ESA-listed fish. In the case of sediment from wildfire suppression activities, the magnitude of it would likely be masked by the sediment eroded and delivered to the stream channel as a result of the fire itself. In addition, there would be a long-term risk of mass erosion from areas where the fire burned through unstable areas, further masking erosion from wildfire suppression actions.

Short-term increases in fine sediment within interstitial spaces of larger bed particles (including spawning gravel and cobbles), and increased turbidity would occur. Overland flow from rainfall or snow-melt events occurring later in time after the fuel treatment projects are completed would be the delivery mechanism to stream channels and the water column. Effects to spawning gravel and coarse substrate such as cobble may last for weeks to months dependent upon shear stress of future flow events to mobilize fine bed particles. Turbidity increases may be undetectable due to background levels in the water column. Armoring of the soil surface,

regrowth of vegetation, and needle/leaf/fine branch drop to the soil surface would ameliorate erosion over time.

The ARBA II describes that turbidity increases as a result of controlled burns would deposit fine coats of sediment on channel substrate a short distance downstream, encourage fish to move downstream, and alter fish behavior patterns for a short time. In cases of fall-spawning fish, the fine layer of sediment deposited on channel substrate will be cleared away as the fish construct redds. It is anticipated that all project related sediment will be flushed out during the first fall/winter/spring high flows after project completion, and site restoration conservation measures are expected to prevent future project related sediment inputs into the stream. Therefore, long-term impacts to turbidity and spawning gravels are not expected. Both ARBO II documents describe that low to moderate intensity prescribed fire result in inputs of fine sediment to streams, but do not describe the magnitude of the effects.

A few pump chances occur in ESA-listed fish habitat. Use of pump chances for water withdrawals may result in stirring up of existing streambed sediments for moments when the hose/pipe is placed and removed in the stream. There will be a very slight increase in turbidity for moments.

Summary of effects to sediment/turbidity/substrate

Fine sediment would enter stream channels as a result of a sub-set of fire suppression and fuels treatment activities occurring within Riparian Reserves proximal to ESA-listed fish habitat. There would be measurable negative effects to turbidity and streambed substrate composition from fine sediments. Effects are anticipated to be short-term, with fine sediments on and between streambed substrate particles dispersed within weeks to months. Episodes of increased turbidity may last hours to days dependent upon extent of overland flow and ability of duff, down wood and live vegetation to capture fine sediment. Effects are neither discountable nor insignificant.

Water Temperature

A subset of wildfire suppression and fuels treatment activities under the PRMP may impact vegetation that provides shade to stream channels, and potentially affect water temperatures, in areas proximal to ESA-listed fish habitat. This would result from back burns used for fire suppression, and low to moderate intensity prescribed fire, as well as hand and mechanical treatments that remove vegetation. Use of BMPs, Program Direction, and PDC from ARBA II would minimize loss of riparian shade canopy from wildfire suppression and fuels treatments.

The Program Direction described above in the effects to the Small and Large Wood Indicator section that prohibits thinning fuels treatments within 60 feet of fish-bearing and perennial streams within the Riparian Reserve (Moist), and the management direction within the inner zone (0-120 feet) of fish-bearing and perennial streams for all three classes of subwatersheds in the Riparian Reserve (Dry) that requires retaining at least 30 percent canopy cover and 60 trees per acre minimum would limit the loss of near stream shade within Riparian Reserves.

Many of the BMPs that would reduce the loss of potential small and large wood recruitment cited above would also limit shade loss near streams. Specifically, BMPs F1, F3, F5, F10, F13

and F15. They do so by limiting the location or amount of fuels reduction or fire suppression actions that may kill or damage trees that provide shade within Riparian Reserves.

Both ARBO II documents state that there would be minor reductions in stream shade as a result of low to moderate intensity prescribed fire. A study conducted in the Sierra Nevada Mountains of California (Bêche et al. 2005) concluded that low to moderate intensity prescribed fire that was actively ignited in the riparian area did not result in a measurable decrease in riparian canopy cover. Mortality of trees in the riparian zone was low, at 4.4 percent. Because it is anticipated that there would be at most, minor decreases in riparian shade from losses of streamside vegetation due to fire suppression and fuels treatments activities, it is extremely unlikely that there would be measurable increases in water temperature. Also, in the case of wildfire, the effects to water temperature from any shade loss from back-burns would likely be masked by the effects to water temperature from shade loss along streams from the fire itself. The ARBA II concluded that controlled burning would result in reduced shade on a limited basis and in such a manner as to have discountable impacts to water temperature; these impacts will be ameliorated through growth of desired riparian vegetation.

In the long-term, fuel reduction projects within Riparian Reserves would reduce the risk of catastrophic wildfire that may nearly completely remove shade canopy.

The effects of water withdrawals at pump chances are addressed in the Western Oregon Programmatic BA (USDA FS et al. 2010). PDC “e” for use of pump chances directs: “Pump only from streams that have continuous surface flow where the pumping will not adversely affect water quantity or quality in stream reaches inhabited by ESA-listed species.” The Western Oregon Programmatic BO (NMFS 2011) identified minor, localized increases in water temperature from the Pump Chance/Helipond Maintenance and Non-Emergency Use category.

Summary of effects to water temperature

Minor reductions in riparian shade canopy from wildfire suppression and fuels treatment activities are anticipated to not have a measurable effect on water temperatures. Fuel reduction projects would reduce the risk of catastrophic wildfire and the loss of significant shade canopy in riparian areas. Use of pump chances will result in minor, localized increases in water temperature.

Peak and Base Flows

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows are also affected by concentration of flows associated with increases in road connectivity to stream channels.

It is extremely unlikely that wildfire suppression or fuels treatment activities will impact vegetation such that peak or base flows would be measurably affected at the scale of HUC12 subwatersheds or larger. Controlled burns and back burns do not remove all of the vegetation. There is management direction for the Riparian Reserve (Dry) that limits how much of a HUC 12 subwatershed would be subject to moderate severity prescribed burns:

"In all subwatershed classes:

- Apply low or moderate-severity prescribed burns where needed to invigorate native deciduous tree species. Moderate severity prescribed burns will be limited to no more than 20 percent of area of Riparian Reserve subwatershed (HUC 12) each year.

- Apply non-commercial tree thinning to adjust fuel loads as necessary to achieve desired fire effects prior to prescribed burning."

BMP F13, described above, has multiple measures to limit firelines within Riparian Reserves, locate them so as to minimize directing flow into water bodies, and till, water-bar or place debris on them to minimize concentration of flows and delivery to water bodies. BMPs F18 and F19 described above, also have measures such as placing drainage structures on roads that would reduce road system hydrologic connectivity post-fire. In combination, these BMPs effectively eliminate the risk of increasing the stream network that may contribute to increased peak flows. Also, in the case of wildfire, the loss of vegetation from the fire itself would have more impact to peak and base flows than back-burns. The only measurable effect to base flows would result from the use of pump chances for water sources. This effect to base flows would be short-term, and the impacts are minimized by BMPs and the PDC of ARBA II (in the case of controlled burns).

BMP R61 addresses the amount of water that may be removed at pump chances:

> "Avoid water withdrawals from fish bearing streams whenever possible. Limit water withdrawals in listed fish habitat and within 1,500 feet of listed fish habitat to 10% of stream flow or less at the point of withdrawal, and in non-listed fish habitat to 50% or less at the point of withdrawal, based on a visual assessment by a fish biologist or hydrologist. The channel must not be dewatered to the point of isolating fish."

The short-term measurable effect to base flows from water withdrawals at pump chances would be minimized by PDC "f" in the Western Oregon Programmatic BA (USDA FS et al. 2010): "When pumping water from streams with ESA-listed fish, ensure that withdrawals do not reduce flows by more than 10%." A 10% reduction in base flows would result in a meaningfully measurable (adverse) effect to the indicator. The use of pump chances in proximity to ESA-listed fish habitat or designated CH is expected to be a relatively rare occurrence considering the BMP and alternative pump chance locations.

Summary of effects to peak and base flows

It is extremely unlikely that wildfire suppression or fuels treatment activities would impact vegetation such that peak or base flows would be measurably increased. A short-term measurable effect to base flows would result from water withdrawals at pump chances. This would be minimized by PDC "f" in the Western Oregon Programmatic BA (USDA FS et al. 2010): "When pumping water from streams with ESA-listed fish, ensure that withdrawals do not reduce flows by more than 10%." A 10% reduction in base flows would result in a meaningfully measurable adverse effect to the indicator.

Riparian Reserve Function and Vegetation Diversity

Some Riparian Reserve functions will be affected by wildfire suppression activity and fuels treatments that occur within the Riparian Reserve. Many functions of Riparian Reserves are addressed by other indicators used for this effects analysis. As described earlier in this section, there may be increases in small wood delivery in the short-term, with long-term benefits to large wood delivery, minimal amounts of riparian shade will be lost in the short-term with no projected impairment of water temperature, and sediment will be delivered to stream channels and the water column as a result of short-term impairment of the filtering ability of the riparian forest floor. In addition, as described below in the effects to the Chemical Contamination and Nutrients indicator, there would be an insignificant effect to that indicator as a result of phosphorous and nitrogen transport through the riparian area to the stream channel. That transport is facilitated by partial loss of duff and vegetation on the forest floor in the short-term by controlled burns.

It is not anticipated that the magnitude and duration of sediment delivery to stream channels as a result of this program would measurably affect the quality of pools, cause changes to width-depth ratio, affect streambank stability, or change the connectivity of the stream with its floodplain. The diversity of riparian vegetation may be reduced in the short-term, for a long-term increase in diversity.

The analysis below for effects to the Roads within Riparian Reserves indicator determined that there may be situations where firelines constructed by heavy equipment may be placed within Riparian Reserves. They would largely be constructed so as not to increase connectivity with stream channels, and would have erosion control measures as soon as possible. However, in the short-term riparian vegetation and the functions it provides would be measurably negatively impacted.

Summary of effects to riparian reserve function and vegetation diversity

There will be a mix of short and long-term insignificant and discountable effects to several functions of Riparian Reserves. There are two short-term effects that are neither insignificant nor discountable. One is impairment of the filtering capability of the riparian forest floor for fine sediments and nutrients from program activities within Riparian Reserves as a result of loss of duff and vegetation from the forest floor. Another is impairment of functions provided by riparian vegetation removed by mechanized construction of firelines for fire suppression. Consequently, there will be an overall adverse effect to the indicator.

Chemical Contamination and Nutrients

Petroleum products are used as fuel and lubricants for chainsaws, mechanical machination machines and dozers that create firelines. Also, drip torches use petroleum products. There is a discountable risk of chemical contamination to streams as a result of fuel spills with employment of Management Direction, BMPs and the ACM/PDC of ARBA II. Similarly, the risk of chemical contamination from chemical retardant, foam or other chemicals used for fire suppression is discountable as a result of BMP F4 that states: “Avoid delivery of chemical retardant foam or additives to water bodies, and wetlands. Store and dispose of ignition devices/materials (e.g., flares, plastic spheres, etc.) outside Riparian Reserves or a minimum of

100 feet from water bodies, floodplains and wetlands. Maintain and refuel equipment (e.g., drip torches, chainsaws) a minimum of 100 feet from water bodies, floodplains and wetlands. Portable pumps can be refueled on-site within a spill containment system."

Controlled burns, back burns and burning of piles will generate nutrients such as phosphorous and nitrogen. While minimized by use of BMPs and Management Direction cited above, some bare soil areas as a result of those burns are anticipated. Such bare soil areas may facilitate the delivery of those nutrients to stream channels from overland flow. There are many variables that would affect the delivery of those nutrients to stream channels, including slope, amount of bare soil (fuel reduction burns typically result in patches of bare areas interspersed with patches with duff and intact vegetation), and distance between burned areas and the stream channel. Also, in the case of wildfire, there would be high severity fire impacts to soils from the wildfire itself that would mask the lower intensity effects of back-burns and fuel treatments. The effects to productivity, eutrophication and dissolved oxygen levels in the water column would vary, with a primary variable being the volume of flow and baseline impairment of the stream. Conservatively, the overall effect to the indicator is adverse.

Summary of effects to chemical contamination and nutrients

There would be discountable effects to the indicator from the use of petroleum products and chemical retardants, foam, and other chemicals used to suppress fires. This results from employment of Program Direction, BMPs and the ACM/PDC of ARBA II. Despite a number of uncertainties, a conservative determination of an adverse effect to the indicator results from the potential for delivery of nutrients such as phosphorous and nitrogen to stream channels as a result of fire suppression and fuels treatments.

Roads within Riparian Reserves

There may be situations where firelines constructed by heavy equipment may be placed within Riparian Reserves. The amount of firelines constructed within Riparian Reserves is limited by BMP F5 and F13, described above. While not serving the purpose of a road for transportation, the effects of firelines on the landscape are similar to that of roads. Firelines created by dozers or other heavy equipment would largely be constructed so as not to increase connectivity with stream channels, and would have erosion control measures as soon as possible (see description above regarding BMPs F13, F18 and F19. Program direction and BMPs would help reduce the risk of effects to sediment delivery and peak/base flows to a discountable probability (see analysis above for the sediment/turbidity/substrate indicator and the peak/base flows indicator). This program has no mechanism to affect migration barriers.

Summary of effects to roads within riparian reserves

Effects on the landscape from fire lines constructed by heavy equipment may be similar to roads. Such fire lines would be designed to not increase connectivity with stream channels, resulting in a discountable probability of affecting peak/base flows and sediment delivery to stream channels. There is no mechanism to affect migration barriers. The overall effect to the indicator is discountable.

Direct Effects to the Species from the Wildfire Suppression and Fuels Treatment Program

Use of pump chances is the only activity that would occur instream with the potential for direct effects to ESA-listed fish. There would be temporary displacement of fish from their territories due to disturbance when water is withdrawn at pump chances in habitat occupied by ESA-listed fish. This would last for the duration of time it takes to fill the pumper truck. There is a potential that small fish can be impinged against pump screens when water is withdrawn. Pumps will have screens that meet NMFS standards when used at sites with ESA-listed fish. Some administrative units require that water pumps be placed in caged structures to off-set the potential for fish entrapment in the pump.

The NMFS programmatic BO (NMFS 2011, consultation no. 2010/02700 (BLM)) that addressed the category of *Pump Chance/Helipond Maintenance and Non-Emergency Use* concluded:

> "While discharge to LFH will likely be reduced (<10% change) for short periods of time (<1 hr), the magnitude of flow reductions is not likely to affect the species or the quality of their critical habitat because the periods of withdrawal will be short and will not affect inflow from tributary streams and hyporheic flow downstream of the point of withdrawal."

Because there will be harassment associated with displacement of ESA-listed fish from territories, and potential harm resulting from impingement on screens, there will be an adverse effect to the species.

Summary

The indicator analysis results are summarized in Table 137. The most impacting effect to the indicator is displayed. Where there is an adverse effect to an indicator, there may also be insignificant, discountable or beneficial effects from different components of the program activities.

Table 137. Summary of indicator analysis results for the Fire and Fuels program.

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Insignificant negative
Sediment/turbidity/substrate	Adverse (short-term due to fine sediment entering channels and water column)
Water temperature	Adverse (short-term due to water withdrawal at pump chances)
Peak/base flows	Adverse (short-term to the base flow component)
Riparian Reserve function and vegetation diversity	Adverse (short-term due to impacts to filtering capability for fine sediments and nutrients)

Chemical contamination / nutrients	Adverse (short-term due to nutrients entering water column)
Roads within Riparian Reserves	Discountable negative
Bull trout subpopulation size	Insignificant negative
Bull trout growth and survival	Insignificant negative
Bull trout life history and isolation	No effect
Bull trout persistence and genetic integrity	No effect

In addition to adverse effects to several of the indicators, it was determined that there would be direct effects to the species, resulting in harassment (temporary displacement of fish from territories as a result of use of pump chances) and potential harm (possible impingement of small fish on pump screens.

3. Fisheries, Hydrology, Invasive Species, Soils and Wildlife

Activities of the Fisheries, Hydrology, Invasive Species, Soils and Wildlife programs with mechanisms to affect ESA-listed fish and their habitat are habitat restoration actions. The ARBA II (USDA FS et al., 2013) and both ARBO II (NMFS 2013, USFWS 2013) documents address the effects of 20 aquatic restoration activities. The descriptions of the activities, effects analyses and effects conclusions are herein incorporated by reference. The first 19 activities are on-the-ground actions. The 20th category addresses direct effects to the species caused by surveys. The list of restoration activities is displayed below.

1. Fish Passage Restoration (Stream Simulation Culvert and Bridge Projects; Headcut and Grade Stabilization; Fish Ladders; Irrigation Diversion Replacement/Relocation & Screen Installation/Replacement.)
2. Large Wood, Boulder, and Gravel Placement (Large Wood and Boulder Projects; Engineered Logjams; Porous Boulder Weirs and Veins; Gravel Augmentation; Tree Removal for Large Wood Projects)
3. Dam, Tidegate, and Legacy Structure Removal
4. Channel Reconstruction/Relocation
5. Off- and Side-Channel Habitat Restoration
6. Streambank Restoration
7. Set-back or Removal of Existing Berms, Dikes, and Levees
8. Reduction/Relocation of Recreation Impacts
9. Livestock Fencing, Stream Crossings, and Off-Channel Livestock Watering
10. Piling and other Structure Removal
11. In-channel Nutrient Enhancement

12. Road and Trail Erosion Control and Decommissioning
13. Non-native Invasive Plant Control
14. Juniper Removal
15. Riparian Vegetation Treatment (controlled burning)
16. Riparian Vegetative Planting
17. Bull Trout Protection
18. Beaver Habitat Restoration
19. Sudden Oak Death Treatments
20. Fisheries, Hydrology, Geomorphology Wildlife, Botany, and Cultural Surveys in Support of Aquatic Restoration

Decompaction of skid trails to improve soil function is not explicitly listed as an ARBA II restoration category. However, it has effects analogous to "tilling compacted surfaces to reestablish native vegetation" in the description of category 12 (Road and Trail Erosion Control and Decommissioning).

The ARBA II consultation utilized the indicators of NMFS (1996), commonly known as the Matrix of Pathways and Indicators (MPI). The MPI indicators encompass the habitat characteristics and processes of the indicators utilized in this BA. A summary of effects to the indicators utilized in this BA, interpreted from the ARBA II analysis, is presented below in Table 138.

Table 138. Effects to indicators for restoration activities of the Fisheries, Hydrology, Invasive Species, Soils and Wildlife programs as interpreted from ARBA II analysis.

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Long-term beneficial.
Sediment/turbidity/substrate	Short-term negative (adverse) for all categories except In-channel Nutrient Enhancement and Surveys. Long-term beneficial for reduction of fine sediments from a variety of sources, including roads put to bed during decommissioning. Also beneficial effect from bedload recruitment against placed large wood in the stream channel, which may increase hyporheic flow and reduce water temperature.
Water temperature	Discountable, except for category of Sudden Oak Death Treatments where the effect is measurable negative (adverse). Long-term beneficial.
Peak/base flows	Long-term beneficial
Riparian Reserve function and vegetation diversity	Short-term negative (adverse). Long-term beneficial.
Chemical contamination / nutrients	Insignificant, except for category of Non-native Invasive Plant Control where the effect is short-term, measurable negative (adverse). Long-term beneficial.
Roads within Riparian Reserves	Long-term beneficial due to road decommissioning.

Direct Effects to the Species from the Fisheries, Hydrology and Soils Program

Some restoration activities will result in harassment and/or harm of ESA-listed fish species, and will result in an adverse effect to the species. The ARBA II describes the mechanisms that cause the adverse effect. Turbidity plumes from instream heavy equipment use will cause fish to move downstream and alter behavior patterns for a short time. Fish may be incidentally injured or killed by heavy equipment that operates in or along the stream channel. Several activity types involve fish salvage that may include isolation, capture, handling, transport, and relocation. Fish handling has the potential to result in fish injury or death. Death may be immediate or delayed. Fish handling increases stress levels and can cause reduced disease resistance, osmoregulatory problems, decreased growth, decreased reproductive capacity, and increased mortality. There is a potential for a small number (up to five percent) of juvenile fish that are present in the dewatered section to avoid being captured and relocated, and thus die because they remain undetected in stream margins under vegetation, rocks, or gravels.

Projects implemented under the In-channel Nutrient Enhancement category will likely harass fish though carcass placement, such as by helicopter. Further, redd and habitat surveys in support of restoration activities, can result in harassment of fish during spawning and other times. Finally, work conducted under the Bull Trout Protection category may incidentally injure or kill ESA-listed fish during removal (isolation, transfer and capture techniques) of non-native fish to help secure Bull trout populations, mainly in headwater streams.

Summary

The indicator analysis presented above in Table 138 determined that there would be short-term negative (adverse) effects with beneficial long-term effects to the following indicators:

- Sediment/turbidity/substrate
- Riparian Reserve function and vegetation diversity
- Chemical contamination/nutrients

There would also be a measurable negative effect with a potential beneficial long-term effect to the Water Temperature indicator from Sudden Oak death treatments.

Entirely beneficial effects would occur to the following indicators:

- Large and small wood
- Peak/base flows
- Roads within Riparian Reserves

In summary, there would be long-term beneficial effects to several indicators at the cost of short-term adverse effects. It was also determined that there would be direct effects to the species, resulting in harassment (temporary displacement of fish from territories as a result of surveys, nutrient enhancement carcass placement, and turbidity plumes) and potential harm (injury or death from heavy equipment operating in streams and fish handling during fish

salvage to remove them from instream project sites). This may result in adverse effects to the species.

4. Forest Management Program

Effects to Environmental Baseline

The effects of timber harvest and forest roads on salmonids and their habitat have been documented in Meehan (1991), Spence et al. (1996), USDC (1997a), and USDC (1997b). Timber harvest has the potential to reduce streamside canopy levels that may result in increased stream temperatures and reduce the supply of large woody debris; alter stream flow regime; and accelerate surface erosion, causing increased sediment delivery and turbidity in streams.

However, these potential impacts will largely be mitigated by application of PRMP management direction, use of BMPs, and the Riparian Reserve land use allocation (LUA). Many of the studies referenced in the literature are based upon regeneration cuts on 50 to 90 percent or greater of the land area in watersheds, in short time frames, with relatively narrow riparian buffers. These circumstances are unlikely to be replicated in projects implemented under the PRMP.

To facilitate the analysis for effects to the habitat indicators at the scale of a site-specific timber management project, the component parts of the Forest Management program are identified as project elements (PE). The project elements are: Roads and Landings, Falling and Yarding, Timber Haul, Fuels Treatment, and Post-harvest Silvicultural Treatment.

Roads and Landings

New road construction, renovation/maintenance, decommissioning and landing construction are included in the project element. Road renovation/maintenance actions include surface maintenance (blading), surface replacement, drainage maintenance and repair, vegetation management (brushing, limbing, seeding and mulching along roadways), and maintenance, replacement and repair of structures such as culverts. Access roads may be decommissioned upon completion of the timber sale. Use of pump chances to draw water for road use purposes is included in the PE.

Road and Landing BMPs would reduce or eliminate impacts within Riparian Reserves. There are 100 road and landing-related BMPs (R 1 to R 100) in FEIS Appendix J (Appendix C of this document). An abbreviated list of BMPs relevant to new road construction is presented below. Others address permanent stream crossings, temporary stream crossings, surface drainage, cross drains, timing of in-water work, low water fords, water quality for noxious weed treatment of road equipment, water source development and use, erosion control, use of fertilizers, dust abatement, road maintenance, road storm-proofing, and road closure and decommissioning,

- R2. Locate temporary and permanent road construction or improvement to minimize the number of stream crossings.

- R3. Locate roads and landings away from wetlands, Riparian Reserves, floodplains and waters of the State, unless there is no practicable alternative. Avoid locating landings in areas that contribute runoff to channels.
- R6. Confine pioneer roads to the construction limits of the permanent roadway to reduce the amount of area disturbed and avoid deposition in wetlands, Riparian Reserves, floodplains and waters of the State. Install temporary drainage, erosion, and sediment control structures. Storm proof or close pioneer roads prior to the onset of the wet season.
- R8. End-haul material excavated during construction, renovation, and/or maintenance where side slopes generally exceed 60 percent and any slope where side-cast material may enter wetlands, floodplains, and waters of the State.
- R11. Locate waste disposal areas outside wetlands, Riparian Reserves, floodplains and unstable areas to minimize risk of sediment delivery to waters of the State. Apply surface erosion control prior to the wet season. Prevent overloading areas, which may become unstable.
- R12. Use controlled blasting techniques to minimize loss of material on steep slopes or into wetlands, Riparian Reserves, floodplains, and waters of the State.
- R13. Use temporary sediment control measures (e.g., check dams, silt fencing, bark bags, filter strips and mulch) to slow runoff and contain sediment from road construction areas. Remove any accumulated sediment and the control measures when work or haul are complete. When long-term structural sediment control measures are incorporated into the final erosion control plan, remove any accumulated sediment to retain capacity of the control measure.

The following management direction from the Hydrology and Soil Resources sections of Appendix A would reduce the impacts of forest roads over time.

- Design culverts, bridges, and other stream crossings for the 100-year flood event, including allowance for bed load and anticipated floatable debris. Culverts shall be of adequate width to preclude ponding of water higher than the top of the culvert. Design stream crossings with ESA-listed fish to meet design standards consistent with existing ESA consultation documents that address stream crossings in the decision area.
- Implement road improvement, storm proofing, maintenance, or decommissioning to reduce or eliminate chronic sediment inputs to stream channels and water bodies. This could include maintaining vegetated ditch lines, improving road surfaces, and installing cross drains at appropriate spacing.
- Suspend commercial road use where the road surface is deteriorating due to vehicular rutting or standing water, or where turbid runoff is likely to reach stream channels.
- Decommission roads that are no longer needed for resource management and are at risk of failure or are contributing sediment to streams, consistent with valid existing rights.
- Avoid road construction and timber harvest on unstable slopes where there is a high probability to cause a shallow, rapidly moving landslide that would likely damage infrastructure (e.g., BLM or privately owned roads, State highways, or residences) or threaten public safety.

Falling and Yarding

Felled trees are bucked into logs. Logs are then brought to landings by various means. The three main yarding types are ground-based, cable and helicopter. Horse yarding is an option that is infrequently used. Ground-based yarding involves heavy equipment such as tractors. Skyline yarding occurs on terrain with sufficient slope to allow one end of the log to be suspended in the air. As a result, this method is often used adjacent to streams. Helicopter yarding is done where road access is limited.

Yarding BMPs TH 1 to TH 27 are employed when applicable to protect soil properties, riparian vegetation, stream banks and channels, water quality from fine sediment delivery, and to minimize soil erosion and concentration of run-off. Please see Appendix C for specific wording of each BMP.

The following management direction from the Riparian Reserve LUA section of Appendix A for both Moist and Dry Riparian Reserve would reduce the impacts of ground-based yarding.

- Do not operate ground-based machinery for timber harvest within 50 feet of streams (slope distance), except where machinery is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.
- Do not operate ground-based machinery on slopes >35 percent. Mechanical equipment with tracks (e.g., excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet (slope distance).

The following management direction from the Riparian Reserve LUA section of Appendix A for the Riparian Reserve in the Eastside Management Area would reduce the impacts of ground-based yarding.

<u>Fish-bearing streams and perennial streams</u>

- Do not conduct thinning and other vegetation treatments using ground-based machinery within 75 feet (slope distance) on either side of the edge of the stream channel, as measured from the ordinary high water line.
- Do not conduct thinning and other vegetation treatments using ground-based machinery on slopes >35 percent, soils sensitive to displacement, rutting, or compaction, or in slide-prone areas.

<u>Non-fish bearing intermittent streams</u>

- Do not conduct thinning and other vegetation treatments using ground-based machinery on slopes > 35 percent, soils sensitive to displacement, rutting, or compaction, or in slide-prone areas.

<u>Lakes, natural ponds and wetlands</u>

- Do not conduct thinning and other vegetation treatments using ground-based machinery within 50 feet (slope distance) on each side of the ordinary high water line of the water feature, or seasonally saturated soils (whichever is greatest).

Note that this project element also includes Tree-Tipping.

Timber Haul

Timber haul is the transportation of logs from the logging site to lumber mills or other storage yards. The following management direction from the Hydrology section of Appendix A would reduce the impacts of timber haul to aquatic and riparian resources.

- Suspend commercial road use where the road surface is deteriorating due to vehicular rutting or standing water, or where turbid runoff is likely to reach stream channels.

Fuels Treatment

This section evaluates treatment of fuels created by Forest Management (timber harvest) projects. On-site treatment of fuels generated by timber harvest can be accomplished through various means. Treatment options include under burn, hand pile and burn, landing pile and burn, machine pile and burn, slash and scatter, and mastication. There would be no broadcast burns under the PRMP to treat Forest Management project generated fuels.

Fuel management BMPs F 1 to F 12 would reduce impacts to aquatic and riparian resources. Please see Appendix C for specific wording of each BMP. Fuel management BMPs F 1 to F 6 are employed when applicable for under burns and jackpot burns to protect Riparian Reserve characteristics, soils, large woody material that is touching the high water mark, and to avoid delivery of chemical retardant foam or additives to water bodies and wetlands.

Fuel management BMPs F 7 to F 9 are employed when applicable for pile and burn fuel treatments to protect and minimize erosion to stream channels, and to protect soil organic materials. Fuel management BMPs F 10 to F 12 are employed when applicable for mechanical and manual fuel treatments to protect Riparian Reserve characteristics, stream channels, and to minimize potential sediment delivery to water bodies, floodplains and wetlands.

Post-harvest Silvicultural Treatment

This project element includes tree planting, pre-commercial thinning, manual removal of competing vegetation and use of fertilizer. Regarding the use of fertilizers, there are no acres projected for use of fertilizer for silvicultural purposes under the PRMP (Table 47). However, it is an option that may be used. It is anticipated that fertilizer may be applied to individual trees or small areas in stands, rather than widespread application that could be measured in acres. It would only occur within the Harvest Land Base LUA. Management direction for the Harvest Land Base LUA only allows for manual application of supplemental nutrients and prohibits aerial application.

Large and Small Wood

This section is organized in the following manner. First, the results of modeling the effects of implementing the PRMP over a 100-year time frame and at the scale of the decision area to potential large and small wood debris recruitment is presented. This is followed by an evaluation of the potential site-scale effects to short-term large and small wood debris recruitment by timber management projects within Riparian Reserves.

Background

Woody debris is an important channel-forming component in forested streams in the Pacific Northwest. Wood traps and stores gravel, generates scour that creates pool habitat, provides overhead cover, and protects banks by reducing stream energy. In headwater streams, small wood can retain fine sediment and prevent downstream transport to fish-bearing reaches. Conifer species persist the longest in stream channels. However, hardwood trees, such as red alder and big leaf maple, provide wood as well as leaf litter that serves as a nutrient base for macroinvertebrates, which in turn provide food for anadromous fish.

Trees closer to the stream have a higher probability of falling into the stream. Wood is delivered to stream channels generally from distances less than one site-potential tree height[14] in width from edge of the active channel. Beyond a distance of one site-potential tree height from the stream, contribution of wood in the form of whole trees is rare and results from episodic debris flows and slope failures. These slope failures result from oversaturation of soils or unstable underlying geology, where large wood along with small wood, boulders, and other substrates can be delivered over longer distances. The 2008 RMP/EIS analyzed land management alternatives using a wood model that accounted for the delivery of wood in the form of whole trees from a variety of sources (USDI BLM 2008, pp. 779-799). That analysis identified three primary sources of instream large wood: riparian tree fall, channel migration, and debris flows (USDI BLM 2008, pp. 376-384, 781-797).

Headwater streams that are prone to debris flow delivery can contribute a large proportion of in-stream wood downstream in fish-bearing stream reaches (Benda *et al.* 2003). In these streams, debris flows will capture wood and sediment from the debris flow area and deliver it to streams. May and Gresswell (2004) estimated debris flow recurrence at an interval of up to 357 years for headwater basins in the Oregon Coast Range.

Riparian tree mortality and subsequent recruitment to streams can represent the primary contribution of large wood in low-gradient meandering streams, while upslope and debris flow contributions can be greatest in higher gradient streams (Bigelow 2007, Reeves *et al.* 2003).

During the last century, many streams were “cleaned” of large wood to make the downstream transport of harvested logs more efficient. Without large wood to retain gravel and other woody material, many streams were scoured to bedrock and have correspondingly poor habitat for fish. Active restoration to offset the loss of habitat has involved the placement of logs and whole trees in addition to boulders into these bedrock channels. These restorative efforts persist for

[14] Site-potential tree-heights generally range from 140 feet to 210 feet across the decision area, depending on site productivity.

several decades as riparian stands develop that are capable of supplying long-term sources of wood to streams.

Past timber harvest of riparian stands has resulted in the replacement of structurally-complex stands with large diameter trees to young stands with small diameter trees. These young riparian stands have a preponderance of smaller diameter trees and a lack of understory vegetation. This results from high tree densities and competition, limiting the ability of these riparian stands to provide functional wood to streams. These young riparian stands are developing at higher densities than the stand conditions under which the existing structurally-complex stands developed (Poage and Tappeiner 2002, Tappeiner *et al.* 1997). Additional support for the "artificial" nature of these stands was provided by Pollock *et al.* (2005) who found that "Riparian stands often develop in a much more open structure, such that stem exclusion is much less common and understory vegetation usually is present throughout the development of a forest." The 2008 RMP/EIS described the effects of past harvest on forest stands across the landscape and riparian forest stands specifically (USDI BLM 2008, pp. 202-212, 375-376), and those discussions are incorporated here by reference.

Analysis at the scale of the decision area and a 100-year time frame

The BLM evaluated the effect of the PRMP on the potential contribution of large and small functional wood to fish-bearing and non-fish-bearing streams over a 100-year time frame. The 2008 RMP/EIS utilized a spatially explicit GIS model to estimate large and small wood delivery to BLM-administered and non-BLM-administered streams for all HUC-10 watersheds within the planning area. The 2008 RMP/EIS analyzed potential large wood and small functional wood contribution to streams considering the effects of forest management and stand growth over time in portions of the landscape capable of delivering wood to streams. That analysis is incorporated here by reference (USDI BLM 2008, pp. 779-797). The analysis reported the effects at the scale of the planning area.

Key assumptions include:

1. For most streams in the planning area, a 20" DBH tree can provide functional wood. The size of wood that can provide stable structure and induce habitat change in a stream (i.e., functional wood) varies by channel width. Generally, wider streams require larger pieces of wood (Beechie *et al.* 2000, **Table 139**). A 20" DBH tree can provide functional wood for channels up to and greater than 50 feet in width.

Table 139. Diameter of a functional wood piece as it relates to width of active stream channel.

Width of Stream Channel (Feet)	Diameter of Functional Wood (Inches)
15	4.5
20	6.0
30	9.0

40	12.0
50	15.0
>50	>20.0

2. A one site-potential tree height distance from the stream channel approximates the area likely to deliver wood to streams. The Regional Executive Team in 2013 released a series of technical summaries by a Science Review Team on the issue of the effects of riparian thinning and those analyses and findings are incorporated here by reference (Spies *et al.* 2013). Key point 9 in Spies *et al*. (2013) states:

> "9. 95% of near-stream wood inputs come from within 82 to 148 feet of a stream. The distance of near-stream inputs to streams varies with forest conditions and geomorphology. Empirical studies indicate that 95% of total instream wood (from near-stream sources) comes from distances of 82 to 148 feet. Shorter distances occur in young, shorter stands and longer distances occur in older and taller stands."

The 148 feet distance is generally less than a one-sight potential tree height distance on streams within the planning area.

The primary near-stream inputs of large wood are from tree mortality and bank erosion, along with landslides and debris flows. The Riparian Reserve along perennial and fish bearing streams under the PRMP would be one site potential tree height distance on either side of the channel. This is where the majority of the large wood contribution to stream channels is recruited.

3. The majority of large and small wood contribution to stream channels would be from within the Riparian Reserves under the PRMP. Timber management activities outside of the outer zones of the Riparian Reserve would have little to no influence upon small and large wood contribution to stream channels (with the rare exception of a debris torrent originating outside of a Riparian Reserve that carries wood to a stream channel). Projected PRMP thinning activities in the outer zone of the Riparian Reserve would have a very small effect upon total large and small wood contribution as the amount of thinning as a percentage of all Riparian Reserve acres is low. It ranges from 0% to 4.1% in the first decade within the geographic areas of ESA-listed fish in the planning area, and gradually declines in subsequent decades (see Table 34 to Table 43 in the Forest Management section of the Proposed Action description: section II.B.4).

4. The structural stage condition of the forest and four stand metrics provide broad measures of the potential for forest lands to provide large and small functional wood to streams. The four stand metrics are: density of large trees (>20" diameter DBH); percentage of forest stand canopy cover in hardwoods; the quadratic mean diameter (QMD) of trees (a weighted average of the size of trees in the stand); and, the number of trees per acre.

The BLM analyzed the potential contribution of wood to streams over time, but did not attempt to model actual wood delivery to streams over time. Wood delivery to streams is influenced by myriad factors, including riparian stand conditions, individual tree processes, disturbance events, and geomorphic processes. Many of these influential factors are inherently

unpredictable, and several would not be affected by implementing the PRMP. Instead, the 2015 DEIS analysis, like the 2008 RMP/EIS, evaluated the potential contribution of wood to streams by assessing the condition of forest stands that could potentially deliver wood to streams. The PRMP would directly and substantially affect the condition of these forest stands, and the BLM can more accurately forecast changes to forest stand condition than wood delivery to streams.

The BLM analyzed the potential contribution of wood to streams over 100 years to provide a meaningful comparison of the effects of the PRMP on fish habitat. Wood loading in streams is highly variable, and wood delivery is only one component. Breakdown of wood, large floods, and debris flows can alter the amount or effectiveness of large wood in the stream, and these processes can take place over large spatial scales. Therefore, analyzing the potential contribution of wood to streams over a shorter time period would not accurately reflect the potential for the PRMP to affect in-stream fish habitat through wood delivery. The effects of land management to the landscape could take up to 100 years to show any discernable change in the amount or quality of fish habitat created by large or small functional wood.

The ability to analyze the effects of the PRMP on potential wood delivery to streams is limited by several factors, including the data available at this scale of analysis on both stream reach and riparian stand conditions, uncertainties about the extent, location, and timing of riparian stand thinning, and the indirect connection between riparian stand conditions and wood amounts in streams. For example, data available at this scale of analysis is not sufficiently site-specific and detailed to evaluate whether the trees in a specific riparian stand are of sufficient size to provide stable in-stream habitat structure in the specific adjacent stream reach. Instead, the BLM must make generalizations and assumptions, to describe current riparian stand conditions, future riparian stand conditions, and stream conditions.

In addition, riparian stand thinning would affect riparian stand conditions and consequently the wood potentially available for delivery to streams. However, forecasting the extent, specific location, and timing of riparian stand thinning required the BLM to make assumptions about a plausible scenario for implementation under the PRMP, adding uncertainty to the effects in any specific location. In general, the amount of riparian thinning forecasted over the next several decades is very low, ranging from 0% to 4.1% in the first decade within the geographic areas of ESA-listed fish in the planning area, and gradually declining in following decades (ranging from 0% to 4.1% in the first decade within the geographic areas of ESA-listed fish in the planning area, and gradually declining in following decades (see Table 34 to Table 43 in the Forest Management section of the Proposed Action description: section II.B.4).

Finally, the analysis addressed the riparian stand conditions, which identified the wood available for delivery to streams, but actual delivery of wood to streams and consequently, the habitat structure in streams, depends on many factors in addition to riparian stand condition, including stochastic processes, which adds an additional layer of uncertainty to the effects in any specific location.

Forest stand structural stage changes within 1 site-potential tree distance from streams under the PRMP

The distribution of the total acres by structural stage for stands within one site-potential tree height from all streams for the current condition and in 2113 with implementation of the PRMP

is displayed in Table 140**.** The model predicts that there will be a trend towards mature and structurally complex stands. About 50 percent of the total acres are in stands in the mature or structurally complex structural stage at present. After 100 years of implementing the PRMP, about 94 percent of the total acres will be in the mature or structurally complex structural stage. This suggests much greater availability of larger diameter trees within a 1 site-potential tree distance from streams that would become available for large wood debris over time with implementation of the PRMP.

Table 140. Acres and percentage of total acres in each structural stage for stands within one site-potential tree height from all streams for the current condition and the PRMP in 2113.

	Early-successional Acres and (%)	Stand Establishment Acres and (%)	Young Acres and (%)	Mature Acres and (%)	Structurally -complex Acres and (%)
Current Condition	10,325 (1.3%)	140,353 (18.2%)	232,064 (30.0%)	179,570 (23.2%)	210,061 (27.2%)
PRMP	1,206 (0.2%)	2,148 (0.3%)	40,506 (5.2%)	335,475 (43.4%)	393,038 (50.9%)

Changes to three tree metrics within 1 site-potential tree distance from streams under the PRMP

Table 141 displays values for the current condition and after 100 years of implementation of the PRMP (2113) for four tree metrics.

Table 141. Changes to three tree metrics for stands within one site-potential tree height from all streams for the current condition and the PRMP in 2113.

	Total Trees per Acre	Trees per Acre > 20” DBH	Hardwood Canopy Cover (%)
Current Condition	317.7	18.8	20.5
PRMP	125.0	37.0	15.6

Currently, riparian stands that are within one site-potential tree height of streams average about 316 trees per acre, of which 19 trees per acre are greater than 20" DBH. Hardwood trees provide approximately 21 percent of riparian canopy cover. In general, current riparian stand conditions are more dense, with smaller diameter trees, than riparian stands historically. After 100 years of implementing the PRMP, model projections include a decrease to 125 trees per acre, and an increase to 37 trees per acre greater than 20" DBH. The percent hardwood riparian canopy cover would decrease to 16 percent. Again, this suggests greater availability of larger diameter trees with the potential to become large wood debris over time under the PRMP. While reduced from 20.5 to 15.6 percent, there is still a considerable component of hardwood trees to contribute to large and small wood debris, as well as for a nutrient source to stream channels.

Regarding the various metrics shown above, it is possible that there would be circumstances in which there could be differences in wood delivery to streams not revealed by this analysis. For example:

- Substantial channel migration could move the stream closer to harvested stands outside of the Riparian Reserve. This could reduce the potential wood contribution to the stream. This could however be offset in the short-term by additional large wood recruited from channel migration. The PRMP would measure the width of the Riparian Reserve from the ordinary high water line, including the channel migration zone for low-gradient alluvial shifting channels, which would effectively widen the Riparian Reserve width on streams that would likely experience substantial channel migration. This difference would reduce or eliminate the likelihood that substantial channel migration could move the stream closer to harvested stands outside of the Riparian Reserve under the Proposed RMP.
- In Class III subwatersheds, tree fall on extremely steep slopes could result in delivery of wood to non-fish-bearing intermittent streams from beyond 50' from the stream. This could result in fewer trees and smaller diameter wood delivered to some streams if the upslope area includes recently harvested stands outside the Riparian Reserve. However, Class III subwatersheds do not contain ESA-listed fish species.
- In Class III watersheds under the PRMP, debris flows from outside the 50 foot Riparian Reserve width for non-fish-bearing intermittent streams could result in fewer trees and smaller diameter wood delivered to streams if the debris flow area includes recently harvested stands outside the Riparian Reserve. Debris flows could exceed 100' in width. However, Class III watersheds do not contain ESA-listed fish species.

These examples represent exceptional or low-probability circumstances. Furthermore, actual wood loading on streams results from multiple factors, and from multiple sources, further lowering the probability that any of these exceptional circumstances would result in any discernible difference in actual wood loading in streams at the watershed scale.

Inner Zone Riparian Reserve Widths

The inner zone widths of the PRMP Riparian Reserve west of Highway 97 along perennial or fish-bearing streams would be 120 feet, with no thinning allowed. Over time, the 120 feet wide inner zone along perennial and fish-bearing streams under the PRMP could result in some

stands that are capable of delivering wood to streams developing without thinning and thus providing smaller wood available for delivery to streams.

Riparian Reserve widths along intermittent non-fish-bearing streams vary by watershed class. In Class I and II subwatersheds, widths are one site-potential tree. In Class I watersheds, management direction provides that the middle zone (50-120 feet) and the outer zone (120 feet to site-potential tree distance) can be thinned to ensure that stands are able to provide trees that would function as stable wood in the stream. In Class II watersheds, management direction provides that the outer zone (50 feet to site-potential tree distance) can be thinned to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. In Class III watersheds, the Riparian Reserve is 50 feet in width and would not be thinned, except for Sudden Oak Death treatments, individual tree cutting or tipping, or the Tree Tipping management direction (as is the case for the inner zones for Riparian Reserves on all streams west of Highway 97).

Along non-fish bearing intermittent streams where thinning is allowed in outer zone areas where trees have the potential to fall into the stream, tree tipping management direction would ensure that instream large and small wood amounts are actually increased, rather than left to chance. It is also worth noting that conifer densities remaining after thinning and tipping treatments are completed, are believed to be well within the range of natural variability.

Management Direction for Riparian Reserve Thinning

The PRMP would direct thinning in the outer zone (and middle zone for non-fish-bearing intermittent streams in Class I watersheds) for a set of purposes including increasing the diversity of riparian species and developing structurally-complex stands. Over time, the management direction in the PRMP could result in some stands capable of delivering wood to streams being thinned and having fewer trees available for delivery to streams.

On fish-bearing or perennial streams where ESA-listed fish are present or where CH has been designated, this would occur in Class I and II watersheds, only in the outer zone of the Riparian Reserve (beyond 120 feet). While the number of trees in that area beyond 120 feet to the site-potential tree height distance may be reduced at that time by thinning, the number of trees that would have sufficient height and diameter to reach the stream channel and serve as functional wood at that time would be very low or nonexistent. This is because there would be few trees taller than 120 feet in the typical 80 year old or younger stand that is most likely to be thinned.

It is acknowledged that some of the trees that would be removed by thinning in the outer zone beyond 120 feet, if left to grow, may ultimately exceed 120 feet in height. However, the probability of such a tree falling in an arc that would intersect the stream becomes increasingly lower as the distance of the tree from the stream increases. Should such a tree hit the stream, it may not remain intact on impact, and that portion of the top of the tree that is in the channel may not be of a diameter to be functional wood (depending upon the width of the channel). Given these considerations, the number of trees that may be removed by thinning in the outer zone of fish-bearing or perennial streams that, if left to grow, would have resulted in functional wood pieces in stream channels is very low.

In the long term, the trees in the outer zone would have accelerated growth and reach the 20-inch dbh class faster than would occur if the stand were left unthinned. In other words, trees would qualify as LWD faster. Trees between the edge of the stream channel to 120 feet would not be thinned, and would be available to fall naturally into the stream channel.

The PRMP also includes tree tipping management direction:

> "Tree Tipping: When conducting commercial thinning[15] in any portion of the Outer Zone in a stand in all watershed classes, fall or tip up to 15 square feet of basal area per acre of live trees, averaged across the Riparian Reserve portion of the stand. Leave felled or tipped trees on site or yard, deck, and make felled or tipped trees available for fish habitat restoration. The felled or tipped trees can be of any size and come from any zone."

When tree tipping is done and trees are felled/tipped in stream channels, or subsequently placed in stream channels, it would result in an increase in functional large and small wood amounts, rather than recruitment of wood to stream channels being left to chance. The number of trees by dbh class that is an approximation of 15 square feet of basal area is presented in Table 142.

Table 142. Number of trees by DBH class approximating 15 square feet of basal area.

DBH (inches)	Number of Trees
10	28
12	19
16	11
20	7
24	5
30	3
38	2

It should also be noted that the amount of Riparian Reserve thinning that would take place under the PRMP is a very small percentage of the total acres of Riparian Reserves in the planning area. The ability to influence the amount of functional wood in fish-bearing or perennial streams by thinning within Riparian Reserves is limited. Only a small percentage of

[15] In the context of management direction for the Riparian Reserve, "commercial thinning" means stand thinning in which some or all of the cut trees are removed from the stand for timber. "Commercial thinning" in this context does not include individual tree falling or tipping or stand thinning in which all of the cut trees are left in the stand for restoration purposes, or fuels reduction treatments in which cut cut trees are burned, chipped, or otherwise disposed of without removal from the stand for timber. "Commercial thinning" may be implemented through a variety of mechanisms, including timber sale contracts and stewardship agreements or contracts.

the total Riparian Reserve acres in any ESA-listed fish species geographic area would be thinned in a decade. With one exception, the range is 0 to <2 percent. That exception is for the decade ending in 2023 for the McKenzie River basin bull trout analysis area, at 4.1 percent.

In summary, the PRMP would increase the large wood and small functional wood contribution to streams over time, including those proximal to ESA-listed fish and to designated CH. This is a beneficial effect to the potential for wood recruitment to stream channels at the scale of the planning area. This analytical conclusion is based on high-quality information using robust analytical methodology and provides an accurate, albeit generalized, description of the effects of the PRMP across the decision area. However, because of the limitations on available data and analytical methodologies and the uncertainties described above, there may be differences regarding potential wood delivery to streams than is apparent in this analysis in some locations and under some circumstances. Such circumstances are exceptional or not conducive to analysis at this scale with the data available. Where such circumstances would be relevant, the BLM would address these site-specific effects on potential wood delivery more fully in the analysis for specific implementation actions.

Analysis at the scale of a site-specific timber management project

Forest management actions within the Riparian Reserves have the potential to affect large and small wood recruitment to stream channels used as habitat by ESA-listed fish species. The design of Riparian Reserves, management direction and use of BMPs condition the potential effects. There are separate analyses for effects of Forest Management activities within Riparian Reserves east and west of Highway 97 because the widths of Riparian Reserves differ, as well as management direction. The effects to the Large and Small Wood indicator are done by PE. The Timber Haul PE has no causal mechanism to affect the Large and Small Wood indicator and will not be analyzed. Trucks driving on roads do not affect live or down trees outside the road prism.

Thinning (west of Highway 97)

Roads and Landings. While anticipated to be a rare occurrence, new road construction for the purposes of Forest Management activities is allowed within the Riparian Reserve where there is no practicable alternative to accomplish resource management objectives. For sediment modeling purposes at the scale of the decision area (see analysis that follows), the BLM estimates approximately 66 miles of new road construction in the first decade within a 200 feet sediment delivery distance to streams. To put the 66 miles in perspective, it would be a subset of the 439 miles of new road construction under the PRMP in the first decade, and add to the existing 14,330 miles of BLM-controlled roads in the planning area.

The sediment delivery distance of 200 feet is a reasonable surrogate for the maximum distance that a tree may grow from a stream that, when the tree falls, may reach a stream channel and serve as functional wood. The 66 miles of new road construction within the first decade within that 200 foot distance is useful to describe the magnitude of the potential loss of live and dead trees when they are removed during road construction, that may have become functional wood in stream channels if they had not been removed. The 66 miles of road construction within 200

feet of streams would occur over a ten year period and be spread out at the scale of the entire planning area. Specific locations are not known at this time, therefore the proximity to ESA-listed fish habitat or designated CH is also not known.

New road construction has the potential to negatively affect sources of large and small wood to stream channels occupied by ESA-listed fish species, by removing trees from the road prism. The extent of the effect is dependent upon the distance of the road from the stream channel, and the length of the road within the Riparian Reserve. The duration of the effect is dependent upon whether the road is a permanent road, or will be decommissioned.

Removal of hazard trees as part of road maintenance may occasionally remove a tree that might have become functional wood in a stream channel. This would be a rare occurrence, however, as Management direction for the Riparian Reserve west of Highway 97 directs retention of hazard trees and blow down trees for fish habitat restoration, unless removal of a portion of the logs is necessary for fuels reduction, or to actually accomplish opening of a road to access roads and facilities (i.e. a very large blowdown event or other disturbance).

New landing construction is expected to be very limited and generally outside of the Riparian Reserve for commercial thinning projects. It is common practice to use existing landings, which are a result of the original logging of the stand subject to thinning. Landings are usually part of a road, often at the end of a spur road.

Falling and yarding. Some stands overstocked with small diameter trees within Riparian Reserves would be thinned under the PRMP. This would affect current and future sources of large and small wood. Due to the small diameter of trees in stands being thinned (no trees >20" dbh, therefore not meeting the definition of large wood), this would only affect small wood. Furthermore, because there will be no thinning within 120 feet of a stream channel for any fish-bearing or perennial stream in all three classes of Riparian Reserves, small wood sources for any habitat occupied by ESA-listed fish species would not be affected. Trees that would meet the definition for small wood (<20" dbh) would not be 120 feet or greater in length and would not be affected by thinning in the outer zone of the Riparian Reserves for fish-bearing and perennial streams.

It is acknowledged that some of the trees that would be removed by thinning in the outer zone beyond 120 feet, if left to grow, may ultimately exceed 120 feet in height. However, the probability of such a tree falling in an arc that would intersect the stream becomes increasingly lower as the distance of the tree from the stream increases. Should such a tree hit the stream, it may not remain intact on impact, and that portion of the top of the tree that is in the channel may not be of a diameter to be functional wood (depending upon the width of the channel). Given these considerations, the number of trees that may be removed by thinning in the outer zone of fish-bearing or perennial streams that, if left to grow, would have resulted in functional wood pieces in stream channels is very low.

Thinning between 50-120 feet from the stream channel for non-fish-bearing intermittent streams in Class 1 and Class II subwatersheds would reduce the potential for small wood recruitment to the channel, but this would occur in stream channels not utilized by ESA-listed fish as habitat. The potential for movement of pieces of functional small wood from these locations to stream channels utilized by ESA-listed fish as a result of high stream flows is extremely unlikely, as

intermittent streams do not have the stream power to move these pieces. These pieces would only be mobilized during very infrequent flood flows, or debris flows.

The Class III Riparian Reserve distance for a non-fish bearing intermittent stream is 50 feet. Beyond that distance a variety of silvicultural treatments are allowed under the PRMP, including thinning and regeneration. Thinning beyond the 50 feet would negatively affect small wood recruitment in the short-term. However, recent studies on density management thinning treatments on second growth stands have indicated that 80% of instream large and small wood originates from within 50 feet of the streams (USDA FS PNW Science Findings 2015). Regeneration cuts would eliminate current and future large and small wood sources beyond the 50 feet buffer. However, these areas are not occupied by ESA-listed fish, nor are channels downstream that are within the Class III 6th field subwatershed. The likelihood that any trees, if left to grow outside the 50 foot buffer, would contribute to potential small or large wood where there is habitat occupied by ESA-listed fish beyond the 6th field subwatershed boundaries is extremely low.

Debris torrents and landslides are a source of wood to streams, and the initiation points for them may occur at distances greater than 50-120 feet from a stream channel. However, this would be a relatively rare occurrence within a thinning project area. Thinning projects are typically located in plantations that are a result of regeneration (clear-cut) logging. If the site is predisposed to debris torrents or landslides that could deliver to stream channels occupied by ESA-listed fish species, it is likely that it would have occurred in the years following the initial logging. Furthermore, during interdisciplinary project planning for proposed harvest areas, areas identified as unsuitable for sustained yield timber production, such as unstable landforms, would be avoided (USDI BLM 1986). The BLM periodically adds such areas to the unsuitable classification through updates to the timber production capability classification system.

The PRMP also includes tree tipping management direction (as described above in the analysis of effects at the scale of the decision area) for the purposes of aquatic or riparian restoration. When tree tipping is done and trees are felled/tipped into a stream channel, or subsequently placed in stream channels, it would result in an increase in functional large and small wood.

In the long term, remaining trees in thinned stands within the Riparian Reserve would have accelerated growth and reach the 20-inch dbh class faster than would occur if the stand were left to natural processes.

Ground-based yarding may occur within some areas of riparian thinning. It would have negative effects to large and small wood recruitment to streams by killing or injuring trees within the skid trails that would otherwise be potential sources of future large and small wood. The following management direction from the Riparian Reserve LUA section of Appendix A for both Moist and Dry Riparian Reserve would reduce the impacts of ground-based yarding to existing live trees in the stand. It does so by excluding some areas from ground-based machinery.

- Do not operate ground-based machinery for timber harvest within 50 feet of streams (slope distance), except where machinery is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.

- Do not operate ground-based machinery on slopes >35 percent. Mechanical equipment with tracks (e.g., excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet (slope distance).

The following BMPs would reduce the potential impact of ground-based skidding on large and small wood recruitment by limiting the total area in designated skid trails and using existing skid trails and landings. This would limit the killing or injuring of trees within the skid trails that would otherwise be potential sources of future large and small wood.

- BMP TH 08. Limit designated skid trails for thinning or regeneration harvesting to ≤15% of the harvest unit area to reduce displacement or compaction to acceptable limits.
- BMP TH 12. Incorporate existing skid trails and landings as a priority over creating new trails where feasible, into a designated trail network for ground-based harvesting equipment, consider proper spacing, skid trail direction and location relative to terrain and stream channel features.

Cable yarding corridors spanning a stream channel are allowed within Riparian Reserves where there is no practicable alternative to accomplish resource management objectives. Creation of yarding corridors involves felling of trees in the corridor, and the yarding itself would damage or kill some small trees within the corridor. This would negatively affect potential sources of current and future small wood, and future large wood to stream channels. However, BMP TH 2 requires trees felled for yarding corridors in the Riparian Reserve within a tree height distance of a stream channel to be directed toward the stream and left on site.

There is currently no estimate of how many yarding corridors may be constructed on streams occupied by ESA-listed fish in the planning area. However, impacts to large and small wood recruitment is expected to be small because of the limited amount of Riparian Reserve thinning that is estimated to occur (see Table 34 to Table 43 in the Forest Management section of the Proposed Action description: section II.B.4), the fact that not all of that thinning would be adjacent to stream reaches occupied by ESA-listed fish, limited use of yarding corridors for Forest Management timber sale units located outside of the Riparian Reserve, and the immediate recruitment of large and small wood as a result of BMP TH 2.

Helicopter yarding results in extremely limited ground disturbance, and therefore would not have meaningfully measurable effects to residual trees that may become large and small wood in stream channels.

Overall, while there are long-term and short-term benefits to potential recruitment of large and small wood to streams occupied by ESA-listed fish species by thinning activities and tree-tipping, the overall effect of the PE is negative and measurable, predominately from skid roads and yarding corridors.

<u>Fuels treatment.</u> Any of the following methods may be used to treat fuels (slash) generated by Forest Management projects: under burn, hand pile and burn, landing pile and burn, machine pile and burn, slash and scatter, and mastication. However, it is fuels treatment that occurs within the Riparian Reserve that has the potential to affect the wood indicator. Landing pile and burn would not affect the wood indicator as landings are typically well outside of the Riparian

Reserve. Because there is a need to protect residual trees in the thinned stand, and steep slopes often prevent use of heavy machinery, the most common slash treatment types for residual fuels in the Riparian Reserve is hand pile and burn, and slash and scatter. Slash and scatter has no causal mechanism to affect the wood indicator. Any burning of slash has the potential to kill an existing tree and affect the wood indicator. However, a slash pile created by the hand pile and burn treatment type typically has a small footprint (BMP F 8 limits piles to 16 feet in height or diameter) and the piles are placed in openings that would not have many existing live trees that could be killed by the burning pile. It is also common practice to plan and implement fuels treatments when fuel moisture and weather conditions minimize the risk of a hot burn and escape of fire that may kill or damage residual trees, or damage soil. The effect of fuels treatment to Forest Management generated slash within the Riparian Reserve is expected to have an insignificant effect to the wood indicator.

Post-harvest silvicultural treatment. Within the Riparian Reserve, there would be extremely limited post-harvest silvicultural treatment. Because there would be no regeneration harvest, there would be no need to plant trees, with the exception of planting on decommissioned roads and skid trails. This would have a very small beneficial effect to potential future wood recruitment. Pre-commercial thinning is associated with regeneration types of harvest, and that would occur outside of the Riparian Reserve. The stands being thinned would be located in the Riparian Reserve outer zone and would be of a sufficient age that there would not be a need to manually remove competing vegetation. Spot-fertilizer use may have a beneficial effect on growth of trees, but its use is so limited and distant from stream channels that its effect on potential large and small wood recruitment would be insignificant. Overall, the PE would have an insignificant effect to the indicator.

Thinning and Other Silvicultural Activities (east of Highway 97)

The following analysis applies to forested lands east of Highway 97 in the Eastside Management Area LUA. Riparian Reserves in this area are 150 feet on each side of fish-bearing and perennial streams and 100 feet on each side of non-fish bearing intermittent streams and lakes. Lost River sucker and shortnose sucker utilize some streams and reservoirs/lakes in this area for habitat. With respect to effects to the wood indicator, the analysis focuses on activities within the Riparian Reserve.

Roads and Landings. The analysis for effects of roads and landings to the wood indicator for the Riparian Reserve West of Highway 97, above, also applies to the Riparian Reserve East of Highway 97.

Falling and yarding. Management direction for various types of water features direct silvicultural treatments within the Eastside Management Area Riparian Reserve to achieve ecological goals.

Management direction that applies to all water features states: “Remove conifer encroachment in the Riparian Reserve where conifers are interfering with the natural vegetation community type, or where excessive erosion may occur.”

Management direction that applies to fish-bearing perennial streams states: “Conduct thinning and other vegetation treatments to accelerate the development of potential natural forest stand

conditions including late-successional stand characteristics and native riparian shrub communities."

Management direction that applies to non-fish bearing intermittent streams states: "Conduct thinning and other vegetation treatments to speed the development of large trees to provide an eventual source of large woody debris to stream channels."

Management direction that applies to reservoirs/lakes states "Conduct thinning and other vegetation treatments within the Riparian Reserve to speed the development of potential natural vegetation communities."

Inner and outer zones are not designated for the Eastside Management Area Riparian Reserve. Consequently, thinning and other silvicultural treatments that cut trees could occur at any distance from the bank or shoreline. This would reduce the potential for short-term recruitment of small wood (presuming that no trees qualifying as large wood would be affected by the thinning or other silvicultural treatments). Developing late-successional stand characteristics, speeding the development of large trees, and speeding the development of potential natural vegetation communities would have beneficial, long-term effects to the large and small wood indicator.

However, while there is management direction to apply thinning within the Riparian Reserve, the BLM projects almost no Riparian Reserve thinning under the PRMP. There is no Riparian Reserve thinning scheduled under the PRMP within the Lost Recovery Unit whatsoever (**Table 40**). The only Riparian Reserve acreage projected for thinning in the Upper Klamath Recovery Unit is 3 acres for the decade beginning in 2043 and 2 acres for the decade beginning in 2053 (**Table 41**). The other harvest methods with projected acres in either Recovery Unit would take place outside of the Riparian Reserve (**Table 30 and Table 31).**

The need for ground-based yarding within the Riparian Reserve is almost nil due to the low amount of thinning projected to occur under the PRMP. Should it be used, the following management direction specific to the Eastside Management Area Riparian Reserve for fish-bearing streams and perennial streams would reduce the impacts of ground-based yarding to existing live trees in the stand. The second bullet statement also applies to non-fish-bearing intermittent streams.

- Do not conduct thinning and other vegetation treatments using ground-based machinery within 75 feet (slope distance) on either side of the edge of the stream channel, as measured from the ordinary high water line.
- Do not conduct thinning and other vegetation treatments using ground-based machinery on slopes >35 percent, soils sensitive to displacement, rutting, or compaction, or in slide-prone areas.

Management direction for the Riparian Reserve of lakes, natural ponds and wetlands would reduce the impacts of ground-based yarding to existing live trees in the stand.

- Do not conduct thinning and other vegetation treatments using ground-based machinery within 50 feet (slope distance) on each side of the ordinary high water line of the water feature, or seasonally saturated soils (whichever is greatest).

The following BMPS would reduce the potential impact of ground-based skidding on large and small wood recruitment:

- BMP TH 8. Limit designated skid trails for thinning or regeneration harvesting to ≤15% of the harvest unit area to reduce displacement or compaction to acceptable limits.
- BMP TH 12. Incorporate existing skid trails and landings as a priority over creating new trails where feasible, into a designated trail network for ground-based harvesting equipment, consider proper spacing, skid trail direction and location relative to terrain and stream channel features.

Cable yarding corridors spanning a stream channel are allowed within Riparian Reserves where there is no practicable alternative to accomplish resource management objectives. Creation of yarding corridors involves felling of trees in the corridor, and the yarding itself would damage or kill some small trees within the corridor. This would negatively affect potential sources of current and future small wood, and future large wood to stream channels. However, BMP TH 2 requires trees felled for yarding corridors in the Riparian Reserve within a tree height distance of a stream channel to be directed toward the stream and left on site.

There is currently no estimate of how many yarding corridors may be constructed on streams occupied by ESA-listed fish in the Eastside Management Area. However, impacts to large and small wood recruitment is expected to be small because of the extremely limited amount of Riparian Reserve thinning that is estimated to occur (as described above), the fact that not all of that thinning would be adjacent to stream reaches occupied by ESA-listed fish, limited use of yarding corridors for Forest Management timber sale units located outside of the Riparian Reserve, and the immediate recruitment of large and small wood as a result of BMP TH 2.

While there are long-term benefits to potential recruitment of large and small wood to streams occupied by ESA-listed fish species by thinning activities (which will be a rare occurrence within the Eastside Management Area Riparian Reserve), the overall effect of the PE is negative and measurable, predominately from actions to reduce conifer encroachment within the Riparian Reserve, and the effects of yarding corridors. These activities would occur infrequently.

Fuels treatment and post-harvest silvicultural treatment. The analysis for effects of timber harvest related fuels treatments and post-harvest silvicultural treatment to the wood indicator for the Riparian Reserve West of Highway 97, above, also applies to the Riparian Reserve East of Highway 97. Note that because there is an extremely low amount of thinning scheduled within the Riparian Reserve, there would be a correspondingly extremely amount of timber harvest related fuels treatments.

Summary of effects to large and small wood

An analysis of potential recruitment of functional wood to streams from within one site potential tree height distance from streams at the end of implementing the PRMP for a 100-year period was performed utilizing a model. Characteristics of the stands that were evaluated included: changes in tree stand structural stage classes; total trees per acre; trees greater >20” DBH per acre; and, percent canopy cover in hardwoods. Results indicate that the effects over the 100-year period to the environmental baseline condition under the PRMP would be an

increased potential for areas within Riparian Reserves to provide functional large and small wood to stream channels. This is a beneficial effect to potential recruitment of functional wood to stream channels over the 100-year time-frame at the spatial scale of the entire planning area, including streams inhabited by ESA-listed fish.

In the short-term, and at the project-scale, some Forest Management activities that occur within the Riparian Reserve would reduce potential for small wood recruitment to stream channels occupied by ESA-listed fish. Within the Riparian Reserve west of Highway 97, this would occur primarily from ground-based yarding, yarding corridors (mitigated by BMP requirements to leave downed trees within the Riparian Reserve and directionally felled toward the stream), and the rare new road construction associated with thinning. Effects to small wood recruitment from thinning in Riparian Reserves of fish-bearing and perennial streams west of Highway 97 would be nearly non-existent due to the 120-foot no-thin buffer. In addition, tree-tipping would directly increase large and small wood numbers in stream channels.

Within Riparian Reserves east of Highway 97, the mechanisms to negatively affect current and future small and future large wood potential for delivery to streams and lakes are: thinning (PRMP thinning is nearly non-existent but may occur) and reducing conifer encroachment; skid trails, yarding corridors (but see mitigating BMPs, above), and new road construction. Because of increased growth of remaining trees within thinned stands, there would be a beneficial effect to future recruitment of large wood.

Given the analysis above, considering the most impacting effects, the overall effect to the large and small wood indicator from implementing the PRMP is adverse. There are short and long-term beneficial effects to the indicator from some components of the PEs, notably faster growth of residual trees in thinned areas that lead to a shorter time-frame to attain a dbh that would result in functional wood in stream channels, from the tree-tipping requirement, and the requirement to fell trees in skyline corridors towards the stream channel and leave them on site.

Sediment/Turbidity/Substrate

This section is organized in the following manner. First, the results of modeling the effects of implementing the PRMP at the scale of the decision area to sediment delivery to streams from the existing road network, and from new road construction associated with timber management projects in the 1st decade, is presented. Then the risk of landslides delivering sediment to streams from the potential effects of timber management activities at the scale of the decision area is evaluated. This is followed by an evaluation of the potential site-scale effects to short-term sediment recruitment to stream channels by timber management projects.

Background

Sediment occurs naturally in stream systems and is an important component of a stream's channel substrate. In large quantities, fine sediment can affect fish directly by increasing turbidity and inhibiting foraging and breathing functions, or indirectly by embedding in stream substrates thereby reducing macroinvertebrate productivity, or smothering developing fishing embryos and fry within redds. Fine sediment in streams can affect fish habitat by filling interstitial spaces in gravel substrate, reducing oxygen flow to incubating eggs, and by

physically preventing newly-hatched fish from emerging. In suspension, fine sediment reduces visibility, reduces foraging ability, and impairs oxygen uptake in gill membranes (Waters 1995).

Thresholds for lethal and sub-lethal effects on fish from increases in sediment delivery have not been well established at the scale of watersheds or greater. Cederholm (1981) concluded that there was a 2 percent decrease of egg to emergence survival of salmonids for each 1 percent increase in fine sediment over natural levels at the watershed scale. Suttle *et al.* (2004) suggest there is no threshold below which fine sediment is harmless to fish, and the deposition of fine sediment in the stream channel (even at low concentrations) can decrease the growth of salmonids, resulting in sub-lethal effects.

The 2008 RMP/EIS summarized the effects of sediment on fish and aquatic habitat and that summary is incorporated here by reference (USDI BLM 2008, pp. 385-388, 799-800). Based upon the analysis in the 2008 RMP/EIS, the BLM assumed that every 1 percent increase in fine sediment from management activities would result in a 3.4 percent decrease in fish survival at the scale of the planning area. The BLM also assumed that increases in fine sediment less than 1 percent would not result in measurable or meaningful effects on fish survival at the large scale.

Analysis at the scale of the decision area

Sediment production from existing BLM-controlled road system and from new construction

Soil erosion is a natural occurrence in a forested landscape, aided by water, climate, gravity, soil properties, and lack of vegetative cover. Forest roads are unnatural, compacted surfaces and offer opportunities for accelerated erosion and potential sediment delivery to stream channels from a variety of sources, including small slumps and slides into the roadway from the cut bank, water channeling from the road or ditches if not properly directed and controlled, and blocked culverts and road fill washouts during floods. Sediment sources from roads are described in more detail in the 2008 RMP/EIS, which is incorporated here by reference (USDI BLM 2008, pp. 343-346).

Roads can deliver up to 90 percent of the total sediment production from forestry activities. This especially occurs on older roads where mid-hillslope construction and side casting of excess soil material was common (EPA 2005). Newer roads built in the last 30 to 40 years typically use ridge top locations, full bench construction practices across steep slopes removing excess soil material to offsite waste areas, and manage drainage more effectively. In general, modern road construction practices produce less sediment delivered to streams from forest roads than older road construction practices (Copstead 1998).

The distance that sediment travels along roadways depends upon a number of factors, including underlying geology, age of road since construction, road gradient, road drainage, and ground cover. The average sediment travel distance from seven studies in different geologies, including highly relevant studies in western Oregon, is 40 feet, with a range of zero to 639 feet. Sediment travel distances from roads are described in more detail in the 2008 RMP/EIS, which is incorporated here by reference (USDI BLM 2008, p. 345). The BLM conservatively used a 200 feet sediment delivery distance for its modeling of sediment yield from roads.

The modeled sediment delivery distance (200 feet) takes into account existing roads paralleling streams and existing roads with inside ditches that carry concentrated flow from a further distance to a stream due to lack of ditch relief culverts, This modeled distance is of little relevance to thinning activities and necessary new road construction in the Riparian Reserve, because these roads are further than mean sediment travel distance to a stream, are separated by the unthinned portions of the Riparian Reserve, and therefore cannot be conduits for runoff to a stream.

Because a large proportion of sediment delivery to streams is from roads associated with timber management activities, and the proximity and magnitude of potential non-road timber management projects within Riparian Reserves with respect to designated CH and to ESA-listed fish species is unknown at this time, the focus of the sediment production potential for timber management activities under the PRMP will be on the road system and potential effects to landslide rates.

The analysis that follows is a summary of that presented in the Hydrology section of the FEIS, which is incorporated by reference. Sediment delivery from roads can result from surface erosion, gullying, and mass wasting. However, due to limitations of model capability and geospatial processing across the large planning area, the analysis is restricted to surface erosion from roads. The empirical basis for the analysis is the Washington Road Surface Erosion Model (WARSEM) Manual (Dube *et al.* 2004). The BLM used the WARSEM methodology combined with BLM spatial GIS data layers to derive estimates of annual long-term sediment production.

Factors affecting surface erosion include geologic parent material, surface type, age of the road, road drainage, degree of vegetative cover on cut and fill slopes, and traffic factors including winter haul. In this analysis, the BLM evaluated watersheds (approximately 60 to 300 mi^2) (USGS hydrologic unit code 10, which had previously been termed “fifth-field” watersheds).

The analysis calculated potential fine sediment delivery (tons/year) from the projected miles of new temporary and permanent roads through 2023. The miles are based upon projected timber volume and road ratios by harvest type. Although the Planning Criteria displayed calculations over a longer period, the analysis is restricted to a ten-year time span because estimations of road construction beyond ten years become speculative. After ten years of implementation, the road system would be fully developed for the most part. That is, the BLM would have built most of the road network necessary to provide access to the actively managed forest stands and road construction would decline over time. In addition, new road construction and logging technology, and changing harvest types would continue to reduce the road construction necessary to provide access to the actively managed forest stands. Therefore, potential fine sediment delivery from new roads in future decades would be lower than the sediment delivery calculated for the first decade.

Approximately 36 percent of all existing BLM-controlled roads on BLM-administered lands are within a 200-foot delivery distance (5,096 miles of 14,330 total miles). The average potential fine sediment delivery yield to streams from existing BLM-controlled roads within the 200-foot sediment delivery distance is 2.26 tons/mi^2/year as shown in Table 143 (USDI BLM 2008, p.

347, Table 3-59). The highest potential fine sediment yield is from natural surface roads, while the lowest potential fine sediment yield is from paved roads.

Table 143. Potential fine sediment delivery from existing roads.

Existing Roads[a]	Roads Within Fine Sediment Delivery Distance (Miles)[1]		Potential Fine Sediment Delivery (Tons/Year)[2]		Watershed Potential Fine Sediment Delivery (Tons/Mile^2/Year)[3]	
	BLM	**Other**	**BLM**	**Other**	**BLM**	**Other**
Natural	1,738	15,874	23,050	233,054	0.86	8.75
Aggregate	2,590	22,938	28,938	30,765	1.09	1.15
Paved	767	2,436	8,277	33,807	0.31	1.27
Totals	**5,096**	**21,249**	**60,265**	**297,626**	**2.26**	**11.17**

[1] Includes BLM-controlled roads and private roads within the decision area from BLM GIS GTRN (roads) coverage.

[2] Includes road segments within 200 feet of a stream channel, where ditch flow carrying fine sediment could enter streams.

[3] Planning criteria estimate in which calculations are based on surface type for each HUC 10 watershed and summed for the planning area.

Model results indicate that the 5,096 miles of existing BLM-controlled roads within the 200-foot sediment delivery distance produce 60,265 tons/year of potential fine sediment delivery. This is approximately 17 percent of all sediment delivered to stream channels from roads of all ownerships within the planning area.

Implementation of best management practices (BMPs) is a primary reason that BLM-controlled roads currently result in a minor portion of the total sediment delivery to streams from roads.

The BLM currently does not use or maintain about 900 miles (6 percent) of the road system that the BLM has decommissioned (i.e., the BLM has closed the road to vehicles and left the road in an erosion-resistant condition). A small percentage of these decommissioned roads are within the 200-foot sediment delivery distance. The process of decommissioning includes the application of BMPs (see BMPs R82 to R92 in Appendix C). Blocking roads from traffic, out-sloping and adding waterbars for drainage control, applying erosion control and reducing or eliminating stream hydrologic conductivity, reduces potential sediment delivery from roads.

Forest management activities require adherence to management direction and the application of applicable BMPs in designing and constructing permanent and temporary roads to maintain or improve water quality. The BMPs include methods that either avoid or minimize the delivery of sediment to streams. There are 21 PRMP road BMPs that would minimize connectivity of new roads with streams and specifically address surface drainage and cross-drains (BMPs R2, R3, R27 and R31 to R48). See Appendix C for a complete description of each BMP. Also see the description of the Roads and Landings PE at the beginning of the Forest Management effects analysis section for descriptions of selected BMPS that would reduce impacts from roads.

The PRMP also includes management direction for road and landing construction and maintenance (see Appendix A). Examples of pertinent management direction in the PRMP were presented earlier in this Forest Management section.

Under the PRMP, new road construction through the 1st decade would result in an additional 165 tons per year of fine sediment delivery to streams. This would be an increase of about 0.3 percent over the baseline condition of **60,265 tons/year**. To place this in context, the No Action alternative would generate 369 tons/year, or more than double the sediment production of new roads under the PRMP. It is an outcome of the differences between the No Action alternative and the PRMP in the mix of timber harvest types, amount of timber harvest, road locations and road surface types.

Note that the PRMP projected sediment yield from new roads is the result of an estimated 66 miles of road being constructed inside the 200-foot sediment delivery boundary. The 66 miles is about 15 percent of the total 439 miles of new road construction projected under the PRMP at the scale of the planning area. Fewer new roads would be located inside a 200-foot sediment delivery distance than in upslope areas, because many transportation routes that parallel streams within a sediment delivery distance to streams are existing, permanent roads.

Management direction prohibits thinning in the inner zone of the Riparian Reserves. This would reduce the need for road construction in the sediment delivery distance and ensure that riparian forests maintain an effective sediment filtration area along streams. New road locations would not be needed to provide access for thinning riparian stands in the inner zone, and would therefore intrude into the 200-foot sediment delivery distance only where there would be no other reasonable routes to access upslope forest stands. Within the sediment delivery distance (200 feet), newly constructed roads would primarily be constructed to provide access for forest thinning within the Riparian Reserve. This thinning would be limited to the outer zone of the Riparian Reserve. Except for roads very near the stream channel or stream crossings (with connected ditches to the first upslope cross-drain), this unthinned, inner zone riparian forest near streams would result in effective sediment filtration, when compared to the mean sediment travel distance of 40 feet (USDI BLM 2008, p. 345, Table 3-58).

Under the PRMP in Class I watersheds, the BLM would only thin stands in the outer zone of the Riparian Reserve to provide trees that would function as stable wood in the stream. In Class II watersheds and Class III watersheds, the BLM would thin stands in the outer zone of the Riparian Reserve to promote the development of large, open grown trees, develop layered canopies, and multi-cohort stands, which would result in more thinning and requiring comparatively more roads than in Class I watersheds

The BLM would decommission 372 miles of permanent road by 2023 under the PRMP, bringing the total road in long-term storage to 1,272 miles (8 percent of the entire road system). Decommissioning includes a variety of practices, ranging from simply blocking access to the road to “full decommissioning,” which may include re-establishing drainage by removing culverts and re-contouring, and planting the roadbed.

The BLM estimates that approximately one-quarter of the roads decommissioned would be “fully decommissioned,” which would typically reduce potential fine sediment delivery by 11 to 13 tons/mile/year. For all decommissioned roads, potential fine sediment delivery would decline

over time, but the amount of improvement would be difficult to estimate. The reduction in potential fine sediment delivery following decommissioning would depend on site-specific and road-specific factors and the level of decommissioning, which cannot be predicted and evaluated at this scale of analysis. The BLM may reopen these decommissioned roads in the future if needed to provide access for management, such as when timber stands in the Harvest Land Base reach harvestable age. Unneeded roads would remain decommissioned. Which roads would be decommissioned and whether they would remain decommissioned would depend on site-specific and road-specific conditions related to whether the road would be needed to provide access for future management actions.

The BLM assumes that an increase of 1 percent or less fine sediment delivery to streams at the scale of the planning area would not result in measurable or meaningful effects on fish survival. Model projections are for an increase of about 0.4 percent. Therefore, the BLM concludes that there will not be measurable or meaningful effects on fish survival at the scale of the planning area by implementing the PRMP.

Potential effects to the risk of landslides that would deliver to stream channels under the PRMP

The analysis that follows is a summary of that presented in the Hydrology section of the FEIS, which is incorporated by reference.

Mountainous topography in western Oregon includes steep slopes, shallow soils, and underlying rock types that may trigger shallow rapid landsliding under high rainfall conditions. Observed differences in the spatial density of landslides are explained in part by variations in geology, topography, and vegetation (Dragovich *et al.*1993). Forests on steep slopes provide partial stability by roots spreading providing mechanical strength and binding of the soil. The important distribution of roots is in the lateral-horizontal direction. Vertical distribution of roots is less important for shallow landslides, because few roots cross the shear plane of the landslides (Schwarz *et al.* 2012). The density of tree roots, especially coarse roots and branching, is important in maintaining slope stability. Tree to tree root grafting further improves slope stability for selective harvest types. Eis (1972) found that 45 percent of selectively cut Douglas-fir trees were root grafted, and approximately half of the stumps from cut trees were still alive 22 years later.

Not all landslides result in effects on streams: from 30 to 70 percent of landslides deliver sediment and other material to streams (Miller and Burnett 2007a). A channelized debris flow (also called debris torrent or sluice-out) is a rapidly moving slurry of soil, rock, vegetation debris and water that can travel long distances from an initiation site through steeply confined mountain channels. Travel distance of stream debris flows depends upon slope gradient, valley width, and high angle tributary junctions encountered. As debris flows move downhill, they entrain additional sediment and organic debris that can expand the original volume by 1,000 percent or more, being more destructive with distance traveled (Benda and Cundy 1990). Debris flows lose energy and terminate at high angle stream tributary junctions and low gradient valley floors.

Shallow, rapidly moving landslide[16] initiation normally requires some combination of steep and convergent slopes, shallow soils overlying semi-impervious bedrock, and heavy or prolonged precipitation. Removing forest cover can elevate susceptibility to landsliding. Because of the multiple factors affecting landslide occurrence, including stochastic factors, it is not possible for the BLM predict landslide occurrence. Instead, this analysis presents a depiction of risk and the effect of timber harvest under the PRMP on that risk.

The BLM evaluated the risk of landslides by measuring relative landslide density using the geographic information system mass wasting hazard model within NetMap (Miller 2003, Miller and Benda 2005, and Miller and Burnett 2007a). The NetMap model produces a naturally occurring landslide susceptibility from geologic and landform factors, but independent of vegetation factors. The modeling is based on landslide inventories from the Coast Range, Western Cascades, and Klamath Provinces. The model produces a spatially distributed estimate of landslide density by mathematically matching observed landslide locations with topographic attributes including slope, convergence (bowl-shaped landforms), and watershed area, using a digital elevation model. BLM used the channelized mass wasting delivery model in NetMap to determine susceptible areas from the hill slope relative landslide density that could deliver to any stream channel.

The BLM calibrated this modeling for heavy precipitation represented by the 1996 storms (70- to 100-year return period). Extreme storms are highly correlated with increased rates of landsliding on susceptible sites. For the 1996 storms, observed landslide densities and size in the Coast Range were the highest for forest stands less than 10 years old, lower for mature forests, and lowest for forested areas between 10 to 100 years (Miller and Burnett 2007a, Robison *et al*. 1999).

The BLM added forecasts of future timber harvest under the PRMP to the NetMap model outputs.

In this analysis, the BLM assumed that regeneration harvest would increase the relative landslide density. After regeneration harvest, cut trees root strength rapidly declines and shallow soils lose mechanical strength. Landslide susceptibility lowers substantially 10 years after regeneration harvest and becomes similar to mixed forests or hardwood stands (Ziemer 1981, Miller and Burnett 2007b). In this analysis, the BLM assumed that commercial thinning would not affect landslide risk. After thinning, residual live trees with intertwined roots promote slope stability. Live trees also transpire water, which helps to lower soil water, a causative factor in slope failures. In this analysis, the BLM grouped together the two regeneration harvest methods of the PRMP: variable retention in the Moderate Intensity Timber Area and the Low Intensity Timber Area.

It is possible that retention trees in variable retention harvests would reduce the effect of regeneration harvest on landslide risk compared to clearcuts. However, the BLM cannot distinguish this potential effect of retention trees on landslide risk at this scale of analysis. The

[16] A shallow, rapidly moving landslide is a mass of soil, rock or debris that rapidly moves down a slope or stream channel at a velocity that is difficult for people to outrun or escape.

BLM derived spatial locations of modeled regeneration harvest from the Woodstock model outputs.

The BLM evaluated relative landslide density only within the Harvest Land Base, because the BLM would implement regeneration harvest only within the Harvest Land Base. This streamlines the analytical procedure to focus on the areas where timber harvest may have a measureable effect on the naturally occurring landslide density. The BLM did not account for the continuing effect of regeneration harvests that the BLM has conducted within the past ten years. The BLM has conducted only a very small acreage of regeneration harvests in the past ten years.

Not all steep slopes are at high risk of landslides. Steep slopes in the Harvest Land Base can be up to 80 percent or more, such as those on smooth sideslopes or competent rock, and have a low risk of landsliding. These areas are typically outside of headwalls or steep, dissected topography, which is usually found in the Riparian Reserve. An exception, based on slope steepness alone, is in the Tyee sandstone bedrock core area in the Coast Range and primarily on the Coos Bay District, where slopes >75 percent slope are considered a landslide risk threshold (ODF 2003). Comparatively, similar landslide initiation risk inside Riparian Reserve in steep and convergent topography occurs on lower slopes (70 percent, except for the Tyee area, where 65 percent slopes are considered a threshold) (ODF 2003). Based on slope alone, the BLM used 75 percent slope as a threshold for landslide risk in the Harvest Land Base (instead of 80 percent) to account for the Tyee sandstone bedrock core area on Coos Bay District, even though it is only a small portion of the decision area.

The analysis within the Harvest Land Base does not account for areas that the BLM has identified or will identify through the timber production capability classification system as unsuitable for sustained yield timber production, such as low-productivity woodlands, unstable landforms, rock bands, talus slopes, meadows, and water-logged soils (USDI BLM 1986). This inventory is ongoing, and the BLM reviews each proposed timber harvest area during interdisciplinary project planning. The BLM will periodically add additional areas to those areas reserved through updates to the timber production capability classification system, when examinations indicate that an area meets the criteria for reservation. Because this modeling does not account for these areas, it overestimates the potential effect of timber harvest on relative landslide risk in these areas.

In regeneration harvest areas the BLM multiplied the naturally occurring landslide density by a factor of three, to represent the additive risk from regeneration harvest. The BLM derived this factor from the relationship of observed landslides in varying forest age classes on the Siuslaw National Forest during the 1996 storms; the landslide density in stands less than 10 years old was approximately three times the average of stands over 10 years old (Miller and Burnett 2007a).

The BLM did not include potential increases to relative landslide risk from new road construction in this analysis. Roads do have the potential to increase landslide risk (Miller and Burnett 2007a, Weaver and Hagans 1996). However, under the PRMP, the BLM would construct few miles of new roads relative to the existing road system. Furthermore, most new

roads would be built on stable areas such as ridge top locations, and would mostly be short spurs to the existing collector roads.

The BLM evaluated the effects of timber harvest on relative landslide density over 50 years. This long period is appropriate, given the importance of stochastic events with long return-intervals (i.e., heavy precipitation) to the underlying landslide risk.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 80-82).

The PRMP Harvest Land Base has 2.41 percent of its land area in slopes steeper than 75 percent. The percentage of land area by naturally-occurring modeled landslide density classes in the PRMP Harvest Land Base LUA is presented in Table 144. This results in a baseline landslide rate of 0.118 landslides per square mile for the entire PRMP Harvest Land Base.

Table 144. Percentage of the PRMP Harvest Land Base LUA area by naturally-occurring landslide density class.

Density / mile^2	0	>0 to 0.25	>0.25 to <1	1 to 5	Total
Percent of Total	49.25%	36.77%	12.58%	1.40%	100%

Model results for relative landslide density in the Harvest Land Base from 2013 to 2063 under the PRMP are presented in **Table 145**.

Table 145. Relative landslide density in the PRMP Harvest Land Base from baseline at 2013 to 2063.

Year	2013	2023	2033	2043	2053	2063
Landslide Density / mile^2	0.118	0.131	0.128	0.131	0.130	0.126

Model results indicate that relative landslide density in the Harvest Land Base would rise from the baseline rate of 0.118 per square mile at year 2013 to 0.131 at 2023, then range from 0.128 to 0.131 through 2053, before declining slightly to 0.126 in 2063. Model results for the PRMP are less than for the No Action alternative initially and at each 10-year increment through the 50-year model period (FEIS Figure 3-100). This is a result of differences in the naturally occurring relative landslide density that is included in the Harvest Land Base between the No Action alternative and the PRMP, combined with the amount and specific locations of regeneration harvest under the No Action alternative and the PRMP.

The size and placement of the Harvest Land Base is as important as the intensity of regeneration harvest. The PRMP would have lower average landslide density with regeneration harvest than the naturally occurring landslide density of the No Action alternative, indicating the importance of included or excluded lands in the Harvest Land Base and where suitable stands are available for regeneration harvest.

The analysis of relative landslide density within the Harvest Land Base did not consider the effect of future implementation of BMPs and future withdrawal of landslide-prone lands from the Harvest Land Base. For example, when areas of susceptible fragile ground are identified during timber harvest planning and field work, the location or manner of harvest would be modified, or the susceptible fragile lands would be withdrawn when determined unsuitable for management activities associated with timber production. The PRMP would include BMPs for timber harvest and road construction, which include the avoidance of landslide-prone steep side-slopes and susceptible headwalls; end hauling of waste material on steep slopes; and other measures designed to avoid landslides. The specific effects of implementation of BMPs and withdrawal of landslide-prone lands would depend upon site-specific and project-specific factors that cannot be quantitatively evaluated at this scale of analysis and would be considered in planning and design of implementation-level actions. However, implementation of BMPs and withdrawal of landslide-prone lands would have the general effect of reducing the relative landslide density under the PRMP.

Even without considering the effect of future implementation of BMPs and future withdrawal of landslide-prone ground, the intrinsic (baseline) relative landslide density would be lower in the Harvest Land Base than in the non-harvest land base under the PRMP. This is because there is proportionally more area of stable lands in the Harvest Land Base compared to the non-harvest land base as a result of the withdrawal of landslide-prone land from the harvest land base.

The BLM used combined landslide density and delivery models in NetMap to calculate the relative susceptibility for direct debris-flow impacts to all stream channels. The BLM classified the traversal proportion grid in NetMap to determine the top 80 percent of debris flow risk that would transverse stream segments, based on the cumulative distribution of values. The BLM intersected the regeneration harvest projected in the Woodstock model by decade with the debris flow risk proportions data layer from NetMap. From this intersection, the BLM determined the potential area of debris flow susceptibility by decade that may be further elevated by regeneration harvest.

Portions of the Harvest Land Base would be susceptible to deliver sediment to a channel by shallow landsliding, whether managed or not, under the PRMP or any of the other alternatives evaluated in the FEIS. In the context of extreme storms, the percentage of regeneration harvest areas under the PRMP that would have some measure of susceptibility to deliver to a channel over the 40-year period from 2023 to 2063 ranges from 6.0 to 7.0 percent (Table 146). By way of comparison, the No Action alternative would have 7.8 percent to 11.1 percent of regeneration harvest areas susceptible to deliver to a channel in the same time frame. The remaining regeneration harvest areas would have essentially no susceptibility at all.

Table 146. Percentage of PRMP regeneration harvest areas prone to debris flows from 2023 to 2063.

Year	2023	2033	2043	2053	2063
Percentage	6.0	6.3	6.1	6.3	7.0

Shallow landsliding may contribute sediment, rocks, and forest debris to stream channels from susceptible portions of regeneration harvest areas during extreme storms, and from other unmanaged areas of the Harvest Land Base. There is increased risk for landsliding where the combination of steep slopes and geomorphic factors lower hill slope stability. Removal of vegetation by regeneration harvest would lower the strength of live roots binding the soil. If an extreme storm would occur during the early-successional period, the susceptibility of landsliding would be increased compared to forests where basal area would be maintained. Under the PRMP over the next 50 years, the area of increased landsliding susceptibility with potential to deliver to streams would range between 6.0 to 7.0 percent of the regeneration harvest area and less than one percent (0.57 percent) of the Harvest Land Base.

It is not possible at this scale of analysis to reasonably quantify the amount of sediment that would be delivered from landslides or debris flows to streams. There will be some sediment delivery to streams from landslides or debris torrents that occur in areas within the Harvest Land Base, post-timber harvest. The risk of landslides or debris flows will be minimized by use of BMPs, management direction and the removal of landslide and debris flow susceptible areas from the Harvest Land Base over time.

The lower relative landslide risk in lands in the Harvest Land Base under the PRMP, and lower percentage of regeneration harvest areas prone to deliver debris flows to streams, in contrast to the No Action alternative, has a beneficial effect to the risk of introducing sediment to stream channels.

Analysis at the scale of a site-specific timber management project

The analysis that follows evaluates the potential for fine sediment to enter stream channels as a result of Forest Management activities. Fine sediment introduced to stream channels could accumulate in interstitial spaces between streambed substrate such as cobbles, reducing available cover for juvenile fish. Fines could become embedded in gravel substrates used for spawning, reducing intergravel flow. These sediments would be flushed during subsequent high flows and dispersed downstream where no discernable effect would be detected.

There may be short-term negative impacts to water quality from increased turbidity. However, at the time when fine sediment from Forest Management activities enters the water column, it may not be distinguishable from background turbidity in stream flows. At that time, fine sediment is being mobilized from the rest of the landscape and some of it is delivered to streams. As sediments are flushed from road surfaces, there could be some short-term increases in instream turbidity that would be dispersed within about 500 feet downstream from the source.

Roads and Landings. The above analysis of sediment delivery to streams from new roads at the scale of the planning area, used for modeling purposes an estimate of 66 miles of new road constructed under the PRMP in the first decade within a 200-foot sediment delivery distance to streams. The analysis concluded that there would be sediment reaching stream channels from these new road segments. At the individual project scale, it is unknown what proportion of new road construction, if any, would deliver fine sediment to stream segments occupied by ESA-listed fish. There are many variables such as road surface type, road slope, cross-drain spacing, ditch vegetation, and out-sloping. However, the BLM acknowledges that there may be some sediment delivery to stream channels from new road construction at a subset of Forest Management projects.

As stated above in the description of this PE, there are 100 road and landing BMPs (see Appendix C) and multiple Hydrology and Soils program direction (see Appendix A) that serve to minimize erosion and sediment delivery to water bodies from BLM road and landing activities.

Culvert replacements at stream crossings with flow at the time of the culvert would be a significant source of short-term turbidity. All culvert replacements would follow management direction and employ BMPs to reduce turbidity and introduction of fines directly to the stream channel. Culvert replacements for streams occupied by ESA-listed fish will follow the aquatic conservation measures (ACM) and project design criteria (PDC) in the BA for fish habitat restoration activities, also known as ARBA II (USDA FS et al. 2013). Similarly, road decommissioning and a variety of road erosion control activities done for Forest Management projects also will follow ACM and PDC of ARBA II. In addition, road maintenance actions would utilize PDC of the biological assessment known as the Western Oregon Programmatic (USDA FS et al. 2010). Both road decommissioning and road maintenance actions may result in fine sediment delivery to stream channels.

Activities such as road decommissioning, road maintenance and upsizing culverts during replacement would reduce erosion and the potential for catastrophic erosion events to deliver fine and coarse sediment to stream channels (e.g., a blow-out of a plugged culvert during a high flow event). This would have a beneficial effect to the indicator.

Overall, the BLM anticipates that there would be an adverse effect to the indicator from a subset of BLM road and landing activities. Effects would be short-term and localized.

Falling and yarding. Falling results in minimal ground disturbance. Yarding creates bare soil areas that may erode and result in sediment transport. Yarding activities that occur upslope from the Riparian Reserve are not anticipated to result in sediment delivery to stream channels because of vegetation and duff within the Riparian Reserve that will effectively capture that sediment. The following analysis describes potential effects from yarding activities occurring within the Riparian Reserve to the Sediment/Turbidity/Substrate indicator. Yarding activities are associated only with thinning in the outer zone of the Riparian Reserve.

There is much more bare soil created by ground-based skidding than by cable yarding. Ground-based yarding may occur within some areas of riparian thinning, and may have negative effects to the indicator. The following management direction from the Riparian Reserve LUA

section of Appendix A for both Moist and Dry Riparian Reserve would reduce the impacts of ground-based yarding to erosion and potential sediment delivery to stream channels.

- Do not operate ground-based machinery for timber harvest within 50 feet of streams (slope distance), except where machinery is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.
- Do not operate ground-based machinery on slopes >35 percent. Mechanical equipment with tracks (e.g., excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet (slope distance).

BMPs TH 1 to TH 24 would reduce the potential impact of ground-based skidding to erosion and potential sediment delivery to stream channels. They address Riparian Reserve inner zone exclusions, avoidance of hydric soils, use during low soil moisture periods, limiting designated skid trails to no more than 15% of the harvest unit area, location of skid trails to channel water away from water bodies, erosion control measures, waterbar construction, subsoiling to minimize surface runoff, and other measures.

The need for ground-based yarding is almost nil in the Eastside Management Area Riparian Reserve due to the low amount of thinning projected to occur under the PRMP. Should it be used, the following management direction specific to the Eastside Management Area Riparian Reserve for fish-bearing streams and perennial streams would reduce the potential for sediment delivery to stream channels as a result of ground-based yarding. The second bullet statement also applies to non-fish-bearing intermittent streams.

- Do not conduct thinning and other vegetation treatments using ground-based machinery within 75 feet (slope distance) on either side of the edge of the stream channel, as measured from the ordinary high water line.
- Do not conduct thinning and other vegetation treatments using ground-based machinery on slopes >35 percent, soils sensitive to displacement, rutting, or compaction, or in slide-prone areas.

Management direction for the Eastside Management Area Riparian Reserve of lakes, natural ponds and wetlands would reduce the potential for sediment delivery to stream channels as a result of ground-based yarding.

- Do not conduct thinning and other vegetation treatments using ground-based machinery within 50 feet (slope distance) on each side of the ordinary high water line of the water feature, or seasonally saturated soils (whichever is greatest).

The same BMPs listed above for the Riparian Reserve west of Highway 97 would serve to reduce the potential impact of ground-based skidding to erosion and potential sediment delivery to stream channels in the Eastside Management Area Riparian Reserve.

Cable yarding corridors spanning a stream channel are allowed within Riparian Reserves where there is no practicable alternative to accomplish resource management objectives. Creation of yarding corridors involves felling of trees in the corridor. There would be no yarding of trees from within the corridor as BMP TH 2 requires all wood felled for corridor construction be kept

in the Riparian Reserve. Therefore, there would be no soil disturbance or erosion yarding from within the corridor, except for yarding within the timber harvest unit boundary upslope.

Use of cable yarding (e.g. skyline systems) for thinning within the Riparian Reserve would have less erosion potential than ground-based systems. Erosion potential is greatest adjacent to the landing, as this is where the logs delivered from throughout the logging unit converge and contact the ground. Landings are typically located distant from streams. Erosion potential is limited within the logging unit to areas where logs initially drag on the ground for short distances before they are fully suspended. Because these are not heavy, large diameter logs the distance of drag and the width of the drag marks are small.

Helicopter yarding results in extremely limited ground disturbance, and therefore would not have meaningfully measurable effects to the Sediment/Turbidity/Substrate indicator.

Tree-tipping may result in some trees/logs being yarded to take them to other locations for purposes of aquatic restoration. The effects to the indicator are as described above for the different yarding methods. The majority of trees directionally felled towards streams or tipped over would not have direct meaningfully measurable effects to the Sediment/Turbidity/Substrate indicator. There may be indirect effects that occur later in time, as the trees in the stream channel would store or sort bedload sediment, or direct flow into streambanks that would result in increased short-term turbidity and sediment that would settle in the streambed at distances downstream.

A sub-set of tipped trees with intact root wads would have direct meaningfully measurable effects. Specifically, they are trees with roots integrated into the streambank. When the tree is tipped, sediment in and around the roots may enter the stream channel. Flows may be directed into the streambank by the rootwad that would cause further erosion, increased short-term turbidity and sediment that would settle in the streambed at distances downstream.

Vegetation and duff within the inner zones of the Riparian Reserve areas west of Highway 97, and undisturbed areas of the forest floor within Riparian Reserves east of Highway 97, would effectively capture much or all of the fine sediment from yarding activities. Regeneration cuts will not occur within Riparian Reserves, and no-cut buffers will act as effective filtering areas to prevent sediment delivery to stream channels from Forest Management activities within the Riparian Reserve. Rashin et al. (2006) evaluated the effectiveness of stream buffers to prevent sediment delivery to streams for two years post-harvest during a study of forest harvest BMPs in the state of Washington. Study sites were primarily logged second-growth stands. Harvest types included clear-cuts for even-aged management and partial-cuts for uneven-aged management. Yarding systems included ground-based and cable. Not all buffers in the study were no-cut; some tree harvesting did occur at a lower intensity within the buffer than upslope from the buffer.

Twenty-two sediment routing surveys were conducted. Average width of one-sided stream buffers ranged from 7 to 66 meters (23 to 217 feet). The average width of buffers in the sample was 25 meters (82 feet), and more than 75 percent of the buffers were between 10 and 35 meters (33 to 115 feet) wide. Average near stream hill-slope gradients ranged from 4 to 75 percent, with half of the study sites having average slopes of 36 percent or greater.

Rashin et al. (2006) concluded that the proximity of ground disturbance to streams is an important factor controlling sediment delivery. A buffer width of 10 meters (33 feet) appeared to be effective at preventing sediment delivery to streams. “Of 212 erosion features identified within 10 m of streams, 69 percent were found to deliver sediment during the first and/or second year following harvest. Conversely, when erosion features are farther than 10 m from streams, delivery is unlikely unless sediment is routed via concentrated drainage. Of 193 erosion features located greater than 10 m from streams, 95 percent did not deliver sediment.”

However, the BLM acknowledges that for a subset of timber management projects under the PRMP, there may be a short-term increase in fine sediment delivery to stream channels proximal to ESA-listed fish and to designated CH as a result of yarding activities.

The planning-area scale analysis presented earlier about the risk of landslide occurrence concluded that less than 1 percent of the Harvest Land Base would be susceptible to landslides with the potential to deliver sediment to streams over time under the PRMP. Without site-specific locations for any specific timber harvest proposal, it is not possible to quantify the risk of a landslide delivering sediment to a stream that would negatively affect ESA-listed fish species or designated CH.

Debris torrents and landslides are a source of sediment to streams, and the initiation points for them may occur at distances greater than 50-120 feet from a stream channel. However, this would be a relatively rare occurrence within a thinning project area. Thinning projects are typically located in plantations that are a result of regeneration (clear-cut) logging. If the site is predisposed to debris torrents or landslides that could deliver to stream channels occupied by ESA-listed fish species, it is likely that it would have occurred in the years following the initial logging. Furthermore, during interdisciplinary project planning for proposed harvest areas, areas identified as unsuitable for sustained yield timber production, such as unstable landforms, would be avoided (USDI BLM 1986). The BLM periodically adds such areas to the unsuitable classification through updates to the timber production capability classification system.

There would be a negative (adverse) effect to the indicator if a landslide occurs as a result of a Forest Management project, and it delivers sediment to a stream channel that would affect ESA-listed fish or designated CH.

<u>Timber haul.</u> Timber haul may result in measurable fine sediment delivery to streams occupied by ESA-listed fish. This may result in increased localized short-term turbidity in the water column and short-term increases in fine sediment in streambed substrate. Effects vary depending upon the duration of the haul, road surface, proximity of haul road locations to streams, connectivity to streams, road surface types and the length of the haul route. Effects are more likely to occur during wet weather haul. The following management direction from the Hydrology section of Appendix A would reduce the impacts of timber haul to the Sediment/Turbidity/Substrate indicator.

- Suspend commercial road use where the road surface is deteriorating due to vehicular rutting or standing water, or where turbid runoff is likely to reach stream channels.

In addition, BMPs R 94 to R 100 are designed to minimize sediment delivery as a result of wet season road use. BMPs address durable rock surfacing and rock depth, pre-haul road structural

treatments, snow removal, adding gravel approaches before entrance onto surfaced roads to minimize sediment tracking, and installing temporary culverts and washed rock on top of low water fords. See Appendix C for a verbatim description of each BMP.

Fuels treatment. Any of the following methods may be used to treat fuels (slash) generated by Forest Management projects: under burn, hand pile and burn, landing pile and burn, machine pile and burn, slash and scatter, and mastication. However, because of the width of the Riparian Reserve and the effectiveness of vegetation and duff within the Riparian Reserve to capture fine sediment from activities outside of the Riparian Reserve, it is fuels treatment that occurs within the Riparian Reserve that has the potential to affect the sediment/turbidity/substrate indicator.

The landing pile and burn technique would not affect the indicator as landings are typically well outside of the Riparian Reserve. Because there is a need to protect residual trees in the thinned stand, and steep slopes often prevent use of heavy machinery, the most common slash treatment types for residual fuels in the Riparian Reserve is hand pile and burn, and slash and scatter. Slash and scatter has no causal mechanism to affect the sediment/turbidity/substrate indicator. Slash piles created by the hand pile and burn treatment type typically have a small footprint (BMP F 8 limits piles to 16 feet in height or diameter) and the piles would be located outside of the inner zone of the Riparian Reserve west of Highway 97.

While there are no zones in the Eastside Management Area Riparian Reserve, there is nearly no thinning planned under the PRMP. There is none planned in the Lost River RU. For the Upper Klamath RU there is 3 acres for the decade beginning in 2043 and 2 acres for the decade beginning in 2053 (Table 41). The need for slash treatment would be almost nil.

Overall, the effect of fuels treatment to Forest Management generated slash is expected to not result in meaningfully measured effects to the sediment/turbidity/substrate indicator.

Post-harvest silvicultural treatment. Because of the effectiveness of vegetation and duff within the Riparian Reserve to capture fine sediment from post-harvest silvicultural treatments occurring upslope from the Riparian Reserve, the analysis here focuses on actions within the Riparian Reserve. There would be extremely limited post-harvest silvicultural treatment within the Riparian Reserve. Because there would be no regeneration harvest, there would be no need to plant trees, with the exception of planting on decommissioned roads and skid trails. Tree planting disturbs very little surface area of soil, and it is unlikely to be transported to stream channels because of other erosion control measures such as seeding and mulching. Pre-commercial thinning is associated with regeneration types of harvest, and that would occur outside of the Riparian Reserve. The stands being thinned would be located in the Riparian Reserve outer zone and would be of a sufficient age that there would not be a need to manually remove competing vegetation (that may result in some soil disturbance). Overall, the PE would have an insignificant effect to the indicator.

Summary of effects to sediment/turbidity/substrate

The potential sediment delivery to stream channels from the existing BLM road network and new road construction for the 1st 10 years under the PRMP was evaluated with a model for the entire planning area. The incremental increase in potential fine sediment delivery from new road construction over the 1st 10 years within the 200-foot sediment delivery distance at the scale of

the planning area is projected at 165 tons/year, an increase of 0.4 percent over the baseline. While this is a small incremental increase, the effect to ESA-listed fish species and designated CH at the scale of the entire planning area is not anticipated to be measurable or meaningful. The model results are likely to be an overestimate, as this model did not account for reductions in sediment delivery to stream channels as a result of road decommissioning under the PRMP. In addition, the model did not account for sediment reductions achieved through other road restoration and storm proofing activities, which are likely to be a substantial focus of future aquatic restoration efforts in the planning area.

The BLM evaluated the risk of landslides as a result of implementing the PRMP by measuring relative landslide density in the geographic information system mass wasting hazard model over a 50-year period within NetMap (Miller 2003, Miller and Benda 2005, and Miller and Burnett 2007a). The BLM added forecasts of future timber harvest to the NetMap model outputs, and assumed that regeneration harvest would increase the relative landslide density while commercial thinning would not affect landslide risk. The BLM evaluated relative landslide density only within the Harvest Land Base because the BLM would implement regeneration harvest only within the Harvest Land Base. The model did not include effects to landslide risk from new roads, because most new roads under all alternatives would be built on stable areas such as ridge top locations, and would mostly be short spurs to the existing collector roads. Model results indicate that the relative landslide density in the Harvest Land Base compared to intrinsic potential for the PRMP would be less initially and at each 10 year interval evaluated throughout the 50 year time frame than for the No Action alternative. This would have a beneficial effect to the potential for landslides as a result of timber management activities over the 50-year time period and at the scale of the planning area. In addition, less than 1 percent of the Harvest Land Base would be susceptible to landslides with the potential to deliver sediment to streams over time under the PRMP.

For a subset of Forest Management actions at the scale of an individual project, the analysis of effects to the indicator by PEs determined that there may be a localized increase in fine sediment delivery to streams proximal to ESA-listed fish. The BLM concludes that meaningfully measurable amounts of fine sediment may be delivered from several sources, including new construction for road segments within 200 feet of stream channels, roads used for wet season haul, and from ground-disturbing activities occurring within Riparian Reserves, such as road decommissioning and road maintenance (including culvert replacements) and in some instances, yarding. There is also an unquantifiable risk of a landslide or shallow debris torrent reaching a stream channel as a result of timber management activities. Sediment entering stream channels may negatively impact the fish habitat value of streambed substrate, including cobbles used for cover and spawning gravels, in the short-term until higher flows scour and disperse the fines downstream. It would also result in short-term increases in turbidity. Utilizing BMPs and management direction would minimize sediment delivery to stream channels.

The overall conclusion is that a subset of Forest Management actions would result in measurable negative (adverse) effects to the Sediment/Turbidity/Substrate indicator.

Water Temperature

The analysis that follows is a summary of that presented in the Hydrology section of the FEIS, and is incorporated by reference.

Background

Stream temperature variation depends upon a number of natural and management factors, including topography, forest vegetation, channel characteristics, streamflow, and climate (Caissie 2006). Water volume and stream width are important as mechanisms by which stream temperatures can fluctuate (Kibler 2007). As stream discharge increases, a fixed amount of solar energy is diluted and the resultant temperature change is decreased. As streams widen, the wetted surface area increases, which results in a higher absorption per unit volume of stream with a corresponding temperature rise.

The interactions controlling stream temperature in mountainous-forested landscapes are complex because simultaneous daily fluxes are occurring over a varying topography with steadily declining streamflow into summer. The temporal area of interest for this analysis is July to August, when clear sky days and solar radiation approach maximum levels. Direct solar radiation is the most important source of the energy budget affecting stream temperature gain at the water and streambed surfaces (Brown 1969, Beschta 1997, Moore and Wondzell 2005, Caissie 2006). During July to August, the sun's altitude is high (following the second horizontal green line from the top), as only the portion of forest canopy to the south in line with the suns daily path is involved. Sun blocking by stream banks or hill slopes in the path of the sun as well as understory brush and forest trees with varying canopy layers and densities produce shade for most daylight hours. There may be a few gaps where sunlight can reach the stream during the morning or afternoon hours, depending on the specific stand characteristics. However, at mid-day when the sun is near its zenith, solar radiation may reach the stream through overhead canopy gaps in the forest or overtop the highest trees shade angle, depending on tree height, setback distance, angular canopy density, and stream width. Small streams are well-shaded because the tree-to-tree spacing is close and canopies spread over the channel. As watershed area increases and streams widen to rivers with floodplains, linear gaps appear over the stream channel.

There are important interactions simultaneously occurring among stream direction (azimuth), topography, tree height, and density in blocking solar radiation. The natural environment poses an array of possibilities in assessing the transmission of solar radiation to the stream. Shade-blocking forest vegetation involves duration and quality. The duration of shade depends upon shade-producing vegetation in the path of the sun at any given time during the day as the sun's path and altitude changes. The quality of shade depends upon solar radiation transmission through forest canopies, where solar radiation decreases as leaf area index and forest density increases.

The 2008 RMP/EIS provides additional detailed background information on the effects of riparian forests on stream shading and is incorporated here by reference (USDI BLM 2008, pp. 336-34; Appendix I- Water, pp. 250-252).

At the reach scale, a loss in stream shade that would result in stream heating could induce non-lethal heat stress on juvenile or adult ESA-listed fish where stream temperatures already exceed ODEQ standards for fish use. This could include lowered disease resistance and reduced growth rates. Effects from canopy removal would be most noticeable in smaller headwater perennial streams that have a continuous canopy over the channel. Shade reductions on intermittent streams that are dry during the hotter summer months would not result in a measurable increase in stream temperatures or affect fish.

Larger order channels (>5th order) would have a sufficient buffer to temperature increases from the large volume of water that the overall effect on salmonids would be negligible (Poole and Berman 2001). Additionally, larger streams have more open canopy over the center of the channel and a small reduction in shade would represent a relatively small change in the overall amount of sunlight reaching the steam.

Analysis at the scale of the decision area

Analytical Methods

The analysis addresses stream shading along each side of fish-bearing and perennial streams on BLM-administered lands west of Highway 97. This analysis evaluates existing and projected forest vegetation that provides shade and maintains cool stream temperatures. Primary components of shade (forest tree height, canopy density, and Riparian Reserve width) form the basis of the analysis, rather than measuring stream temperature variation along watercourses directly. The physics of stream temperature gain or loss within forest streams is highly correlated to the extent and quality of shading vegetation (see Background section, above).

The PRMP defines overall Riparian Reserve widths, divided into an inner zone and an outer zone. The analysis assumed that the defined inner zone would be maintained unthinned and that restoration thinning would occur in outer zones.

The BLM used two different methodologies to evaluate stream shade. Method A determines the width of Riparian Reserves by empirical relationships necessary to provide 80 percent effective shade and relies upon previous work in the 2008 RMP/EIS (USDI BLM 2008). Effective shade is the percentage of sun blocking by topography, forest trees, and vegetation during a solar day. Effective shade reaches an upper limit in the 80 to 90 percent range for normally-stocked young to mature forest stands (USDA FS and USDI BLM 2012). During daylight hours in the summer months when stream heating is a concern, the sun's altitude (vertical zenith angle) and horizontal position (azimuth) change constantly directing solar radiation down to the earth's surface. Solar radiation intensity at the water surface varies with the sun's altitude, azimuth, and cloud cover, diminishing with blocking by topography and reflection or adsorption by forest tree crowns (Brazier and Brown 1972, Boyd 1996). The sun's path length through vegetation decreases transmissivity, particularly where leaf area is high (DeWalle 2010). Where the solar angle exceeds the forest shade angle from the tallest trees, solar radiation will reach the water body (Boyd 1996). When varying angular canopy density is summed for the primary daytime hours and weighted for the proportion of incoming solar radiation blocked for each time period, an estimate of effective shade is obtained. Angular canopy density is the sun-blocking

vegetation in the path of the sun from 10 a.m. to 2 p.m. (Brazier and Brown 1972). For normally stocked young to mature forest stands, forest shade tends to reach a maximum near 80 percent effective shade, where increasing the width of the Riparian Reserve further only marginally improves effective shade. Gaps in forest vegetation as well as the quality of shade from needles, leaves, tree-branches and boles, even in mature forest stands, prevent much higher measures of effective shade. There is always some solar radiation transmissivity to the water surface through needles and leaves and over the tallest trees, especially near solar noon.

Method A compares the Riparian Reserve allocation of the PRMP to a 60-foot width inner area and 50 percent canopy closure zone to one site-potential tree height width[17] (USDI BLM 2008, Appendix I – Water, pp. 250-253) along each side of perennial and fish-bearing streams. Analytical conclusions determine the miles of perennial and fish-bearing streams that are not substantially similar by HUC 12 watershed. Streamside forests reach a shade limit in the range of 60- to 100-feet width. Wider Riparian Reserves would provide no further shade benefit, because the solar path lengths through forest vegetation are sufficiently long, where direct beam solar radiation has already been extinguished (DeWalle 2010). A disadvantage of Method A is that it considers a uniform management prescription in the outer zone. The empirical relationships in Method A do not consider angular canopy density that blocks sunlight outside the 10 a.m. to 2 p.m. daily period. However, this design has a negligible effect on decreasing effective shade, because incoming solar radiation intensity is significantly lower during early morning and late afternoon hours, mountainous topography provides shade at these hours, and longer solar path lengths through the sides of forest trees are extinguishing available solar radiation (Boyd 1996, DeWalle 2010). Method A basis does not crosswalk with water quality studies and models to determine if temperature changes are occurring from before-after management activities. Rather, Method A uses an approach that establishes effective shade that is near potential natural shade, based on empirical relationships by Brazier and Brown (1972) and Steinblums *et al.* (1984).

Method B, proposed by the Environmental Protection Agency, presents a mechanistic modeling approach that uses the ODEQ shade model to develop shade loss tables for the Riparian Reserve design. The rationale uses a before-after-control-impact design, where observed changes in stream temperature are due to the difference between pre-harvest and post-harvest monitoring (Groom *et al.* 2011). The EPA methodology considers whether various widths and canopy cover densities in inner and outer zones of the Riparian Reserve would result in shade loss associated with management that would increase stream temperature. Although Groom *et al.* (2011) determined that levels less than six percent shade loss would have no statistical effect on raising stream temperatures, the EPA has proposed an analytical threshold of no greater than three percent shade loss level, to allow for a factor of safety. In this analysis, shade loss levels greater than three percent would represent a risk of stream temperature increases. This analytical threshold does not represent a specific requirement for management, but an analytical tool for interpreting the results of this analysis.

[17] Site-potential tree height generally varies from 140 to 240 feet width in the planning area.

BLM cross-walked shade density from the ODEQ shade model to canopy cover in the Woodstock model to provide a common attribute in addition to riparian area width to evaluate the PRMP using the EPA shade loss tables. The change is necessary because modeled canopy cover measures have removed tree-to-tree overlap that influences canopy density and shade. Results from modeled canopy density underestimate field measured canopy cover. Fiala *et al.* (2006) found that modeled canopy cover is consistently lower when compared to field measurement of canopy cover and suggest that a regression equation is best to compare measurements of canopy cover. McIntosh *et al.* (2012) compared modeled canopy cover results with a ground-based estimate of canopy cover and reported that equations underestimated cover by 17 percent on average at high cover levels (greater than 70 percent) in wet conifer and wet hardwood stands. Using this approach, the BLM used field measured canopy cover along selected streams from western Oregon districts to form a regression equation (Figure 41) between pre-harvest vegetation density (shown in the EPA shade loss tables) and canopy cover. The EPA reviewed this regression equation, and provided field measured studies that support the interpretations. This is a modification of the analytical methodology described in the Planning Criteria (USDI BLM 2014, pp. 68-72).

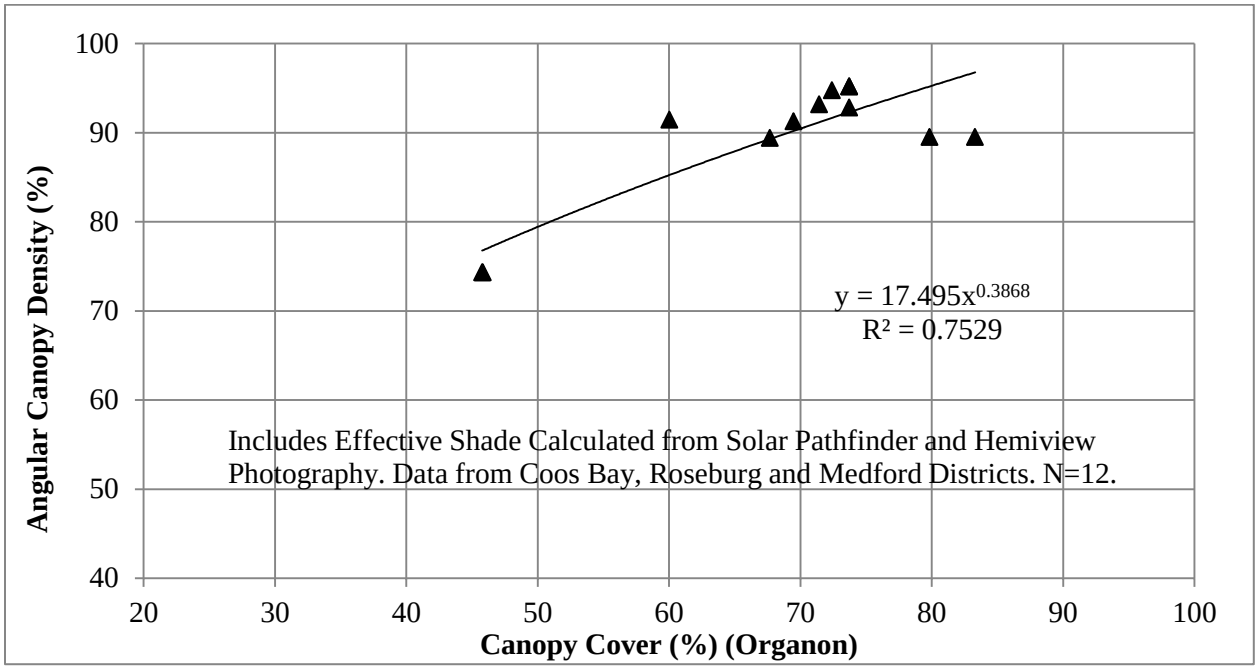
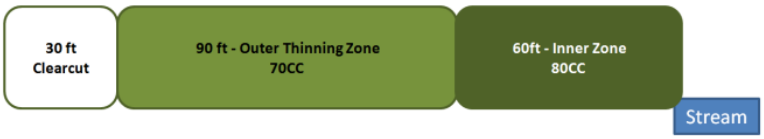
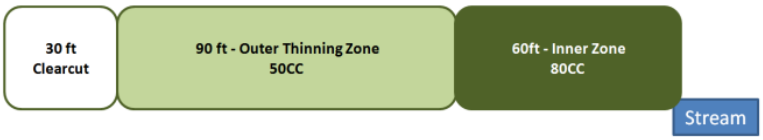
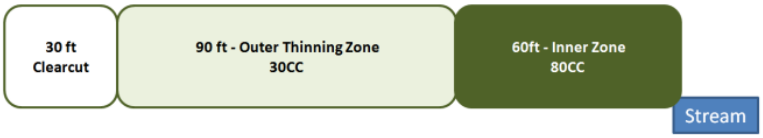
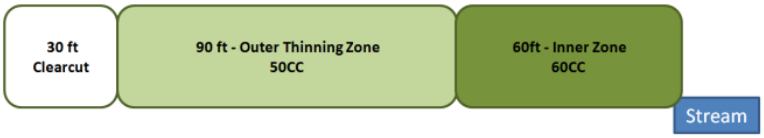
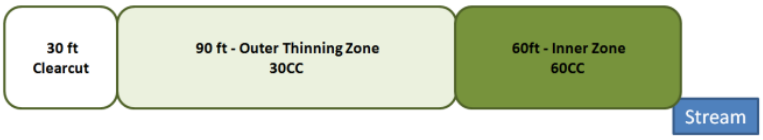
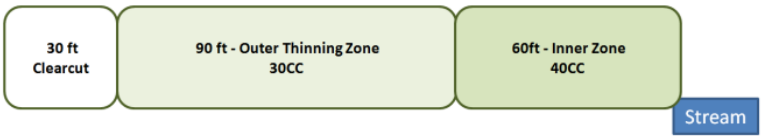


Figure 41. Canopy cover and angular canopy density in forest stands.

In this analysis, the BLM and EPA calculated shade lost from the combination of the existing canopy density of the inner zone and the outer zone with the PRMP's management direction to retain a specific threshold of canopy cover (Table 147). In this analysis, the BLM and EPA divided fish-bearing and perennial streams into 0.25-mile segments and then merged with the Woodstock model canopy cover by decade until 2063 for the Riparian Reserve design. This methodology ignores the small amount of canopy cover overlap at stream segment nodes and at stream junctions. To apply these shade loss tables spatially, the BLM tracked the changing inner zone canopy cover, along each side of fish-bearing and perennial streams for each decade until

2063, and applied the outer zone canopy cover for purposes of reading the EPA shade loss tables. In this way, the BLM calculated the miles of fish-bearing and perennial streams that would exceed 3 percent shade loss until 2063. This is a modification of the analytical methodology described in the Planning Criteria (USDI BLM 2014, pp. 73-75).

Table 147. Modeled shade loss for a 150-foot-wide Riparian Reserve, with a 60-foot inner no harvest zone, at various thinning intensities and initial canopy conditions (EPA 2014).

Scenario (Two Sided Treatments)	Stream Aspect			
	North South	NW/SE	East West	Average
Pre-harvest Condition - 80% Canopy Cover				
	1.3	1.1	0.9	1.1
	2.6	1.9	1.3	1.9
	4.4	3.0	1.6	3.0
Pre-harvest Condition - 60% Canopy Cover				
	5.7	4.9	5.6	5.4
	9.7	7.7	6.9	8.1
Pre-harvest Condition - 40% Canopy Cover				
	13.8	12.7	16.2	14.2

Modeling design and constraints over a large plan area prevent varying of certain factors known to influence shade. With either method, assumptions about tree heights cannot vary spatially. The BLM calibrated Method A with tree heights for mature to old-growth forest stands. The BLM and EPA calibrated Method B with tree heights for forest stands 50- to 70-years-old. Neither method considers terrain slope and the positive effect of topographic shade during early morning and late afternoon hours. Method A ignores solar radiation outside of 10 a.m.to 2 p.m. In contrast, Method B may overestimate shade loss by not considering topographic shade. Method B tracks stream orientation in shade loss outputs, while Method A does not. However, Method A provides a design that averages all stream orientations where solar radiation can vary in the path of the sun. Both methods do not consider tree set back distance from the stream that may increase solar radiation or the shading effects of understory brush or stream incision. Method A uses a uniform Riparian Reserve design, emphasizing greater than 80 percent effective shade where there is at least a 60-foot inner zone, without any particular prescription constraints in the outer zone. Method B accounts for variable management actions and variable canopy cover density in the inner and outer zone. Method B does not identify an actual reduction in stream shading, but a susceptibility to such a reduction in stream shading if the BLM were to thin the outer zone along certain streams.

Both Methods A and B assume for analytical purposes that regeneration harvest has removed canopy cover outside of all Riparian Reserves. Although this assumption is not realistic, because the majority of the decision area would be in reserves and planned regeneration harvest within the Harvest Land Base would be spread out temporally and spatially across the Harvest Land Base under all alternatives. However, this assumption is unlikely to affect the analytical conclusions under Methods A or B; studies and modeling suggest that direct solar radiation from outside of riparian buffers of the widths allocated in the alternatives does not increase shade loss at the stream, because solar radiation has already been reflected, adsorbed or otherwise extinguished by forest vegetation inside the riparian buffer.

The Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 65-75).

Results

There are 6,970 miles of fish-bearing or perennial streams where forest management within the outer zone of the Riparian Reserve would potentially affect stream temperature. The PRMP Riparian Reserve design for Class I, II and III would maintain an unthinned 120-foot width inner zone, which would overlay the primary shade zone and the secondary shade zone. The inner zone alone would be sufficient to avoid reduction in stream shading under Method A. Nevertheless, the PRMP also includes an outer zone to one site-potential tree height in which any thinning would maintain at least 30 percent canopy cover and 60 trees per acre. The outer zone would provide a high protection to the inner zone for blow-down at the edge of the Riparian Reserve.

Utilizing Method B, under the PRMP there would be 5.9 to 38.1 miles by decade of fish-bearing or perennial streams that would be susceptible to shade reductions that could affect stream temperature if the BLM applies thinning in the outer zone of the Riparian Reserves over a 50-

year time frame (Table 148). The highest number by decade (38.1) is approximately 0.5 percent of the 6,970 total miles of fish-bearing or perennial streams.

Table 148. Predicted miles of perennial or fish-bearing streams susceptible to water temperature increases by thinning in Riparian Reserves by decade in the entire PRMP planning area using Method B.

Decade	2013	2023	2033	2043	2053	2063
Miles	33.8	38.1	7.0	7.1	5.9	7.1

The predicted miles by ESA-listed salmon ESU, steelhead DPS, sucker RU and within the McKenzie River basin bull trout analysis area are shown in Table 149.

Table 149. Predicted miles of perennial or fish-bearing streams susceptible to water temperature increases by thinning in Riparian Reserves by decade using Method B by fish species geographic area.

ESU/DPS/RU	Miles of Perennial or Fish-bearing Streams Susceptible to Water Temperature Increases by Thinning by Decade					
	2013	2023	2033	2043	2053	2063
LCR Chinook salmon	0.3	0.3	0	0.3	0	0
LCR coho salmon	0.3	0.3	0	0.3	0	0
LCR steelhead	0.3	0.3	0	0.3	0	0
OC coho	6.0	8.8	3.4	1.1	0.6	2.0
SONCC coho	24.2	25.9	2.6	4.7	4.0	3.7
UWR Chinook	1.2	0.9	0.8	0.8	0.8	1.2
UWR steelhead	1.4	1.1	1.0	1.0	1.0	1.4
McKenzie River Basin bull trout	0	0	0	0	0	0
Lost River RU suckers	0	0	0	0	0	0
Upper Klamath RU suckers	2.0	2.0	0	0	0	0

The most miles per decade of perennial or fish-bearing streams predicted to be susceptible to water temperature increases by thinning are in the SONCC coho salmon ESU. It is 25.9 miles for the decade 2023-2032. However, to put this in context, the total Riparian Reserve acres for perennial or fish-bearing streams in the SONCC coho salmon ESU is 53,342. Of the 53,342 acres, the BLM model predicts 391.3 acres per year would be thinned for the 2nd decade. Assuming for analytical purposes that a site potential tree height averages 200 feet, and a stream channel width for a perennial or fish-bearing stream averages 20 feet, then the total width of the Riparian Reserve would be 420 feet (200 feet on each side of the stream plus the 20 foot channel width). An acre of Riparian Reserve would have a stream length of 104 feet (43,560 square feet per acre divided by 420 feet). A mile of stream would be equivalent to 50.8 acres of Riparian Reserve (5,280 feet per mile divided by 104 feet stream length per acre). Therefore, there would be approximately 1,050 miles of Riparian Reserves of perennial or fish-bearing streams in the SONCC coho ESU (53,342 acres divided by 50.8 acres per mile).

The most miles that would be susceptible to temperature increases from thinning is 25.9 miles out of 1,050 total miles in the decade beginning in 2023. The BLM harvest model predicts that 391.3 acres of perennial or fish-bearing streams would be thinned in that decade. The thinning would only occur in the outer zone, from 120 feet to site-potential tree distance, assumed here to average 200 feet. An acre would be equivalent to about 545 feet linear distance along one side of the stream (43,560 square feet per acre divided by 80 feet). A mile of thinned Riparian Reserve would be about 9.7 acres (5,280 feet per mile divided by 545 feet per acre. The miles thinned in the 2nd decade would be about 40.3 miles of the 1,050 total miles of Riparian Reserve for fish-bearing or perennial streams in the SONCC coho salmon ESU. There is about a 4 percent chance (40.3 miles out of 1050 miles) that a specific stream mile that is susceptible to a water temperature increase by thinning, would be thinned in that decade.

Using Method B, the shade loss thresholds are exceeded most frequently where the forest canopy density is < 60 percent in the 60-foot no harvest zone. Even if the outer zone adjacent to an inner zone with low canopy cover were to be thinned, not all of the susceptible reaches would be treated in a given year and as some reaches are treated other reaches would recover, reducing the overall effect of canopy removal. The unharvested condition of the inner zone, regardless of initial canopy cover, would reduce the miles of susceptible steams in future time periods, until a relatively constant canopy cover would be attained, commensurate with mature or structurally complex riparian forests. This is why stream mileage susceptible to shade reductions would decline within the first 20 years under the PRMP, and then would remain relatively constant in future decades.

Method B identifies 5.9 to 38.1 miles of fish-bearing and perennial stream miles under the PRMP that would be susceptible to shade loss that may result in measurable increases in water temperature if the outer zone of the Riparian Reserve were to be thinned. However, without site-specific information for any specific riparian thinning project that includes the proximity to ESA-listed fish species and designated CH, as well as the magnitude of the project (the linear distance of the Riparian Reserve outer zone treated), and whether or not any of the miles projected to be thinned would include any of the miles predicted to be susceptible to water temperature increases by thinning, the effects at the scale of the planning area cannot be precisely predicted.

Analysis at the scale of a site-specific timber management project

There is no causal mechanism for the Timber Haul PE to affect shade canopy and water temperature, and it will not be analyzed further. The BLM makes an assumption that any Forest Management actions outside of a Riparian Reserve would not impact shade canopy to a stream and therefore would not affect water temperature. The analysis that follows concentrates on activities occurring within the Riparian Reserve.

Roads and Landings. The above analysis of sediment delivery to streams from new roads at the scale of the planning area, used for modeling purposes an estimate of 66 miles of new road constructed under the PRMP in the first decade within a 200-foot sediment delivery distance to fish-bearing or perennial streams. The 200-foot distance is approximately equivalent to a site potential tree height; the width of a Riparian Reserve with the exception of the Riparian Reserve for non-fish bearing intermittent streams in Class III subwatersheds. The 66 miles will be used as an approximation of how many miles of road may potentially remove shade canopy within a Riparian Reserve.

As described above for the analysis of effects to water temperature at the scale of the planning area, shade reductions on intermittent streams that are dry during the hotter summer months would not result in a measurable increase in stream temperatures or affect fish.

At the individual project scale, it is unknown what proportion of the projected 66 miles of new road construction within the 200-foot distance to perennial or fish-bearing streams, if any, may reduce shade canopy to stream segments occupied by ESA-listed fish. There are many variables such as the orientation of the road to the sun's path (is the road between the sun and the stream), the distance within the Riparian Reserve between the road and the stream, and the length of the road within the Riparian Reserve. It is ~~extremely~~ unlikely that any new road or landing construction would occur within the inner zone of a Riparian Reserve. BLM recent experience is that most road construction or renovation to provide access for Riparian Reserve thinning projects occurs in what would be the outer zone, or entirely outside of the Riparian Reserve. Most of the road construction is short spur roads.

The likelihood that any new road/landing construction for an individual timber sale may occur within the outer zone of a PRMP Riparian Reserve that may coincide with any of the perennial or fish-bearing stream segments with riparian areas susceptible to shade loss that may result in a water temperature increase is very low. At the planning area scale, only 0.5 percent (38.3 miles of a total of 6,970 miles) of all perennial or fish-bearing streams were determined to be susceptible to a water temperature increase by outer zone thinning by Method B and none by Method A. The BLM assumes that the same percentage would apply to stream segments susceptible to a water temperature increase by new road construction in the outer zone. The 0.5 percent is an overestimation of the effects to ESA-listed fish, as some of the 38.3 miles may not occur where it may measurably increase water temperature in stream reaches occupied by ESA-listed fish or contain designated CH.

Falling and yarding. Given the information presented in Table 149 above, at the scale of ESA-listed fish geographic areas, there would be no risk of a water temperature increase from thinning in the outer zone of the Riparian Reserve for fish-bearing or perennial streams in the Lost River RU for Lost River sucker and shortnose sucker, or for the McKenzie River basin bull trout analysis area. Given the very low miles of fish-bearing or perennial streams susceptible to water temperature increases, and the low acres of projected Riparian Reserve thinning within the first decade under the PRMP, there is an extremely low probability that thinning would take place that may result in a measurable increase in water temperature.in the following ESUs, DPSs and RUs: LCR Chinook salmon; LCR coho salmon; LCR steelhead; UWR Chinook salmon; UWR steelhead; in the Upper Klamath; and, OC coho salmon. There would be a low probability in the SONCC coho salmon ESU. Shade would be protected in the Eastside Management Area LUA. Management direction for fish-bearing and perennial streams there requires the BLM to "Retain and promote long-term site-potential shade conditions."

Should thinning take place in a susceptible stream reach, a loss in stream shade that would result in stream heating could induce sub-lethal heat stress on ESA-listed fish species in areas where stream temperatures already exceed ODEQ standards for fish use. Sub-lethal effects may manifest as lowered disease resistance, reduced growth rates and migrating to areas with cooler water temperatures (potentially resulting in competition for space with other individuals).

Effects from canopy removal would be most noticeable in smaller headwater perennial streams that have a continuous canopy over the channel. Shade reductions on intermittent streams that are dry during the hotter summer months would not result in a measurable increase in stream temperatures or affect fish.

Larger order channels (>5th order) would have a sufficient buffer to temperature increases from the large volume of water that the overall effect on salmonids would be negligible (Poole and Berman 2001). Additionally, larger streams have more open canopy over the center of the channel and a small reduction in shade would represent a relatively small change in the overall amount of sunlight reaching the steam.

Fuels treatment. Fuels treatment that occurs within the Riparian Reserve has the potential to affect the water temperature indicator. The mechanism would be loss of shade to stream channels as a result of fuel treatments. Because there is a need to protect residual trees in the thinned stand, and steep slopes often prevent use of heavy machinery, the most common slash treatment types for residual fuels in the Riparian Reserve are hand pile and burn, and slash and scatter. Slash and scatter has no causal mechanism to affect the water temperature indicator.

Burning of slash has the potential to kill an existing tree and affect shade. However, a slash pile created by the hand pile and burn treatment type typically has a small footprint (BMP F 8 limits piles to 16 feet in height or diameter), would be located in the outer zone of the Riparian Reserve, and the piles are placed in openings that would not have many existing live trees that could be killed by the burning pile. The likelihood that any burn piles would kill trees or other vegetation that provides shade to a perennial or fish-bearing stream channel is very low. The likelihood that this would occur in a stream reach susceptible to a water temperature increase is also very low (0.5 percent of all miles of perennial or fish-bearing streams in the planning area by method B; none by method A). Considering the compounding effect of low likelihood of

killing shade vegetation on a very small footprint, and a very low likelihood of occurring within a susceptible stream reach, the overall effect to the indicator by the PE is discountable.

Post-harvest silvicultural treatment. Within the Riparian Reserve, there would be extremely limited post-harvest silvicultural treatment, and none that would affect shade canopy over streams. Because there would be no regeneration harvest, there would be no need to plant trees, with the exception of planting on decommissioned roads and skid trails. However, because these activities would be outside of the inner zone, effects to the water temperature indicator would be discountable. Pre-commercial thinning is associated with regeneration types of harvest, and that would occur outside of the Riparian Reserve. The stands being thinned would be located in the Riparian Reserve outer zone and would be of a sufficient age that there would not be a need to manually remove competing vegetation. Spot-fertilizer use may have a beneficial effect on growth of trees, but its use is so limited and distant from stream channels that its effect on potential shade is discountable. Overall, the PE would have a discountable effect to the indicator.

Summary of effects to water temperature

The BLM analyzed stream shading using two models. By Method A, PRMP Riparian Reserve thinning in the outer zone would avoid any measurable increases in stream temperature. Results from Method B identified approximately 0.5 percent of fish-bearing and perennial streams in the planning area where forest management (thinning) in the Riparian Reserve outer zone of fish-bearing or perennial streams under the PRMP would potentially affect stream temperature.

Without site-specific information on the proximity and magnitude of any future riparian thinning project and associated road construction to ESA-listed fish species and designated CH, it is speculative to determine if there would be a measurable effect to shade and water temperature at either the planning area scale or at the site-specific scale. The probability of thinning or new road construction within a susceptible stream reach is very low, based upon the low (or in two cases, no) miles of such streams within each ESU, DPS, RU or in the McKenzie River bull trout analysis area, the low acres of thinning projected within the Riparian Reserve, and the small number of miles of Riparian Reserve thinning used for modeling purposes at the scale of the planning area.

It should be noted that monitoring over the last 20 years of NWFP implementation has detected statistically significant improving trends in watershed yearly seven-day average water temperatures (USDA FS and USDI BLM AREMP), suggesting that Forest Management activities on Federal lands, including riparian thinning actions, have not resulted in water temperature increases in this timeframe. This is important to note, because past riparian thinning treatments were much closer to perennial streams, and consisted of heavier thinning actions than what is currently proposed in the PRMP. Based upon the results of NWFP monitoring, the results of the water temperature modeling efforts presented above at the planning area scale, and the PE analysis, the BLM concludes that the risk of future PRMP Forest Management actions resulting in measurable increases to water temperatures where it may affect ESA-listed fish species or designated CH is virtually non-existent, and the conclusion is a discountable effect to the water temperature indicator.

Peak and Base Flows

Background

Increased frequency and severity of flood flows during winter can affect over-wintering juvenile fish and eggs incubating in the streambed. Eggs of fall and winter spawning fish, including Chinook salmon and bull trout, may suffer higher levels of mortality when exposed to increased flood flows (Jager et al. 1997). Scouring of the streambed can dislodge the eggs (Schuett-Hames et al. 2000) and elevated sediment transport caused by high flow can increase sediment deposition in redds, suffocating eggs (Peterson and Quinn 1996). Spring spawning fish, such as steelhead and cutthroat trout, also may suffer increased egg mortality due to dewatering of redds caused by earlier snow melt runoff (Jager et al. 1997). Shifts in the timing and magnitude of natural runoff will likely introduce new selection pressures that may cause changes in the most productive timing or areas for spawning.

Ongoing low intensity storms are common in the planning area, but occasional intense storms will produce a storm depth of more than 6 inches of precipitation in 24 hours (NOAA 1973). These storms generate peak flows that may overflow banks and cause channel changes, with a return frequency of 2 to 100 years.

Experimental subwatershed studies in hydrology demonstrate elevated peak flows during flood-producing storms when a high proportion of timber basal area has been removed by forest harvest (Figure 42), particularly within rain-on-snow watersheds (Grant *et al.* 2008). As the proportion of forest stand harvest increases within a watershed, evapotranspiration, direct interception, and potential for fog drip declines, while the potential for snow accumulation and melt increases. Snow accumulates faster in openings, but is also susceptible to elevated snowmelt rates compared to a forest (Harr 1981, Harr and Coffin 1992). Storm flow causes runoff along road surfaces into drainage ditches or upon fills, while subsurface routes may be day-lighted in road cuts or flow paths cut off or modified under the road surface. This can result in quicker runoff into stream channels during storms where ditch lines connect, compared to slower subsurface flow routes (Harr 1976, Harr *et al*. 1979, Megahan *et al.* 1992, Wemple *et al.* 1996). As storm intensity increases, runoff would more fully synchronize, contributing to peakflows (Megahan and Kidd 1972, LaMarche and Lettenmaier 2001, Luce 2002, Wemple and Jones 2003).

Likelyhood of peak flow increase (High ← → Low)			Potential considerations
High	Moderate	Low	Road density
All or most	Some	Few or none	Road connectivity
Fast	Moderate	Slow	Drainage efficiency
Large	Small	Thinned	Patch size
Absent	Narrow	Wide	Riparian buffers

Figure 42. Site conditions and treatments for risk of peak flow increase. Source: Grant *et al*. 2008 PNW-GTR-760 p. 40.

There has been a long debate regarding the magnitude of peak flows resulting from timber harvesting and road building. The 2008 RMP/EIS contained a review of the research and debate over peak flows (USDI BLM 2008, pp. 357-359), which is incorporated here by reference.

There are 1,203 subwatersheds within the planning area. When separated by hydroregion, 679 subwatersheds are predominately rain-dominated, 96 subwatersheds are predominately rain-on-snow-dominated, 163 subwatersheds are predominately snow-dominated and 265 subwatersheds have proportions of each hydroregion. Figure 43 shows the proportion of subwatersheds by hydroregions in the planning area.

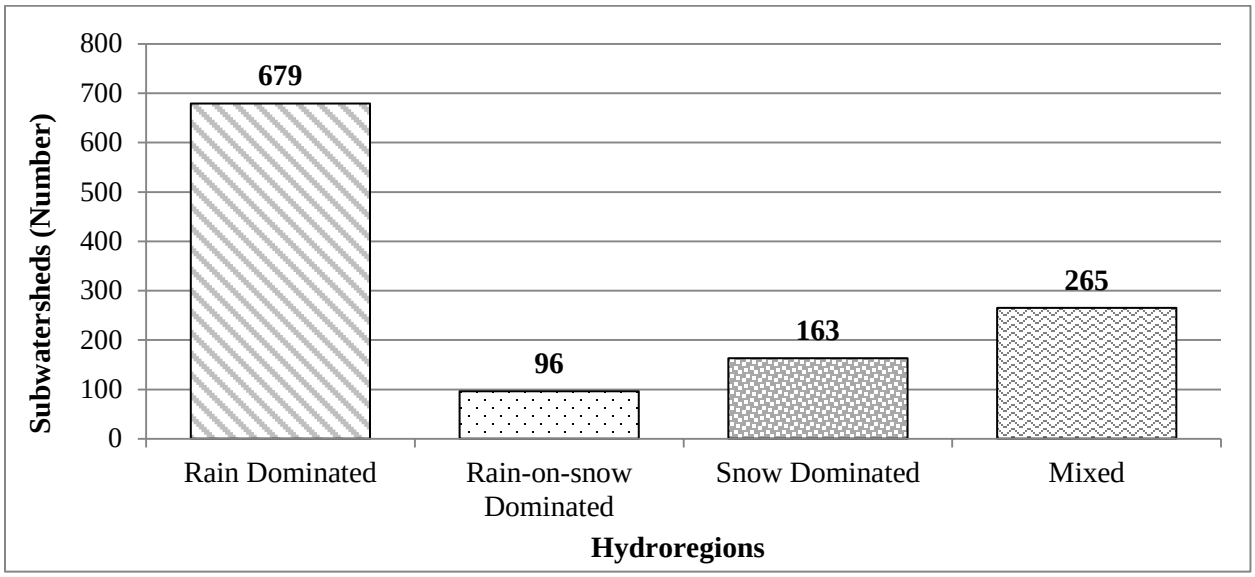


Figure 43. Number of subwatersheds by hydroregions in the planning area.

Of the 96 subwatersheds (3 percent) in the decision area that are rain-on-snow dominated, 38 subwatersheds include BLM-administered lands, for 197,709 BLM-administered acres. These intermediate elevations in rain-on-snow subwatersheds are analyzed with the methodologies

presented in the Planning Criteria, and they range in area from 3,300 to 27,400 acres, with a mean size of 15,500 acres and an area of 591,626 acres.

Figure 44 shows the potential sediment transport and channel scour by channel gradient and stream type for 1-6 year recurrence interval peak flows from forest management and roads. Gravel bed channel types with a 1 to 2 percent gradient are most likely to be affected for any detected peak flow increase from forest management and roads. Generally, these gravel bed stream types are a small proportion of total stream miles (less than 10 percent) in any subwatershed in the decision area. Most streams in the decision area are cascade or step-pool channel types. The predominance of cascade or step-pool channel types and the general absence of sand-bed channel types in the decision area reduces the likelihood that any peak flow increases would result in changes to channel structure in the decision area.

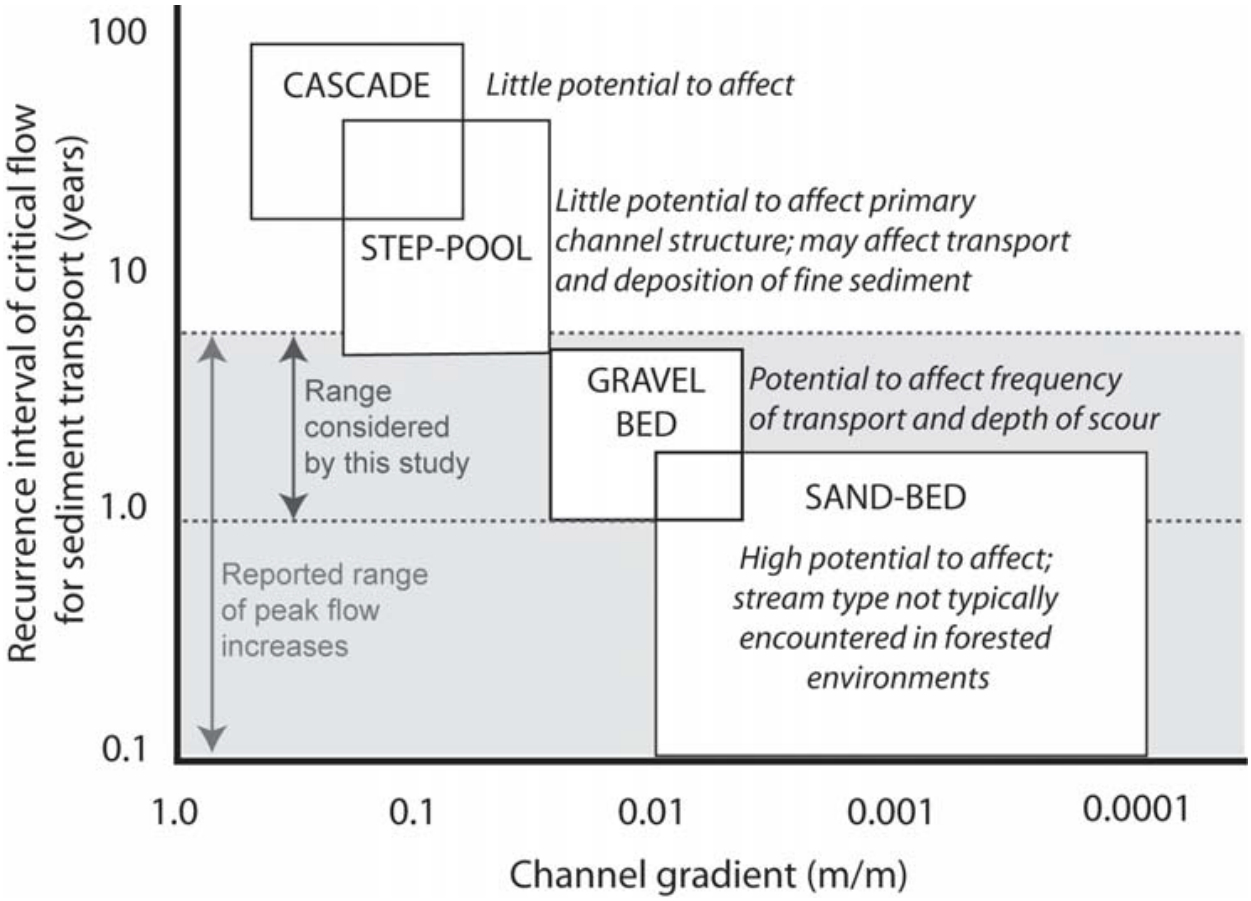


Figure 44. Sediment transport by return period and stream type.

Source: Grant *et al.* 2008 PNW-GTR-760 p. 43.

Analysis at the scale of the decision area

The analysis that follows is a summary of that presented in the Hydrology section of the FEIS, which is incorporated by reference.

Analytical Methods

Peak stream flows occur infrequently in the planning area, normally from November and February, but carry the majority of the sediment load with high stream energies that may erode and change channel form (Cooper 2005). Peak flows from storm events with a return interval of 1 year or greater have the capacity to mobilize sediment and bed load transport (Andrews 1983 and 1984). Timber harvesting and associated activities alter the amount and timing of peak flows by changing site-level hydrologic processes (e.g., surface flow, sediment movement) (Keppeler and Ziemer 1990, LaMarche and Lettenmaier 1998, Wemple and Jones 2003, Wright *et al.* 1990). Grant *et al.* (2008) concluded that field reviews do not provide evidence that timber harvesting increases peak flows for storms with return intervals longer than 6 years, because the storm event is strong enough that forest management is not an influencing factor in peak flows. Therefore, peak flow storms with 1- to 6-year return intervals reflect the range for measuring the impacts on peak flows from timber harvest.

Hydroregions are a classification of landscapes based on the precipitation type and longevity. Hydroregions in western Oregon distinguish predominant precipitation type during the winter months that generally correspond to elevation and latitude. Within the planning area, there are three hydroregions: rain, rain-on-snow (or transient snow zone), or snow hydroregions. The rain hydroregion is generally below 2,000 feet in elevation in the Coast Range. This hydroregion includes valleys up to 1,200-3,600 feet in elevation from north to south along the western Cascades, from the Columbia River to the California border. The rain-on-snow hydroregion, where shallow snow accumulations come and go several times each winter, are 1,200-3,600 feet in elevation in the northern Oregon Cascades, gradually rising to 2,500-5,000 feet in elevation in the southern Oregon Cascades. The snow hydroregion is generally above 3,600 feet in elevation, and it is centered along the Cascades crest.

This issue presents an analysis of the cumulative effects on peak stream flows of past, present, and reasonably foreseeable future actions, including both land management on BLM-administered lands and non-BLM-administered lands.

In this analysis, the BLM addressed effects on peak flows in the rain-on-snow hydroregion only, because there is little evidence that the forest harvest activities can elevate peak flows in the rain hydroregion or snow hydroregion (Grant *et al.* 2008). The 2008 RMP/EIS includes a more detailed discussion of the effects of timber harvesting in the rain-dominated watersheds (USDI BLM 2008, pp. 352-354), which is incorporated here by reference.

The BLM addressed effects on peak flows at the subwatershed level (Hydrologic Unit Code 12, previously termed “sixth-field” watershed).[18] Subwatersheds are generally 10,000-40,000 acres in size and have a single outlet. The BLM selected the subwatershed scale for this analysis, because it better captures the BLM forested land pattern at closer to a site scale. The subwatershed scale is more sensitive to vegetation and runoff-related changes. In this analysis, the BLM addresses subwatersheds that meet the following three criteria:

[18] Hydrologic Unit Codes are a U.S Geological Survey classification based on a national standard to define systems through hierarchy.

- BLM-administered lands are more than 1 percent of the subwatershed;
- The subwatershed has more than 100 acres of BLM-administered lands in the rain-on-snow hydroregion; and
- More than 60 percent of the subwatershed is in the rain-on-snow hydroregion.

In this analysis, the BLM calculated the total open area from forest harvest and roads for all lands in rain-on-snow subwatersheds as a percent of the total subwatershed area by decade. The BLM then refined open area percentage by factoring harvest unit opening percentages based on treatment type in these rain-on-snow hydroregion and compared these to the response curve (Grant *et al.* 2008). Total open area in this analysis was comprised of:

- Early-successional structural stage from the Woodstock model for BLM-administered lands,
- Early-successional forest from the Landscape, Ecology, Modeling, Mapping and Analysis (LEMMA) for non-BLM-administered lands
- Road area for all lands

The BLM has made three modifications from the analytical methodology described in the Planning Criteria. First, the BLM only addressed subwatersheds that are predominately rain-on-snow, with more than 60 percent of the subwatershed in the rain-on-snow zone. This is a change from Step 1 of the Analytical Methods in the Planning Criteria, which included all subwatersheds with any amount of the rain-on-snow hydroregion. Only subwatersheds that are predominately rain-on-snow are appropriately compared to the Grant *et al.* (2008) response curve.

Second, the BLM used change detection methods rather than rule set described in Step 3 in the Planning Criteria to calculate the early-successional forest on non-BLM-administered lands. Using the Landscape, Ecology, Modeling, Mapping, and Analysis (LEMMA) satellite imagery and vegetation classification the BLM identified new regeneration harvest areas on non-BLM-administered lands for the base period with available imagery, 1996 to 2006, for each identified rain-on-snow subwatershed. The BLM projected this rate of regeneration harvest forward in 10-year increments for 50 years.

Third, the BLM added the acres of roads in rain-on-snow sub-watersheds to the acres of early-successional forest for BLM-administered lands and non-BLM-administered lands. The BLM calculated the area of roads from GIS spatial data for each subwatershed by assuming an average road cut of 15 feet, road width of 15 feet, and road fill of 15 feet, and multiplying that width by the total road length. Including the area of roads allows a direct comparison with the Grant *et al.* (2008) response curve of reported percentage change in peak flow with percent area harvested in the rain-on-snow hydroregion. This is an addition to Step 4 described in the Planning Criteria.

The BLM compared the total open area for each rain-on-snow subwatershed for each alternative and time period to the rain-on-snow response curve from Grant *et al.* (2008) that were constructed from data at the site scale (few to hundreds of acres). Response curves for the rain-

on-snow hydroregion developed by Grant *et al.* (2008) indicate that a mean of 19 percent of a watershed area with roads would need to be harvested to detect a change in peak flow response.

Interpretation of measured peak flow increases at the site scale to larger scales, including the subwatershed scale, poses a scale problem. Changes in peak streamflow are influenced by harvest, but also by the age and pattern of forest stands within a larger watershed, location, and extent of roads, area extent of riparian areas and watershed condition. Very few studies, such as Jones and Grant (1996) and Bowling and Lettenmaier (2001), address peak flow response in larger watersheds, or the effects of a varying suite of forest management. These studies have shown that peak flow increase from forest harvest decreases with increasing watershed area. Proceeding downstream, flood peaks become flattened due to channel resistance, transmission losses, floodplain storage, and storm size variation over the watershed. Further, timing of tributary inputs typically desynchronizes peak flows causing reductions in unit stream flows of 50 percent or greater (Woltemade and Potter 1994). Jones and Grant (1996) describe that, in larger watersheds (15,000 to 150,000 acres), peak flow increases in adjoining watersheds with different forest stand structural stages were less than the year-to-year natural variability of stream flows. This suggests that stream channels are already adjusted to a range of peak flows that is greater than a land use variation.

Planning Criteria provides more detailed information on analytical assumptions, methods and techniques, and geographic and temporal scales, which is incorporated here by reference (USDI BLM 2014, pp. 76-80).

Results

Table 150 to Table 155 display the rain-on-snow subwatersheds with BLM-administered lands by decade with more than 19 percent of the subwatershed that are, or would be, in an open condition with regeneration harvest units and roads under the PRMP, by ESA-listed fish geographic area. According to Grant *et al.* (2008), these subwatersheds would be susceptible to a detectable change in peak flow response. Under the PRMP, the number of subwatersheds with BLM-administered lands that would be susceptible to a peak flow increase would vary from 6 to 10 subwatersheds in any period to 2063. This represents, at most, approximately 0.8 percent of all subwatersheds in the planning area.

Table 150. Rain-on-snow subwatersheds with BLM land ownership susceptible to a detectable change in peak flow response by decade under the PRMP within the Lower Columbia River Chinook salmon and coho salmon Evolutionarily Significant Units, and the Lower Columbia River steelhead Distinct Population Segment.

Stream Name HUC Number	Decade					
	2013	2023	2033	2043	2053	2063
Upper Clear Creek[1]	-	-	-	X	X	X

170900110601						
There are 34 subwatersheds with BLM land ownership in the LCR Chinook salmon and coho salmon ESUs. There are 28 in the LCR steelhead DPS.						

[1]Upper Clear Creek does not have Chinook salmon distribution or designated CH.

Table 151. Rain-on-snow subwatersheds with BLM land ownership susceptible to a detectable change in peak flow response by decade under the PRMP within the Oregon Coast coho salmon Evolutionarily Significant Unit.

Stream Name HUC Number	Decade					
	2013	2023	2033	2043	2053	2063
Camas Creek[1] 171003050302	X	X	X	X	X	X
Lost Creek-East Fork Coquille River[1] 171003050301	X	X	-	-	X	X
Lower North Fork Siletz River[1] 171002040402	X	X	X	X	X	X
Upper Rock Creek 171003050103	X	X	X	X	X	X
There are 262 subwatersheds with BLM land ownership in the OC coho salmon ESU.						

[1]Camas Creek, Lost Creek-East Fork Coquille River and Lower North Fork Siletz River do not have coho salmon distribution or designated CH.

Table 152. Rain-on-snow subwatersheds with BLM land ownership susceptible to a detectable change in peak flow response by decade under the PRMP within the Southern Oregon / Northern California Coasts coho salmon Evolutionarily Significant Unit.

Stream Name HUC Number	Decade					
	2013	2023	2033	2043	2053	2063
North Fork Silver Creek	X	X	-	-	-	-

171003110902						
There are 146 subwatersheds with BLM land ownership in the SONCC coho salmon ESU.						

Table 153. Rain-on-snow subwatersheds with BLM land ownership susceptible to a detectable change in peak flow response by decade under the PRMP within the Upper Willamette River Chinook salmon Evolutionarily Significant Unit.

Stream Name HUC Number	Decade					
	2013	2023	2033	2043	2053	2063
Upper Abiqua Creek 170900090105	X	X	X	X	X	X
Middle Little North Santiam River 170900050504	-	X	X	X	X	X
Upper Clear Creek[1] 170900110601	-	-	-	X	X	X
There are 122 subwatersheds with BLM land ownership in the UWR Chinook salmon ESU.						

[1]Upper Clear Creek does not have Chinook salmon distribution or designated CH.

Table 154. Rain-on-snow subwatersheds with BLM land ownership susceptible to a detectable change in peak flow response by decade under the PRMP within the Upper Willamette River steelhead Distinct Population Segment.

Stream Name HUC Number	Decade					
	2013	2023	2033	2043	2053	2063
Upper Abiqua Creek 170900090105	X	X	X	X	X	X
Middle Little North Santiam River 170900050504	-	X	X	X	X	X
There are 111 subwatersheds with BLM land ownership in the UWR steelhead DPS.						

Table 155. Rain-on-snow subwatersheds with BLM land ownership susceptible to a detectable change in peak flow response by decade under the PRMP within the Upper Klamath Recovery Unit for Lost River sucker and shortnose sucker.

Stream Name HUC Number	Decade					
	2013	2023	2033	2043	2053	2063
Fall Creek-Klamath River[1] 180102060502	X	X	X	X	X	X
There are 30 subwatersheds with BLM land ownership in the Upper Klamath RU.						

[1]Fall Creek-Klamath River does not have Lost River sucker or shortnose sucker distribution within the Planning Area. The subwatershed is split by the Oregon-California border, which is also the Planning Area boundary. There is no designated CH for either species in the entire subwatershed. However, the Klamath River is known to be occupied by both species on the California side of the subwatershed. This is located a minimum of 2.5 miles from the Planning Area boundary. There are 2,304 acres of the BLM Eastside Management Area LUA on the Oregon side of the subwatershed, within the Planning Area boundary.

There are no subwatersheds that are, or would be susceptible to a detectable change in peak flow response in the McKenzie River Basin bull trout analysis area, or in the Lost Recovery unit for shortnose and Lost River suckers.

Note that for some of the susceptible subwatersheds shown in the tables, there is no distribution of the ESA-listed species of concern using Streamnet (for salmonids) or USFWS GIS layer distribution information (for Lost River and shortnose suckers), nor is there designated CH. This suggests that effects to the species or its habitat from a detectable peak flow increase may not occur downstream if a larger watershed area is considered. Studies by Jones and Grant (1996) and Bowling and Lettenmaier (2001) indicate that peak flow increases from forest harvest decreases with increasing watershed area.

The Upper Clear Creek subwatershed is the only subwatershed in the LCR Chinook salmon ESU identified as susceptible to peak flow increases, and it does not have any LCR Chinook salmon distribution. Three of four subwatersheds identified as susceptible to peak flow increases in the OC coho salmon ESU do not have coho salmon distribution (Camas Creek, Lost Creek-East Fork Coquille River and Lower North Fork Siletz River). The Upper Clear Creek subwatershed in the UWR Chinook salmon ESU does not have Chinook salmon distribution. The Fall Creek-Klamath River subwatershed does not have Lost River sucker or shortnose sucker distribution.

Analysis at the scale of a site-specific forest management project

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows may also be affected by concentration of flows associated with increases in road connectivity to stream channels.

The timber haul PE has no mechanism to affect peak or base flows, and will not be evaluated further.

Roads and Landings. Roads connected to streams have the potential to concentrate stream flows and affect peak flows. The above analysis of sediment delivery to streams from new roads at the scale of the planning area, used for modeling purposes an estimate of 66 miles of new road constructed under the PRMP in the first decade within a 200-foot sediment delivery distance to fish-bearing or perennial streams. The 200-foot distance and 66 miles are used as criteria for the maximum amount of new roads from which flows from road surfaces and ditch lines may enter perennial or fish-bearing stream channels. The BMPs listed below for road surface drainage and cross-drains will reduce that mileage by directing flows from roads onto the forest floor. It is not known how many miles of the projected 439 miles of PRMP new road construction would deliver water directly to intermittent, non-fish bearing channels.

A number of BMPs reduce the potential for concentration of flows from roads that may increase peak flows. They are summarized here, but a complete verbatim description of each BMP is presented in Appendix C. BMPs R 2, R 3 and R 4 minimize the number of stream crossings and total road transportation system mileage, direct locations of roads and landings away from water bodies unless there is no practicable alternative, and avoid locating landings that contribute runoff to channels.

BMP R 26 directs disconnecting road runoff to stream channels at permanent road crossings by outsloping the road approach. If outsloping is not possible, use runoff control, erosion control and sediment containment measures. These may include using additional cross drain culverts, ditch lining, and catchment basins. Prevent or reduce ditch flow conveyance to the stream through cross drain placement above the stream crossing.

BMPs R 30 to R 38 address surface drainage of roads, including use of crowning, insloping, outsloping, rolling dips, water bars and other methods. BMP R 38 directs the design of landings to disperse surface water to vegetated stable areas. BMPs R 39 to R 47 address the location, spacing and other characteristics of cross-drains, including the diameter and type of cross-drain culverts according to predicted ditch flow.

The likelihood that any new road/landing construction for an individual timber sale may occur within a subwatershed that is susceptible to a peak flow increase is very low, as detailed above in the peak flow analysis at the scale of the planning area. The BMPs

The only component of this PE that may have a measurable effect to base flow is the use of pump chances to obtain water for road purposes. BMP R 60 addresses the amount of water that may be removed:

> "Avoid water withdrawals from fish bearing streams whenever possible. Limit water withdrawals in listed fish habitat and within 1,500 feet of listed fish habitat to 10% of stream flow or less at the point of withdrawal, and in non-listed fish habitat to 50% or less at the point of withdrawal, based on a visual assessment by a fish biologist or hydrologist. The channel must not be dewatered to the point of isolating fish."

A short-term measurable effect to base flows would result from water withdrawals at pump chances. This would be minimized by PDC "f" in the Western Oregon Programmatic BA (USDA FS et al. 2010): "When pumping water from streams with ESA-listed fish, ensure that withdrawals do not reduce flows by more than 10%." A 10% reduction in base flows would result in a meaningfully measurable (adverse) effect to the indicator. The use of pump chances in proximity to ESA-listed fish habitat or designated CH is expected to be a relatively rare occurrence considering the BMP and alternative pump chance locations.

Falling and yarding. The likelihood that the removal of trees from a specific BLM timber management activity would exacerbate the risk of a detectable peak flow increase sufficient to erode channel beds, impact channel form, and thereby negatively impact instream and riparian habitat conditions for ESA-listed fish species and designated CH at the subwatershed scale or larger is low. There will be only 6-10 subwatersheds at any given time in the rain-on-snow hydro-region across the range of the planning area in a 50-year time frame that are susceptible to a detectable peak flow increase (see planning-area scale analysis above). Some of these watersheds will not be proximal to the distribution of ESA-listed fish species or designated CH as described below.

There are no subwatersheds susceptible to peak flow increases in the Lost River RU for Lost River sucker or shortnose sucker, or the McKenzie River basin for bull trout. The Upper Klamath RU for Lost River sucker and shortnose sucker has one subwatershed that is susceptible to a detectable peak flow response. Fall Creek-Klamath River does not have Lost River sucker or shortnose sucker distribution within the Planning Area. The subwatershed is split by the Oregon-California border, which is also the Planning Area boundary. There is no designated CH for either species in the entire subwatershed. However, the Klamath River is known to be occupied by both species on the California side of the subwatershed. This is located a minimum of 2.5 miles from the Planning Area boundary. There are 2,304 acres of the BLM Eastside Management Area LUA on the Oregon side of the subwatershed, within the Planning Area boundary.

The only subwatershed susceptible to a peak flow increase in the LCR Chinook salmon ESU does not have any Chinook salmon distribution or designated CH. There are only one or two subwatersheds out of the total subwatersheds in the remaining ESUs or DPSs that are susceptible to detectable peak flow increases and have distribution or designated CH of the ESA-listed fish species of concern within the Planning Area:

- 1 of 34 subwatersheds in the LCR coho salmon ESU
- 1 of 28 subwatersheds in the LCR steelhead DPS
- 1 of 262 subwatersheds in the OC coho salmon ESU
- 1 of 146 subwatersheds in the SONCC coho salmon ESU
- 2 of 122 subwatersheds in the UWR Chinook salmon ESU
- 2 of 111 subwatersheds in the UWR steelhead ESU

The BLM in its project planning process may choose to defer timber management activities in any specific subwatershed that is susceptible to a peak flow increase, or design the sale so as not to exceed a threshold of open areas that would cause a detectable peak flow increase.

However, should the BLM implement a timber management project that would be of sufficient magnitude to measurably increase the risk of a peak flow in a subwatershed with ESA-listed fish species, there would be an increased risk of negative impacts attributed to peak flow increases that may result in the following habitat characteristics:

- Elevated sediment transport caused by high flow would increase turbidity and increase deposition of fine sediments in the streambed when flows subside
- Bed substrate would be scoured, including spawning gravel and incubating embryos or sac fry
- Channel form would be affected, changing the distribution of pools/riffles/runs
- Large and small wood debris providing functions within the stream channel would be redistributed and possibly rafted out into the floodplain (this may also be a beneficial effect if more wood is introduced into the channel)
- Short-term impacts to macroinvertebrate production until recolonization of bed substrate takes place

As described earlier in the description of the Peak/Base flow indicator, logging can induce a higher summer base flow response than prior to logging. This was observed to last for a period of years in small catchments <100 hectares in size with a rainfall-dominated precipitation regime (Moore and Wondzell 2005). The effect diminishes over time, and is attributed to increased evapotranspiration from hardwood and young conifer trees. Many of the studies where this phenomenon was detected occurred where a catchment had a fairly large percentage of clear-cut or patch-cut logging. An increase in summer base flow may take place for a sub-set of BLM logging projects under the PRMP. This would have a short-term beneficial effect to base flows.

Fuels treatment. Any of the following methods may be used to treat fuels (slash) generated by Forest Management projects: under burn, hand pile and burn, landing pile and burn, machine pile and burn, slash and scatter, and mastication. The main mechanism for effects to peak and base flows is large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. Peak flows are also influenced by roads that are hydrologically connected to stream channels, but the fuels treatment PE does not affect that mechanism. PRMP timber harvest activities (falling) of the Forest Management program will have removed the vast majority of vegetation that may affect flows in a catchment. Any incidental loss of remaining live vegetation from the treatment of timber harvest fuels would be miniscule in the water budget of a catchment in comparison to the trees removed during timber harvest. Considering this minute effect to the water budget of a catchment from Forest Management project generated fuels treatment, and the very low risk of any particular harvest unit being in a subwatershed susceptible to a peak flow increase, the overall effect of the fuels treatment PE to the peak flow aspect of the indicator is discountable. Similarly, there is a very low probability that fuels treatment would contribute to a base flow increase in small catchments. The overall effect of fuels treatment to the Peak and Base flows indicator is discountable.

Post-harvest silvicultural treatment. Tree planting would increase evapotranspiration and would reduce the risk of an increase in peak or base flows over time. Pre-commercial thinning is

associated with regeneration types of harvest. Thinning may result in a slight reduction in short-term evapotranspiration that would quickly return to original or higher levels over time with accelerated tree growth of remaining trees in the stand. This would not likely have a measurable effect to the risk of detectable peak or base flows. Spot-fertilizer use may have a beneficial effect on growth of trees and may therefore contribute to an increase in evapotranspiration, but because its use is so limited, it would not likely have a measurable effect to the risk of detectable peak or base flows., but its use is so limited and distant from stream channels that its effect on potential shade is discountable. Overall, the PE would have an immeasurable effect to the Peak and Base Flows indicator.

Summary of effects to peak/base flows

The BLM analyzed subwatersheds in the BLM planning area that met the following criteria, to determine if any would be susceptible to detectable change in peak flow response using criteria from Grant et al. (2008): BLM administers > 1 percent of the subwatershed, there is >100 acres of BLM land ownership in the rain-on-snow hydro-region, and >60 percent of the subwatershed is in the rain-on-snow hydro-region. Modeling over a 50 year time at 10 year intervals indicates that there would be 6-10 watersheds that would be susceptible to detectable peak flow increases at any given 10 year period. At this large scale (6-10 of a population of 1,203 subwatersheds in the planning area), the potential for BLM to impact peak flows in rain-on-snow watersheds is very low. ESA-listed fish are not present in some of the subwatersheds determined to be susceptible to a peak flow increase.

There is no site-specific information at this time to determine whether or not there would be Forest Management actions in any of the susceptible watersheds, the proximity of any future actions to ESA-listed fish species or to designated CH, and whether or not the project design would affect the risk of a detectable peak flow increase. Therefore, it is highly speculative to state that there would be negative impacts from the Forest Management program to habitat utilized by ESA-listed fish species or to designated CH as a result of detectable increases in peak flows. The risk of it occurring is very low considering that there would only be 6-10 subwatersheds at any 10 year interval in the entire planning area that are susceptible to a peak flow increase.

The analysis indicates there would be either no subwatersheds susceptible to detectable peak flow increases, or the susceptible subwatersheds have no ESA-listed fish presence or designated CH, for the LCR Chinook salmon ESU, the Lost RU for Lost River and shortnose sucker, and the McKenzie River Basin bull trout analysis area. Please see above for a detailed description of the one subwatershed in the Upper Klamath RU. There would be one subwatershed susceptible to a detectable peak flow increase in each of the following ESA-listed fish species geographic areas: LCR coho salmon ESU (34 total subwatersheds); LCR steelhead DPS (28 total subwatersheds); OC coho salmon ESU (262 total subwatersheds); and, the SONCC coho salmon ESU (146 total subwatersheds). There would be two subwatersheds susceptible in both the UWR Chinook salmon ESU (122 total subwatersheds) and the UWR steelhead DPS (111 total subwatersheds).

Regarding base flows, a sub-set of BLM logging projects under the PRMP may result in increased summer base flow for a period of years in small catchments. It is uncertain if this

would be detectable downstream where habitat is occupied by ESA-listed fish. If it does manifest downstream, the increase in flow would increase available habitat at a time when it is limiting for juvenile salmonid rearing. This would result in a short-term beneficial effect to the indicator.

A short-term measurable negative (adverse) effect to base flows would result from water withdrawals at pump chances. This would be minimized by PDC "f" in the Western Oregon Programmatic BA (USDA FS et al. 2010): "When pumping water from streams with ESA-listed fish, ensure that withdrawals do not reduce flows by more than 10%." BMP R 60 has similar language. A 10% reduction in base flows would result in a meaningfully measurable (adverse) effect to the indicator. The use of pump chances in proximity to ESA-listed fish habitat or designated CH is expected to be a relatively rare occurrence considering the BMP and alternative pump chance locations.

Among the PEs and their subcomponents, the only measurable negative (adverse) effect to the Peak and Base Flows indicator is from the rare water withdrawal at pump chances where the stream is occupied by ESA-listed fish or where there is designated CH. The overall effect to the Peak/Base flow indicator is therefore "adverse."

Riparian Reserve Function and Vegetation Diversity

Analysis at the scale of the decision area and a site-specific forest management project

Some Riparian Reserve functions will be affected by Forest Management projects that occur within, or may affect conditions within the Riparian Reserve. Many functions of Riparian Reserves are addressed by other indicators used for this effects analysis and the results of the analyses are reiterated here. Because there are multiple components of this indicator, the effects to each component are evaluated collectively by PEs of the Forest Management program.

Providing large and small wood. As described earlier in the effects to the Large and Small Wood indicator, model results indicate that there would be a beneficial effect to potential recruitment of functional wood to streams. An analysis of potential recruitment of functional wood to streams from within one site potential tree height distance from streams at the end of implementing the PRMP for a 100-year period was performed utilizing a model. Characteristics of the stands that were evaluated included: changes in tree stand structural stage classes; total trees per acre; trees greater >20" DBH per acre; and, percent canopy cover in hardwoods. Results indicate that the effects over the 100-year period to the environmental baseline condition under the PRMP would be an increased potential for areas within Riparian Reserves to provide functional large and small wood to stream channels. This is a beneficial effect to potential recruitment of functional wood to stream channels over the 100-year time-frame at the spatial scale of the entire planning area, including streams inhabited by ESA-listed fish.

In the short-term, and at the project-scale, some Forest Management activities that occur within the Riparian Reserve would reduce potential for small wood recruitment to stream channels occupied by ESA-listed fish. Within the Riparian Reserve west of Highway 97, this would occur primarily from the ground-based yarding and yarding corridors (mitigated by BMP requirements to leave downed trees within the Riparian Reserve and directionally felled toward the stream) components of the Falling and Yarding PE, and the rare new road construction

associated with thinning (Roads and Landings PE). Effects to small wood recruitment from thinning in Riparian Reserves of fish-bearing and perennial streams west of Highway 97 would be nearly non-existent due to the 120-foot no-thin buffer. In addition, tree-tipping would directly increase large and small wood numbers in stream channels (Falling and Yarding PE).

Within Riparian Reserves east of Highway 97, the mechanisms to negatively affect current and future small and future large wood potential for delivery to streams and lakes are: thinning (PRMP thinning is nearly non-existent but may occur) and reducing conifer encroachment; skid trails, yarding corridors (but see mitigating BMPs, above) (all components of the Falling and Yarding PE), and new road construction (Roads and Landings PE). Because of increased growth of remaining trees within thinned stands, there would be a beneficial effect to future recruitment of large wood in both westside and eastside Riparian Reserve .

Given the analysis above, considering the most impacting effects, the overall effect to the Providing Large and Small Wood component of the Riparian Reserve Function and Vegetation Diversity indicator from implementing the PRMP is adverse. There are short and long-term beneficial effects to the indicator from some components of the PEs.

Filtering sediment, nutrients, and chemical contaminants. There will be a generally short-term negative effect to the sediment filtering function. For a subset of Forest Management projects, there may be a localized increase in fine sediment delivery to streams proximal to ESA-listed fish. Fine sediment would be delivered from several sources, including road segments within 200 feet of stream channels used for log haul (primarily wet weather haul), and from ground-disturbing activities occurring within Riparian Reserves, such as road construction and decommissioning, road maintenance (including culvert replacements) (all components of the Roads and Landing PE), and yarding corridors and skid trails (Falling and Yarding PE). Effects from fuels treatments are expected to be insignificant (Fuels Treatment PE). There is also an unquantifiable risk of a landslide or shallow debris torrent reaching a stream channel as a result of timber management activities (Falling and Yarding PE). This would negatively affect the Riparian Reserve function of serving as a filter for sediments. Forest management actions such as culvert replacement, road maintenance and road decommissioning would have short-term negative effects and a long-term beneficial effect (Roads and Landings PE).

There will be an insignificant negative effect to the nutrient filtering function. Increased nutrients from upslope sources, such as slash burning (Fuels Treatment PE), would move downslope but largely be effectively captured by duff, down wood, live herbaceous vegetation and soil in undisturbed parts of the forest floor within the Riparian Reserve. Similarly, chemical contaminants such as fertilizers would be effectively filtered (Post-harvest Silvicultural Treatment PE). Non-target effects of their application are minimized by use of management direction that prohibits aerial application. There is also no scheduled use of fertilizer. It is expected to be used rarely and localized.

Given the analysis above, considering the most impacting effects, the overall effect to the Filtering Sediment, Nutrients, and Chemical Contaminants component of the Riparian Reserve Function and Vegetation Diversity indicator from implementing the PRMP is adverse.

Shade to streams function. Use of an EPA model identified approximately 0.5 percent of fish-bearing or perennial stream miles in the planning area where thinning in the Riparian Reserve outer zone under the PRMP would potentially affect stream temperature (Falling and Yarding PE). It is not known if any future thinning activities would take place along any of those vulnerable stream miles, or the magnitude (distance along stream) of the impact to shade. There may be some minor losses of stream shade that would have insignificant effects, such as where there is a cable-yarding corridor. However, without site-specific information on the proximity and magnitude of any future riparian thinning project where ESA-listed fish species and/or designated CH are present, it cannot be determined if there will be an adverse effect to the shade to streams function. The conclusion of effect to the water temperature indicator was a discountable effect, due to the low probability of a susceptible stream reach being thinned and a low probability of any road construction within the outer zone of a Riparian Reserve that may remove shade within a stream reach susceptible to water temperature increases by shade removal. The BLM may choose to avoid thinning projects in the identified susceptible areas.

Channel geometry and habitat-forming processes. It is not anticipated that large and small wood delivery, the magnitude and duration of sediment delivery to stream channels, effects to peak or summer base flows, or physical effects from yarding or road construction as a result of the Forest Management program would measurably affect the number or quality of pools, cause changes to width-depth ratio, affect streambank stability, or change the connectivity of the stream with its floodplain. Effects would be insignificant.

Riparian vegetation diversity. Thinning and other silvicultural activities within the Riparian Reserves largely occur within plantations (Falling and Yarding PE). These unnaturally overstocked stands are often conifer monocultures with low diversity. Forest management activities within Riparian Reserves are guided by management direction such as:

- Conduct thinning and other silvicultural treatments to accelerate the development of potential natural forest stand conditions including late-successional stand characteristics and native riparian shrub communities. (Applicable to the Eastside Management Area).
- Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands. (Applicable to the outer zone of Class II and III watershed Riparian Reserve for fish-bearing perennial streams, and the outer zone of Class III intermittent, non-fish-bearing streams).

Thinning and other silvicultural treatments within Riparian Reserves should increase riparian vegetation diversity, and would have a beneficial effect to the indicator.

Summary of effects to riparian reserve function and vegetation diversity

There will be a mix of short and long-term insignificant and discountable effects to several functions of Riparian Reserves. The effect to the shade function is uncertain, as it is unknown if future thinning may occur in the outer Riparian Reserve of the approximately 0.5 percent of fish-bearing and perennial streams in the planning area determined to be vulnerable to shade loss that may result in a water temperature increase. However, there is a low probability of thinning

any susceptible stream reach (1 in 200). There would be a beneficial effect to vegetation diversity. There is also a low probability of any new road construction that may reduce stream, shade occurring in the outer zone of the Riparian Reserve of a stream segment that may be susceptible to a water temperature increase from a loss of shade.

There are two negative effects to the Riparian Reserve and Vegetation Diversity indicator that are neither insignificant nor discountable. One is the result of a measurable negative (adverse) impact to the large and small wood indicator, with a long-term beneficial effect (Falling and Yarding PE). This would affect the function of being a source of wood to stream channels. Another is impairment of the sediment filtering function. Fine sediments may enter stream channels from road segments used for log haul within 200 feet of stream channels (primarily from wet weather haul), and from ground-disturbing activities occurring within Riparian Reserves, such as road construction and decommissioning, road maintenance (including culvert replacements) (all associated with the Roads and Landings PE), and yarding corridors and skid trails (both associated with the Falling and Yarding PE). Consequently, there will be an overall adverse effect to the indicator. The measurable negative effects are generally short-term.

Chemical Contamination and Nutrients

Use of fertilizers has the potential for chemical contamination of streams. Fuel spills of petroleum products from machinery and equipment used in timber harvest, timber haul and road construction/maintenance and decommissioning activities also have the potential for chemical contamination of streams. The PRMP does not include use of herbicides for treatment of competing vegetation in conifer plantations.

The effects of the use of fertilizers for Forest Management are discussed in Meehan (1991) and Spence et al. (1996). Use of fertilizers has the potential for chemical contamination of streams. Burning of slash will generate nutrients such as phosphorous and nitrogen. The potential to deliver fertilizers and nutrients to stream channels is mitigated by project design under the PRMP, including use of BMPs, management direction and no-treatment buffers. PRMP management direction for the Harvest Land Base LUA regarding the use and application of fertilizers states: “Manually apply supplemental nutrients where necessary to enhance vigor and growth of desired vegetation. Do not use aerial application methods.” However, the PRMP does not project any acres of fertilizer application. Use of fertilizers is expected to be rare and localized.

In addition to primary productivity, there are other sources of nutrient input and food web stimulus into small fish-bearing streams. Opening the riparian overstory and increasing the available light that reaches the stream can increase primary productivity (Hill *et al.* 1995), hasten breakdown of litter and leaf material (Lagrue *et al.* 2011) and translate to increases in macroinvertebrate and fish biomass (Kiffney *et al.* 2014, Wootton 2012). However, Danehy and co-authors found little effect on instream flora, fauna, or macroinvertebrate assemblages due to thinning (Danehy et al. 2007). Additionally, periphyton biomass was larger in thinned stands than in mature stands, and macroinvertebrate assemblages, biotic metrics, functional feeding group composition, and biomass measures were the same in both mature and thinned riparian stands (Danehy et al. 2007). This occurs because changes in abiotic and biotic features of these systems are less dramatic with the retention of trees near the channel (Danehy et al. 2007). Fish-

bearing stream reaches can receive nutrient influxes from headwater reaches. Both invertebrates and detritus can be exported downstream from non-fish-bearing, headwater reaches year-round and, in turn, support large numbers of juvenile fish (Wifpli and Gregovich 2002).

Analysis at the scale of a site-specific forest management project

Roads and Landings, Falling and Yarding, and Timber Haul. These PEs have a common mechanism for possible chemical contamination. It is the potential for contamination from fuel spills, lubricants and hydraulic fluid. Potential sources are from use of heavy equipment and chain saws.

Contract requirements specify spill containment measures for all machinery and equipment used in timber harvest activities. Heavy equipment is fueled on landings. Spills associated with loading equipment may occur but are also likely to be very small and would occur within the road prism. A fuel spill kit is required of operators in case of accidental spill to minimize adverse aquatic effects. Chainsaws use minimal amounts of gas and any spills would likely be very small. The no harvest inner zones of Riparian Reserves are sufficient to minimize potential transport of spilled fuels and fluids to stream channels during timber falling and ground-based harvest.

Equipment using fuel and hydraulic fluids are used in road construction, renovation, decommissioning and rock quarry development activities. Based upon experience with past projects, there is a very low probability of spilling significant amounts of fuel or oil near enough to channels to be transported and present a risk to aquatic organisms. Project contract requirements and mitigation measures are effective to contain potential fuel and fluid transmission into waterways, reducing the possibility of aquatic habitat contamination to a discountable risk.

The greatest risk for introducing petroleum products into stream channels is during culvert replacement projects, particularly those that would occur in fish-bearing streams. The ARBA II has aquatic conservation measures for heavy equipment use to minimize or prevent chemical contamination in streams:

i. All equipment used for instream work will be cleaned for petroleum accumulations, dirt, plant material (to prevent the spread of noxious weeds), and leaks repaired prior to entering the project area. Such equipment includes large machinery, stationary power equipment (e.g., generators, canes, etc.), and gas-powered equipment with tanks larger than five gallons.

ii. Store and fuel equipment in staging areas after daily use.

iii. Inspect daily for fluid leaks before leaving the vehicle staging area for operation.

iv. Thoroughly clean equipment before operation below ordinary high water or within 50 feet of any natural water body or areas that drain directly to streams or wetlands and as often as necessary during operation to remain grease free.

The NMFS ARBO II states that the use of heavy equipment creates a risk that accidental spills of fuel, lubricants, hydraulic fluid, coolants, and other contaminants are likely to occur. Effects

are acutely toxic at high levels and sub-lethal adverse at lower concentrations. The USFWS ARBO II displays that a negative effect with a significant magnitude would occur for the chemical contamination/nutrients indicator for construction activities (which would include culvert replacements).

The timber haul component has contract requirements for spill abatement. Experience with past timber haul without incident (communication between trucks is excellent and accidents are rare) reduces the possibility of aquatic habitat contamination to a discountable risk.

Overall, the effect of the three PEs to the Chemical Contamination and Nutrients indicator is measurable negative (adverse). This is a result of road construction or renovation work that may introduce chemicals into streams during culvert replacements in streams.

Falling and yarding. Thinning riparian stands, especially near streams, could potentially increase the primary productivity in streams by increasing sunlight to streams and altering the litter fall composition. The PRMP would limit near-stream thinning to the area in the outer zone of Riparian Reserves west of Highway 97 (beyond 120 feet on either side of fish bearing or perennial streams; beyond 50 feet on either side of non-fish- bearing intermittent streams) to maintain stream shading. Management direction for fish-bearing and perennial streams in the Eastside Management Area LUA requires the BLM to "Retain and promote long-term site-potential shade conditions."

Thinning in the outer zone of Riparian Reserves west of Highway 97, or within the Riparian Reserves of the Eastside Management Area LUA, would not result in a measurable increase in primary productivity and subsequent growth rates of juvenile resident/anadromous or adult resident ESA-listed fish as a result of an increase in biomass of the macroinvertebrate forage base.

Fuels treatment. Nutrients from slash burns would be effectively filtered by the intact forest floor in the distance between thinning activities and stream channels. This would be a minimum of either 50 or 120 feet depending upon whether the stream is in the Riparian Reserve stream category of non-fish-bearing intermittent, fish-bearing, or perennial. There would be at most an insignificant effect to the indicator.

Post-harvest silvicultural treatment. Use of fertilizers has the potential for chemical contamination of streams. This is mitigated by project design under the PRMP, including use of BMPs, management direction and inner zone Riparian Reserve buffers. Applicable BMPs include:

- S3. For streams and water bodies that support domestic use, apply fertilizer further than 100 feet from the edge of the active channel or shoreline.

- S4. Locate storage, transfer, and loading sites outside Riparian Reserve and separated from hydrological connections (e.g., road ditches that are linked to stream channels).

- SW8. Avoid loading, or storing chemical, fuel, or fertilizer in DEQ sensitive zones within drinking water source areas for public water systems, known domestic source water watersheds, or Riparian Reserve inner zone.

Management direction does not allow aerial application of fertilizers. It would be spread by hand for spot treatments. The probability of fertilizer entering stream channels with designated CH or ESA-listed fish presence when applied manually at localized spots within plantations is extremely unlikely. It would be at minimum, a distance of 120 feet from fish-bearing or perennial stream channels. Once applied, the probability of any of it moving to a fish-bearing or perennial stream channel during a precipitation event is also extremely unlikely, as much of would be absorbed by the target and other vegetation before the precipitation event, and what remains would be captured in the duff layer of the forest floor between the application area and the stream. There would be discountable effects to ESA-listed fish or designated CH from BLM use of fertilizers.

Summary of effects to chemical contamination / nutrients

Use of fertilizers has the potential for chemical contamination of streams. The probability of an effect to ESA-listed fish or designated CH is extremely low. It is mitigated by use of management direction that precludes aerial application of fertilizer, BMPs and the inner zone distance of 120 feet for Riparian Reserves on fish-bearing or perennial streams. The effect to the indicator from use of fertilizers in plantations is discountable.

Chemical contamination from petroleum products associated with heavy equipment use during culvert replacements on fish-bearing streams with ESA-listed fish present, or where there is designated CH, may occur. Effects would be minimized by management direction, BMPs and the Aquatic Conservation Measures of the ARBA II.

Nutrients from slash burns would be effectively filtered by the intact forest floor in the distance between thinning activities and stream channels. There would be at most an insignificant effect to the indicator.

Thinning in the outer zone of Riparian Reserves under the PRMP is unlikely to result in a beneficial effect to rearing ESA-listed fish species and to corresponding PCEs of designated CH from increased primary productivity and subsequent effects to the food chain.

Overall, a conservative judgment of the effect to the indicator is a short-term negative (adverse) effect based solely upon the potential contamination of streams by petroleum products during replacements of culverts on fish-bearing streams.

Roads within Riparian Reserves

Analysis at the scale of a site-specific forest management project

The only Forest Management program PE that may affect the indicator is Roads and Landings.

Roads and Landings. While anticipated to be a rare occurrence, new road construction for the purposes of Forest Management activities is allowed within Riparian Reserves where there is no practicable alternative (BMP R 3). The sediment modeling analysis (above) stated that a total 437 miles of new road construction is projected under the PRMP at the scale of the planning area. For sediment modeling purposes, an estimate of 66 miles was used for new road construction within the 200-foot sediment delivery distance in the first decade. However, the impetus for entering Riparian Reserves for Forest Management activities is for thinning

projects, located largely within plantations. The mainstem road network already exists to the plantations (exceptions being those that have been decommissioned). So, the need for road construction within Riparian Reserves will be limited.

Construction of the likely short spur roads in the Riparian Reserve to facilitate Forest Management activities will follow management direction and employ BMPs. Most will likely be at the outer (uphill) edge of the Riparian Reserve and not be hydrologically connected to stream channels. This will minimize the potential for concentration of flows during precipitation events, and the downslope parts of the Riparian Reserve would effectively maintain a sediment filtration area between the road and stream channels. Some of these new road segments would be decommissioned post-project.

The sediment modeling analysis (above) stated that a total of 372 miles of permanent road would be obliterated by 2023 under the BMP. It is not known what proportion of these roads would be within the Riparian Reserve, so it is not possible to determine whether or not there would be a net reduction of roads within the Riparian Reserve over time.

There will be some culverts replaced that currently are partial barriers to migration of ESA-listed fish species. This would have a beneficial effect to the indicator.

Considering the above analysis, there would be an overall insignificant effect to the indicator.

Summary of effects to roads within riparian reserves

There would be a beneficial effect from improvement of fish passage at culvert replacement projects. The overall effect to the indicator, however, is an insignificant negative effect. Roads are likely to be constructed within Riparian Reserves, but effects to peak/base flows and sediment delivery would be minimized because it is probable that most roads will not be hydrologically connected to stream channels.

Direct Effects to the Species from the Forest Management Program

Temporary displacement of ESA-listed fish from their territories may occur due to disturbance when yarding corridors are constructed and are in operation. ESA-listed fish will be captured at some culvert replacement sites, held and then released back to the stream. This activity will follow the ACMs and PDC of the ARBA II. Because there will be harassment associated with displacement of ESA-listed fish from territories, and potential harm resulting from capturing and handling fish, there may be an adverse effect to the species.

Summary

The indicator analysis results are summarized in Table 156.The most impacting effect to the indicator is displayed. Where there is an adverse effect to an indicator, there may also be insignificant, discountable or beneficial effects from different components of the program activities. Note that these effects will occur for a sub-set of Forest Management actions.

Table 156. Summary of indicator analysis results for the Forest Management program.

Indicator	Effects to the Indicator (most impacting)

Large and small wood	Adverse (loss of wood from ground-based yarding skid roads and road construction within Riparian Reserves)
Sediment/turbidity/substrate	Adverse (short-term due to fine sediment entering channels and water column). Primary sources include road construction, decommissioning and maintenance, wet season haul and culvert replacements.
Water temperature	Discountable (very low probability of thinning a stream reach on a fish-bearing or perennial stream that is susceptible to water temperature increases due to only 0.5 percent of all stream reaches in the planning area being susceptible). Not all susceptible stream reaches would be in reaches occupied by ESA-listed fish or designated as CH. AREMP water temperature monitoring has detected an improving trend for water temperatures on Federal land in the NWFP area over the past 20 years. There would be a wider no-thin buffer under the PRMP than has been employed for thinning under the NWFP.
Peak/base flows	Adverse. It is solely from use of pump chances in streams. There is a low probability of timber harvest or new road construction resulting in a peak flow increase that would affect ESA-listed fish or designated CH. There is also a potential short-term beneficial effect to base flows in small catchments (<100 hectares) for a small sub-set of timber harvest actions.
Riparian Reserve function and vegetation diversity	Adverse (short-term due to impacts to large and small wood delivery function, and filtering capability for fine sediments and nutrients)
Chemical contamination / nutrients	Adverse (short-term effect may result from petroleum products used by heavy equipment entering stream channels during culvert replacements in fish-bearing streams)
Roads within Riparian Reserves	Insignificant negative

In addition to adverse effects to several of the indicators, it was determined that there would be direct effects to the species, resulting in harassment (temporary displacement of fish from territories as a result of construction and use of cable yarding corridors) and potential harm (handling of fish to remove them from culvert replacement sites).

5. Lands and Realty

The following analysis is based upon a road constructed under a discretionary right-of-way grant across BLM land, where the right-of-way will result in road construction within a Riparian Reserve adjacent to a stream occupied by ESA-listed fish or containing designated CH.

While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (Lightcap, pers. comm. 2015).

Based upon the past history of limited acres of land exchanged since 1995, the PRMP management direction quoted above that requires the maximizing of public resource values, and fish biologist involvement in the NEPA process, it is extremely unlikely that BLM-administered land occupied by or designated as CH for ESA-listed fish species would be exchanged. Any specific lands or realty action at a future date that may affect ESA-listed fish species or designated CH would be subject to an ESA consultation at that time.

Effects to Environmental Baseline

Large and Small Wood

Road construction for a right-of-way would affect large and/or small wood recruitment, dependent upon its location within the Riparian Reserve. If very near the stream, both large and small wood would be affected, as trees in either size class would be removed from the road prism. The magnitude of the effect to the indicator would be dependent upon the length of the road segment that is within the Riparian Reserve. It would have a measurable adverse effect to the indicator.

Summary of effects to large and small wood

Road construction within a Riparian Reserve would result in a measurable negative adverse effect to the indicator because trees would be removed from the road prism.

Sediment/Turbidity/Substrate

Road construction for a right-of-way within Riparian Reserves of streams proximal to the distribution of ESA-listed fish species would be a mechanism for fine sediment to enter stream channels. Use of BMPs and management direction for road construction would minimize fine sediment delivery to stream channels and the water column.

There are 100 road and landing-related BMPs in Appendix C. An abbreviated list of BMPs relevant to new road construction is presented below. Others address permanent stream crossings, temporary stream crossings, surface drainage, cross drains, timing of in-water work, low water fords, water quality for noxious weed treatment of road equipment, water source development and use, erosion control, dust abatement, road maintenance, road storm-proofing, and road closure and decommissioning.

- R2. Locate temporary and permanent road construction or improvement to minimize the number of stream crossings.
- R3. Locate roads and landings away from wetlands, Riparian Reserves, floodplains and waters of the State, unless there is no practicable alternative. Avoid locating landings in areas that contribute runoff to channels.

- R6. Confine pioneer roads to the construction limits of the permanent roadway to reduce the amount of area disturbed and avoid deposition in wetlands, Riparian Reserves, floodplains and waters of the State. Install temporary drainage, erosion, and sediment control structures. Storm proof or close pioneer roads prior to the onset of the wet season.
- R8. End-haul material excavated during construction, renovation, and/or maintenance where side slopes generally exceed 60 percent and any slope where side-cast material may enter wetlands, floodplains, and waters of the State.
- R11. Locate waste disposal areas outside wetlands, Riparian Reserves, floodplains and unstable areas to minimize risk of sediment delivery to waters of the State. Apply surface erosion control prior to the wet season. Prevent overloading areas, which may become unstable.
- R12. Use controlled blasting techniques to minimize loss of material on steep slopes or into wetlands, Riparian Reserves, floodplains, and waters of the State.
- R13. Use temporary sediment control measures (e.g., check dams, silt fencing, bark bags, filter strips and mulch) to slow runoff and contain sediment from road construction areas. Remove any accumulated sediment and the control measures when work or haul are complete. When long-term structural sediment control measures are incorporated into the final erosion control plan, remove any accumulated sediment to retain capacity of the control measure.
- R27. Disconnect road runoff to the stream channel by outsloping the road approach. If outsloping is not possible, use runoff control, erosion control and sediment containment measures. These may include using additional cross drain culverts, ditch lining, and catchment basins. Prevent or reduce ditch flow conveyance to the stream through cross drain placement above the stream crossing.
- R30. Effectively drain the road surface by using crowning, insloping or outsloping, grade reversals (rolling dips) and waterbars or a combination of these methods. Avoid concentrated discharge onto fill slopes unless the fill slopes are stable and erosion proofed.
- R31. Outslope temporary and permanent low volume roads to provide surface drainage on road gradients up to 6% unless there is a traffic hazard from the road shape.
- R34. Construct variable road grades and alignments (e.g., roll the grade, grade breaks) which limit water concentration, velocity, flow distance and associated stream power.
- R36. Design roads crossing low-lying areas so that water does not pond on the upslope side of the road. Provide cross drains at short intervals to ensure free drainage.
- R39. Locate cross drains to prevent or minimize runoff and sediment conveyance to waters of the State. Implement sediment reduction techniques such as settling basins, brush filters, sediment fences, and check dams to prevent or minimize sediment conveyance. Locate cross drains to route ditch flow onto vegetated and undisturbed slopes.
- R40. Space cross drain culverts at intervals sufficient to prevent water volume concentration and accelerated ditch erosion. At a minimum, space cross drains at

intervals referred to in the BLM Road Design Handbook 9113-1 (USDI BLM 2011), Illustration 11 -"Spacing for Drainage Lateral." Increase cross drain frequency through erodible soils, steep grades, and unstable areas.

- R42. Locate surface water drainage measures (e.g., cross drain culverts, rolling dips, water bars) where water flow will be released on convex slopes or other stable and non-erosive areas that will absorb road drainage and prevent sediment flows from reaching wetlands, floodplains and waters of the State. Where possible locate surface water drainage structures above road segments with steeper downhill grade. Locate cross drains at least 50 feet from the nearest stream crossing and allow for a sufficient non-compacted soil and vegetative filter.
- R44. Discharge cross drain culverts at ground level on non-erodible material. Install downspout structures and/or energy dissipaters at cross drain outlets or drivable dips where alternatives to discharging water onto loose material, erodible soils, fills, or steep slopes are not available.

Depending upon the road's connectivity with the stream network via side drains, and the distance between the forest floor and the stream that would serve as a sediment-filtering zone, some to all of the fine sediment would be captured before it entered the stream channel. If the road construction created a stream crossing (culvert or bridge) there would be a segment of the road that would drain to the stream directly. The amount of sediment delivered would also depend upon the road surface. The gradation from higher to lower is from native surface to gravel surface to pavement.

Fine sediment may lead to short-term increases in fine sediment within interstitial spaces of larger bed particles (including spawning gravel and cobbles), and increased turbidity would occur. Overland flow from rainfall or snow-melt events occurring later in time after the road construction is completed would be the delivery mechanism to stream channels for roads not directly connected to stream channels via a adjacent road ditchlines, culvert or bridge. Effects to spawning gravel and coarse substrate such as cobble may last for weeks to months dependent upon shear stress of future flow events to mobilize fine bed particles. Sediment entering stream channels later in time during run-off events may lead to turbidity increases that may be undetectable due to background levels in the water column. The effect to the indicator in the worst case would be measurable (adverse).

Summary of effects to sediment/turbidity/substrate

Fine sediment as a result of right-of-way road construction may enter stream channels within Riparian Reserves proximal to ESA-listed fish habitat. While there are a number of variables that would condition how much fine sediment is delivered, it is anticipated that here would be measurable negative effects to turbidity and streambed substrate composition from fine sediments for a sub-set of road right-of-way construction projects. Effects are anticipated to be short-term, with fine sediments on and between streambed substrate particles dispersed within weeks to months. Episodes of increased turbidity may last hours to days dependent upon several factors: connectivity of the road with the stream network; extent of overland flow; and, ability of duff, down wood and live vegetation to capture fine sediment draining from the road surface to the forest floor. Effects are neither discountable nor insignificant.

Water Temperature

A road right-of-way construction project may remove vegetation that provides shade to stream channels, and potentially affect water temperatures, in areas proximal to ESA-listed fish habitat. The magnitude of the shade loss would be dependent upon the length of the road that is within a distance that the height of the vegetation is providing shade to the stream channel. Because the BLM would condition the location of the road segment, the amount of shade-producing vegetation removed for a road right-of-way construction project is unlikely to lead to a measurable increase in water temperature. This results in an insignificant effect to the indicator.

Summary of effects to water temperature

There will be an insignificant effect to the indicator because the amount of shade-producing vegetation removed for a road right-of-way construction project is unlikely to lead to a measurable increase in water temperature.

Peak and Base Flows

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows are also affected by concentration of flows associated with increases in road connectivity to stream channels.

The location and design standards for roads constructed under a BLM right-of-way agreement would result in very little road connectivity with stream channels. It is unlikely that a road constructed under a BLM road right-of-way agreement would lead to changes in peak or base flows that would be measurable at the scale of 6th field HUC subwatersheds or larger. There would be an insignificant effect to the indicator.

Summary of effects to peak and base flows

There would be an insignificant negative effect to the indicator because roads constructed under a discretionary BLM right-of-way agreement would have little connectivity with stream channels. See BMPs R27, R30, R31, R34, R36, R39, R40, R42, and R44 in the list above.

Riparian Reserve Function and Vegetation Diversity

Some Riparian Reserve functions will be affected by road right-of-way construction that occurs within a Riparian Reserve. Other indicators used for this effects analysis address many functions of Riparian Reserves. As described earlier in this section, there may be decreases in small and/or large wood delivery because trees would be removed from within the road prism, leading to a measurable negative effect to the Large and Small Wood indicator. In the worst case, there would be a short-term, measurable negative (adverse) effect to the Sediment/Turbidity/Substrate indicator due to fine sediment delivery to stream channels. An insignificant effect to the water temperature indicator would occur because the BLM would condition the road location, minimizing shade loss to stream channels. The filtering capability of the forest floor to prevent fine sediment from reaching channels may be negatively affected

by road construction. In addition, as described below in the effects to the Chemical Contamination and Nutrients indicator, there would be an insignificant effect to that indicator.

It is not anticipated that the short-term nature, and the small magnitude and duration of sediment delivery to stream channels as a result of this program would measurably affect the quality of pools, cause changes to width-depth ratio or affect streambank stability. A road right-of-way within a portion of a Riparian Reserve may be within a floodplain. Dependent upon the specific right-of-way location, it may negatively affect the connectivity of a stream with its floodplain for a short distance. Because of the BMPs and program direction, this is expected to be a rare occurrence. The overall diversity of riparian vegetation would not be reduced.

The analysis below for effects to the Roads within Riparian Reserves indicator determined that there would be a measurable (adverse) effect to the indicator. Overall, there would be a measurable (adverse) effect to the Riparian Reserve Function and Vegetation Diversity indicator.

Summary of effects to riparian reserve function and vegetation diversity

There are measurable negative effects to the Large and Small Wood, Sediment/Turbidity/Substrate and Roads Within Riparian Reserves indicators. In addition, there would be impairment of the filtering capability of the riparian forest floor for fine sediments, and potential loss of connectivity of a stream with its floodplain (dependent upon the specific location of the right-of-way). Consequently, there will be an overall measurable negative (adverse) effect to the Riparian Reserve Function and Vegetation Diversity indicator.

Chemical Contamination and Nutrients

Heavy equipment and chainsaws used during the construction of roads use petroleum products as fuel. The potential for chemical contamination from a fuel spill reaching a stream channel is limited. BMP SP2 states:

> "Take immediate action to stop and contain leaks or spills of chemicals and other petroleum products. Notify the Oregon Emergency Response System, through the District Hazard Materials specialist, of any spill that enters the waters of the State.
>
> Inspect and clean heavy equipment as necessary prior to moving on to the project site, in order to remove oil and grease, noxious weeds, and excessive soil.
>
> Inspect hydraulic fluid and fuel lines on heavy-mechanized equipment for proper working condition.
>
> Where possible, maintain and refuel equipment a minimum of 150 feet away from streams and other water bodies, except small equipment (e.g. chainsaws or water pumps). Refuel small equipment from no more than 5-gallon containers. Use absorbent material or a containment system to prevent spills when re-fueling small equipment within the stream margins or near the edge of water bodies."

Consequently, the overall effect to the indicator is insignificant.

Summary of effects to chemical contamination and nutrients

There would be insignificant effects to the indicator from the possibility of a fuel spill. Use of BMP SP2 would minimize the risk of causing meaningfully measurable chemical contamination of waters occupied by ESA-listed fish species.

Roads within Riparian Reserves

In the worst case, an approved right-of-way agreement would result in a road segment being constructed within a Riparian Reserve. It would be constructed to minimize connectivity with stream channels and, if a stream crossing is created, would not be a barrier to fish migration. However, it could result in fine sediment being delivered to stream channels as well as removal of some riparian vegetation. Consequently, there would be a measurable negative effect to the indicator.

Summary of effects to roads within riparian reserves

A road constructed within a Riparian Reserve would adversely affect several functions of the Riparian Reserve. Consequently, there would be a measurable negative (adverse) effect to the indicator.

Direct Effects to the Species from the Lands and Realty Program

The only mechanism for a direct effect to an individual ESA-listed fish would be if a new road crossing is required on a stream occupied by the species. This would be a very rare event for a discretionary road right-of-way. Fish salvage may occur, and there is the potential for harm or harassment during such activities. In addition, if there is heavy equipment operating in the stream channel, there is the potential for a fish to be injured or killed.

Summary

The indicator analysis results are summarized in Table 157. The most impacting effect to the indicator is displayed. Where there is an adverse effect to an indicator, there may also be insignificant or discountable effects from different components of the program activities.

Table 157. Summary of indicator analysis results for the Lands and Realty program.

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Measurable negative (adverse)
Sediment/turbidity/substrate	Measurable negative (adverse)
Water temperature	Insignificant negative
Peak/base flows	Insignificant negative
Riparian Reserve function and vegetation diversity	Measurable negative (adverse)
Chemical contamination /	Insignificant negative

nutrients	
Roads within Riparian Reserves	Measurable negative (adverse)

In addition to adverse effects to several of the indicators, it was determined that there would be direct effects to the species resulting in harassment or harm, if road construction involves fish salvage during construction of a stream crossing.

6. Livestock Grazing

In past BLM evaluations and ESA consultations, livestock grazing actions distant from the distribution of ESA-listed fish species and designated CH, or where livestock access to stream reaches containing ESA listed fish is precluded or limited by fencing, terrain, down wood or dense woody vegetation, have been determined to be *No Effect* or *May Affect Not Likely to Adversely Affect* to ESA-listed fish species and respective designated CH. Adverse effects may occur for livestock grazing actions where livestock have access to streams occupied by ESA-listed fish. In the specific case of SONCC coho salmon, designated CH includes riparian areas 300 feet on either side of the stream from the normal high water line. Here, adverse effects to designated CH may occur where livestock have access to the riparian areas within that distance from the normal high water line of the stream channel. The ARBA II also concludes that the effects of constructing riparian exclusion fencing, controlled access for walkways across streams, and developing upslope water facilities results in an effect determination of *"May Affect, Likely to Adversely Affect."*

The following analysis is based upon an allotment where livestock have access to a stream or standing body of water that is inhabited by ESA-listed fish. These circumstances occur in a subset of allotments administered by the BLM, notably in the SONCC coho salmon ESU and the Lost Recovery Unit for Lost River sucker.

Note that the analysis below does not reflect the effects of implementing the livestock grazing CMA on the New River. The Coos Bay BLM District has consulted on the effects of that action and the NMFS concurred on a NLAA effect determination for effects to the species (NMFS 2002, consultation number 2002/01058). There were no effects to habitat indicators that were greater than insignificant, and no direct effect to the species resulting in harm or harassment.

Also note that because of steep terrain, it is extremely unlikely that cattle access the Klamath River. The BLM believes that effects to any of the habitat indicators by livestock grazing adjacent to the Klamath River would be no greater than "insignificant."

Effects to Environmental Baseline

The potential effects of livestock grazing on salmonids and their habitat are discussed in Meehan (1991), Spence et al. (1996), Chaney et al. (1990), Clary and Webster (1989), and Johnson (1992). Livestock grazing can have both acute and chronic effects. Acute effects are those that contribute to the immediate loss of incubating embryos and/or fish, such as by trampling of redds, and loss of specific habitat features or localized reductions in habitat quality.

Chronic effects are those that, over time, result in widespread reductions in habitat quantity and/or quality or loss of entire fish populations (for further discussion see Meehan (1991) and USDC (1997b). The primary potential impacts for BLM allotments would be from grazing near or on streambanks and removing and/or trampling associated vegetation. Livestock grazing can result in increases in water temperature by reducing streamside vegetation that provides shade and by altering the shape of stream channels that increases the surface area of a stream. Grazing can result in fine sediment delivery to stream channels.

Grazing effects on the sediment regime are primarily expressed in the interception of precipitation, infiltration of the soils, and surface runoff. Concentrated trampling of banks and intensive use can result in soil compaction, reduced vegetative cover and erosion. Grazing at any intensity influences infiltration and sediment production, and heavy grazing is statistically different from light and moderate grazing with respect to hydrologic effects (Johnson 1992). In a review of many studies, Johnson (1992) found that in most cases, moderate grazing affects infiltration and sediment production but is not statistically different from no grazing.

Range management techniques used by the BLM to reduce or eliminate the impact of livestock grazing to streambanks, instream habitat, water quality and riparian areas include:

- Following utilization standards
- Adjusting AUMs based upon monitoring
- Rest-rotation grazing with multiple pastures
- Early season use of riparian pastures
- "Flash" (high intensity, short duration) grazing where cattle are moved relatively quickly from pasture to pasture and several pastures are rested during the growing season each year
- Placement of mineral and salt supplement blocks a minimum of ¼ mile upslope from permanent waterbodies or Riparian Reserves
- Exclusion fences
- Herding
- Development of upland water sources

Livestock grazing BMPs will reduce grazing impacts (Table 158).

Table 158. Livestock grazing BMPs.

BMP Number	Best Management Practices
G 1	Fence water developments, including springs and seeps, unless other methods are available. Pipe overflow away from the developed source area.

BMP Number	Best Management Practices
G 2	Do not locate salting areas within ¼ mile of permanent water sources or Riparian Reserves.
G 3	Locate new permanent livestock handling or management facilities (corrals, pens, or holding pastures) outside Riparian Reserves or 200 feet from water bodies and on level ground where drainage would not enter surface waters. Make changes as necessary to existing facilities within Riparian Reserves to meet water quality standards and regulations.
G 4	Apply specific grazing strategies for riparian wetland areas, including timing, intensity, or exclusion for maintenance of proper functioning condition. Use one or more of the following features: Inclusion of the water bodies, floodplains, and wetlands within a separate pasture. Fence or herd livestock out of water bodies, floodplains, and wetlands for as long as necessary to allow vegetation to recover. Control the timing and intensity of grazing to keep livestock off stream banks when they are most vulnerable to damage and to coincide with the physiological needs of target plant species. Add more rest to the grazing cycle to increase plant vigor, allow stream banks to revegetate, or encourage more desirable plant species composition. Limit grazing intensity to a level that will maintain desired species composition and vigor. Permanently exclude livestock from those water bodies, floodplains, and wetlands areas that are at high risk and have poor recovery potential, and when there is no practical way to protect them while grazing adjacent uplands.
G 5	Recover degraded water bodies through adjustments to forage utilization levels, improved livestock distribution, and management through fencing, vegetation treatments, water source developments, or changes in season of use or livestock numbers.

Management direction for livestock grazing is presented in Appendix A.

The ARBA II (USDA FS et al., 2013) and both ARBO II documents (NMFS 2013, USFWS 2013) include an analysis of the effects of the Livestock Fencing, Stream Crossings and Off-Channel Livestock Watering Facilities category. It is described in ARBA II:

Projects will be implemented by constructing fences to exclude riparian grazing, providing controlled access for walkways that livestock use to transit across streams and through riparian areas, and reducing livestock use in riparian areas and stream channels by providing upslope water facilities. Such projects promote a balanced approach to livestock use in riparian areas, reducing livestock impacts to riparian soils and vegetation, streambanks, channel substrates, and water quality. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

Large and Small Wood

Low to moderate intensity livestock grazing generally has little effect to sources of large and small wood. An exception is when grazing occurs within hardwood stands such as aspen, alder, birch, and cottonwoods that could contribute larger pieces of wood to small streams. Livestock will graze young hardwoods, and rarely young conifers, but at levels that would not result in meaningfully measured effects to future large and small wood availability. There may also be incidental trampling of hardwood or conifer seedlings, but at very low levels. The effect to the indicator is immeasurable or insignificant.

Summary of effects to large and small wood

The effect to the indicator is insignificant, because there would not be meaningfully measured effects to large and small wood availability as a result of livestock grazing.

Sediment/Turbidity/Substrate

Livestock use can result in trampled and grazed riparian vegetation, and altered stream banks. Livestock use trails to access streams for water. Livestock may concentrate in certain areas, creating patches of relatively bare soil. Some of these areas may adjoin stream sections used by ESA-listed fish species for spawning, incubation, larval development and rearing. Erosion can result in fine sediment entering stream channels. Habitat impacts are likely to include areas of exposed streambank up to a few feet wide where livestock access streams to drink or cross, and areas of bank disturbance where livestock graze in riparian areas.

Erosion of soil from bare areas is likely to result in a slight increase in turbidity for a short distance downstream during rainstorms or runoff events. However, it is often difficult to distinguish turbidity resulting from grazing impacts and background turbidity. A slight increase in fine sediment deposition on substrate for a short distance downstream of exposed and disturbed areas is also likely to occur. There is the potential for fine sediment to slightly increase embeddedness within gravels suitable for spawning where it is located downstream from the exposed and disturbed streambank areas. These impacts are expected to be localized due to the scattered nature of the allotments and short-term, due to adaptive management that would be implemented to reduce these occurrences when they are discovered. Consequently, the effect to this indicator by livestock use is measurable and significant.

The ARBA II concluded that activities in the livestock fencing, stream crossings and off-channel livestock watering facilities category may increase short-term sediment loads into a stream channel during project implementation. This would result in short-term negative increases in turbidity. The following PRMP grazing management direction would minimize effects from range improvements:

- Implement range improvement projects in adherence with the following:
  - Conduct inventories and surveys for cultural resources, ESA-listed species, and Bureau Special Status Species prior to authorization of any project construction. Implement appropriate mitigations to reduce or eliminate potential effects to these resources.
  - Design projects to minimize surface disturbance at all project sites.
  - Rehabilitate disturbed soil to blend into surrounding soil surface. Re-vegetate using seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable, to replace ground cover, reduce soil loss from wind and water erosion, and discourage the potential establishment of any invasive plant species.
  - Use existing roads and trails to access areas for range improvement construction to the extent practicable. If needed, unimproved trails and tracks would be created to reach construction sites and provide access for future maintenance of the improvements. Locate unimproved trails or tracks outside riparian management areas where workable.
  - Limit brushing and tree limb removal to only that necessary for surveying, placement, and construction of improvements.

Fine coats of sediment would be deposited on channel substrate downstream. The distance traveled would depend on the geomorphology of the stream (i.e. whether it is a transport or depositional reach, how much wood is in the channel to trap sediment, and channel slope). Fine sediment on and within substrate used for spawning would be cleared away by fall-spawning salmonids. It is anticipated that most project-related sediment would be flushed out during the first high flows after project completion. However, smaller amounts of sediment may pulse through the stream system with subsequent flow events. Site restoration conservation measures are expected to prevent future project related sediment inputs into the stream. Therefore, long-term impacts to turbidity and spawning gravels are not expected from the grazing-related restoration actions covered in ARBA II. Adverse effects would be reduced by use of ACMs and PDCs of ARBA II, as well as PRMP BMPs and management direction. Overall, the effect to the indicator from the ARBA II grazing-related activities would be a measurable and significant effect.

Administration of livestock grazing by permittees involves use of vehicles on and off roads, as well as infrastructure maintenance. There is the potential for fine sediment to be transported to stream channels, primarily at road crossings, during rainstorms or runoff events. However, it would be indistinguishable from fines generated by other road users and background sources of fines. This should not result in meaningfully measurable amounts of turbidity, cobble embeddedness, or fines on spawning gravel. Range riding with horses will not cause any meaningfully measured increases in streambed sediment or turbidity. Maintenance activities are typically distant from occupied streams or designated CH, disturb little to no soil, and are not hydrologically connected to stream channels. Overall, the effects to the indicator from use of

vehicles, range-riding with horses, and grazing infrastructure maintenance is immeasurable insignificant.

Effects to the sediment/turbidity/substrate indicator would be minimized by use of PRMP grazing BMPs:

BMP G1. Fence water developments, including springs and seeps, unless other methods are available. Pipe overflow away from the developed source area.

BMP G2. Do not locate salting areas within 0.25 mile of permanent water sources or Riparian Reserves.

BMP G3. Locate new permanent livestock handling or management facilities (corrals, pens, or holding pastures) outside Riparian Reserves or 200 feet from water bodies and on level ground where drainage would not enter surface waters. Make changes as necessary to existing facilities within Riparian Reserves to meet water quality standards and regulations.

BMP G4. Apply specific grazing strategies for riparian wetland areas, including timing, intensity, or exclusion for maintenance of proper functioning condition.

Use one or more of the following features:

- Inclusion of the water bodies, floodplains, and wetlands within a separate pasture.
- Fence or herd livestock out of water bodies, floodplains, and wetlands for as long as necessary to allow vegetation to recover.
- Control the timing and intensity of grazing to keep livestock off stream banks when they are most vulnerable to damage and to coincide with the physiological needs of target plant species.
- Add more rest to the grazing cycle to increase plant vigor, allow stream banks to revegetate, or encourage more desirable plant species composition.
- Limit grazing intensity to a level that will maintain desired species composition and vigor.
- Permanently exclude livestock from those water bodies, floodplains, and wetlands areas that are at high risk and have poor recovery potential, and when there is no practical way to protect them while grazing adjacent uplands.

BMP G5. Recover degraded water bodies through adjustments to forage utilization levels, improved livestock distribution, and management through fencing, vegetation treatments, water source developments, or changes in season of use or livestock numbers.

Summary of effects to sediment/turbidity/substrate

Fine sediment would enter stream channels as a result of livestock access, construction of some livestock exclusion fences and cattle stream crossings, as well as from development of some

off-channel livestock watering facilities. Sediment from these sources would result in measurable short-term increases in turbidity, as well as fine sediment deposition on streambed substrate, including spawning gravels. These effects are anticipated to be short-term (becoming immeasurable before the next grazing season). The effect to the indicator is measurable, and therefore adverse.

Water Temperature

The preferred forage for cattle is grass or grass-like species. In meadow streams with narrow channels, they often are the plants that provide most of the stream shade. Livestock use will potentially reduce vegetation heights to 4 or 6 inches. This will considerably reduce stream shade in those circumstances compared to the ungrazed potential vegetation heights. There may also be some grazing on hardwood trees such as willows, which would reduce stream shade.

Livestock use is likely to result in measurable water temperature increases for certain stream reaches. These negative impacts are expected to be generally confined to narrow, low gradient stream channels where grass/grass-like vegetation, and small woody shrubs provide the majority of the stream shade. The effect to this indicator by livestock use is measurable.

Summary of effects to water temperature

Grazing of narrow streams with grass or grass-like species providing the shade is likely to reduce the shade to a point where a measurable stream temperature increase would result. This would be a measurable (adverse) effect.

Peak and Base Flows

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows are also affected by concentration of flows associated with increases in road connectivity to stream channels. Base flows can be negatively affected by livestock drinking directly from a stream channel.

The activity does not include road construction. BMPs would not allow grazing allotments to reduce vegetation levels to the point where there would be a measurable change to peak or base flows. However, there is the potential for a measurable effect to base flows by livestock drinking directly from small streams at summer low flows. Similarly, in the case of sucker species, livestock drinking from a reservoir at minimum pool may measurably negatively affect base level water availability. In that specific circumstance when the water body supports ESA-listed fish or designated CH, there would be an adverse effect to the indicator.

Summary of effects to peak and base flows

The effect to the indicator is measurable negative (adverse) in the circumstance when livestock drink from a small stream or reservoir at low flow/minimum pool, where the stream or reservoir provides habitat for ESA-listed fish and/or has designated CH.

Riparian Reserve Function and Vegetation Diversity

Some Riparian Reserve functions will be affected by livestock grazing that occurs within the Riparian Reserve. Many functions of Riparian Reserves are addressed by other indicators used for this effects analysis. Grazing would reduce shade provided by grass or grass-like vegetation, and also from grazing of hardwood trees such as willows. The combined effects may result in measurable water temperature increases in specific situations where the stream has a narrow channel and grass or grass-like vegetation provides the stream shade. The filtering capability of near stream vegetation would be impaired, resulting in fine sediment entering stream channels. As described below, there would be a measurable (adverse) effect to the Chemical Contamination and Nutrients indicator from phosphorous and nitrogen sources (urine and dung in riparian areas).

Streambanks may be altered, negatively affecting steambank stability. There may be localized changes in channel geometry, with an increased width-to-depth ratio (shallowing of the stream). The diversity of riparian vegetation may be reduced in the short-term. Overall, there would be a measurable (adverse) effect.

Summary of effects to riparian reserve function and vegetation diversity

There will be localized short-term negative (adverse) effects to several functions of Riparian Reserves. They are effects to: shade and water temperature; filtering capability for fine sediment; bank stability; channel geometry; and, diversity of riparian vegetation. Consequently, there will be an overall adverse effect to the indicator.

Chemical Contamination and Nutrients

Urine and dung from livestock use in riparian areas and directly deposited into streams or reservoirs results in nutrient loading of nitrogen and phosphorous. In small streams at low flow periods, and reservoirs at base pool levels, this can increase oxygen demand and algal growth, reducing habitat quality for ESA-listed fish species. At higher stream flow and larger reservoir pool situations, nutrient increases could result in increased primary productivity that may increase macroinvertebrate production. In the low flow/minimum pool situation, it would result in measurable negative effects to the indicator.

The risk of chemical contamination to streams by vehicle use during grazing administration by permittees is not expected to be meaningfully measured. Maintenance activities are typically distant from designated CH, and at locations not hydrologically connected to stream channels. Therefore, it is extremely unlikely for petroleum products spilling from power tools to affect the indicator. Use of horses for range riding will have similar, but very reduced effects to the indicator from horse dung and urine, when compared to livestock grazing. The overall effect of grazing administration and maintenance activities to the indicator would not be meaningfully measured, and is therefore an insignificant negative effect.

Summary of effects to chemical contamination and nutrients

Livestock grazing will result in urine and dung in riparian areas, and potentially in the stream/reservoir itself. This will lead to increases in nutrients such as nitrogen and phosphorous in the water column. During low flow periods in streams and minimum pool periods in reservoirs, this nutrient enrichment could lead to reduced dissolved oxygen levels and increased

algal growth, reducing habitat quality for ESA-listed fish species Therefore, the effects to the indicator are measurable (adverse).

Roads within Riparian Reserves

There is no road construction or maintenance associated with livestock grazing. Consequently, there is no mechanism to affect the indicator. There is no effect to the indicator.

Summary of effects to roads within riparian reserves

There is no effect to the indicator because there is no road construction or maintenance associated with livestock grazing.

Direct Effects to the Species from the Livestock Grazing Program

There is a potential for some life stages of ESA-listed fish species to be present in stream reaches when cattle have access to the stream. Cattle walking into the water would disturb and/or displace individual fish. This may cause them to move away from cover, leave established territories, expose them to predation, and cause them to expend energy. The Management direction below would limit interactions between livestock and ESA-listed or Bureau Sensitive fish.

- Restrict livestock from streams with ESA-listed or Bureau Sensitive fish species during spawning, incubation, and until 30 days following the emergence of juveniles from spawning areas.

However, it is concluded that there may be harm or harassment to individual fish as a result of livestock grazing where cattle have access to stream reaches where the species are present.

Summary

The indicator analysis results are summarized in Table 159. The most impacting effect to the indicator is displayed. Where there is an adverse effect to an indicator, there may also be insignificant, discountable or beneficial effects from different components of the program activities. The analysis above was based upon an allotment where livestock have access to a stream or standing body of water that is inhabited by ESA-listed fish. The site-specific circumstances of an allotment may result in different effects to the indicators, dependent upon the exposure of the habitat characteristics to the effects of livestock grazing, and the timing, duration and magnitude of that exposure.

The adverse effects summarized below would occur at scattered locations within and downstream from BLM land with designated CH for the species. For shortnose suckers, it would occur within and downstream for short distances from the 7.5 miles of stream and 147.1 acres of designated CH in or adjacent to livestock grazing allotments in the Lost River Recovery Unit. This is out of a total of 39 miles and 5,382 acres of designated CH in the Lost River Recovery Unit within the planning area. For SONCC coho salmon, it would occur within and downstream for short distances from the 64.7 miles of stream and an estimated 4,706 acres of designated CH in or adjacent to livestock grazing allotments. This is out of a total of 3,097

miles and an estimated 225,236 acres of designated CH in the SONCC coho salmon ESU within the planning area.

Table 159. Summary of indicator analysis results for the Livestock Grazing program.

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Insignificant negative
Sediment/turbidity/substrate	Adverse (short-term measurable negative effects due to fine sediment entering channels and water column)
Water temperature	Adverse (a measurable negative effect in specific stream reaches where grass or grass-like vegetation and willows provide shade to narrow stream channels)
Peak/base flows	Adverse (measurable negative in the circumstance where livestock drink from a small stream or reservoir at low flow/base pool).
Riparian Reserve function and vegetation diversity	Adverse (short-term due to measurable negative effects to: shade and water temperature; filtering capability for fine sediment; bank stability; channel geometry; chemical contamination from livestock urine/feces; and, diversity of riparian vegetation.)
Chemical contamination / nutrients	Adverse (short-term measurable negative effects due to decreased dissolved oxygen and increased algal growth in streams with low flows or reservoirs at minimum pool).
Roads within Riparian Reserves	No effect

In addition to adverse effects to several of the indicators, it was determined that there would be direct effects to the species, resulting in harm or harassment as a result of livestock interactions with individual fish in stream channels.

Over time, monitoring and adaptive management are expected to result in a lessening of potential impacts stemming from grazing activities. If effectiveness monitoring indicates that applied grazing scenarios are not resulting in progress toward meeting the standards for rangeland health, the BLM would adjust grazing levels and management practices to correct this situation.

7. Minerals

BMPs for salable mineral activity under the PRMP address measures to reduce the possibility of sediment delivery or chemical contamination to floodplains, wetlands, Riparian Reserves, and waters of the state (Table 160).

Table 160. BMPs for salable mineral activity under the PRMP.

BMP Number	BMP Description
M 1	Locate stockpile sites on stable ground where the material would not move into water bodies, floodplains, and wetlands.
M 2	Locate, design, and construct salable mineral sites to control runoff and prevent or minimize sediment delivery to streams. Prevent overburden, solid wastes, drainage water or petroleum products from entering wetlands, Riparian Reserves, flood plains and waters of the State.
M 3	Locate, design, and maintain settling ponds to contain sediment discharges.
M 4	When a quarry or rock pit is depleted or vacated, stabilize cutbanks, headwalls, and other surfaces to prevent surface erosion and landslides. Close roads, excavations, and crusher pads in accordance with Roads and Landings section. Remove all potential pollutants to prevent their entry into wetlands, Riparian Reserves, floodplains, and waters of the State.
M 5	Use erosion-reduction practices, such as seeding, mulching, silt fences, and woody debris placement, to limit erosion and transport of sediment to streams from quarries. Provide drainage from stockpiles and mineral sites, dispersed over stable vegetated areas rather than directly into stream channels. Grade all material sites, where practicable to conform with the surrounding topography prior to closure. Utilized topsoil as a medium to for successful revegetation. Reseed and plant trees, where needed.

The operation of existing rock quarries has undergone ESA consultation for Pacific salmon species, resulting in the Western Oregon Programmatic Consultation BO (NMFS 2011, consultation no. 2010/02700). Project Design Criteria (PDC) identified for quarry operations covered under the Programmatic BO are shown in Table 161.

Table 161. Project design criteria (PDC) for rock quarry operations covered by the Western Oregon Programmatic Biological Opinion (NMFS 2011).

PDC	PDC Description
A	For quarries within riparian areas, conduct activities with the potential to introduce sediment into streams only during the dry season (generally May 15 to October 15). If unusual circumstances (e.g., emergency road repair) require such activities to occur outside of the dry season to prevent greater damage to water quality and fish habitat, prevent off-site sediment soil movement through use of filter materials (such as straw bales or silt fencing) and other mitigation measures.
B	For quarries within riparian areas, prepare and carry out an erosion and pollution control plan, commensurate with the scope of activity at the quarry, that includes the following information: (1) The name, phone number, and address of the responsible official; (2) best management practices to confine vegetation and soil disturbance to the minimum area, and minimum length of time, as necessary to complete the action, and otherwise prevent or minimize erosion and sedimentation associated with the action; (3) best management practices to confine, remove, and dispose of hazardous materials generated, used, or stored at the work site; and (4) procedures to contain and control a spill of any hazardous material generated, used or stored at the work site, including notification of proper authorities.
C	Avoid ground-disturbing activities during wet periods that have the potential to generate and deliver sediment to streams.
D	Exposed soils that may deliver sediment to streams shall be treated prior to fall rains with grass seed, slash, water bars or other appropriate methods that will minimize or eliminate sediment

	delivery.

Term and Condition 3 of the NMFS programmatic BO is specific to rock quarry operations:

> "To implement reasonable and prudent measure #3 (blasting in rock quarries), the USDFS, BLM, and BIA/CIT shall:
>
> a. Apply the minimum setback distances (or greater) from LFH for blasting, based on charge weight, as identified in Appendix 9 to this document. Blasting closer to LFH than the setback distances identified in Appendix 9 to this document is LAA listed species, is beyond the scope of this opinion, and would require an individual consultation under section 7 of the ESA.
>
> b. Prohibit blasting during upstream migration of adults, adult holding, spawning, and egg incubation for ESA-listed fish within 3 miles of LFH. Blasting during these periods is LAA listed species, is beyond the scope of this opinion, and would require an individual consultation under section 7 of the ESA."

All quarry operations will conform to the BMPs, PDCs and Terms and Conditions of the programmatic consultation, state and federal laws and regulations.

The Programmatic BO (NMFS 2011) describes the criteria for the ESA effect determination for rock quarry operations. It has two main components: the nature of the environmental disturbance that will be caused by the action, and the proximity of the environmental disturbance to Listed Fish Habitat (LFH). Activities that cause or sustain the following types of disturbance in the following locations shall be considered LAA listed species and their critical habitats, and subject to pre-activity notification and annual reporting; actions that do not cause or sustain these types of disturbance, or that occur outside of the following locations shall be considered NLAA. The appropriate PDCs for each activity shall apply.

1. Nature of the environmental disturbance. The following types of disturbance shall lead to a determination of LAA when they occur in proximity to LFH:
    a. erosion or compaction of riparian soils, streambanks, or channel substrates
    b. removal or suppression of native riparian vegetation
    c. runoff containing sediment, nutrients, pesticide, salts, or other pollutants that are delivered to LFH through a system of culverts, ditches or channels
    d. removal of water
2. Proximity of the environmental disturbance to LFH. An environmental disturbance shall be considered in proximity to LFH when it occurs in the following locations:
    a. any area within 150 feet (slope distance) of LFH
    b. any area within 150 feet (slope distance) of any stream that is up to 300 feet upstream of LFH
    c. any area that is physically connected to LFH by a system of ditches, channels or culverts such that runoff or sediment delivered from that area into the drainage system will eventually be delivered to LFH without being intercepted and

immobilized by a riparian or vegetation buffer

d. for removal of water only, any stream reach within LFH or within 1,500 feet of LFH

Effects to Environmental Baseline

The variety and magnitude of possible mineral activities on BLM land is diverse. The footprint can range from far less than one acre to many acres. Most Plans of Operation are less than 3 acres, and rock quarries typically range from .01 to 5 acres (Parry, pers. comm. 2015). A sub-set of mineral activities could be proximal to the distribution of ESA-listed fish and to designated critical habitat. Consequently, the effects to ESA-listed fish and their designated CH could range from "No Effect" to "May Affect, Likely to Adversely Affect" (LAA). It would be speculative to analyze the effects of a worst-case scenario that may be extremely unlikely to occur for actions of any of the three categories of BLM mineral management (Salable, Locatable, Leasable). Currently, there are no proposals before the BLM for leasable minerals, including geothermal fluid minerals.

It is known that the ESA effect determination for effects of BLM rock quarry operations to ESA-listed Pacific salmon and designated CH is either NLAA or LAA for specific conditions described in the Western Oregon Programmatic Consultation BO (NMFS 2011). The specific conditions are described above in the salable minerals section. The adverse effects in that consultation for rock quarry operations correspond to the following indicators of this BA:

- Sediment/turbidity/substrate (fine sediment delivery to water column and streambed)
- Chemical contamination (from spills or leaks of fuel, lubricants, hydraulic fluid or coolants)

In addition, adverse effects from rock quarry operations could occur due to hydroacoustic impacts from blasting, and the reduction of forage organisms for juvenile ESA-listed Pacific salmon as a result of fine sediment reducing their living space on streambed substrate.

The ESA effect determination for the approval of Forest Service Notices of Intent for suction dredge gold mining in streams inhabited by SONCC coho salmon and OC coho salmon and to designated CH in watersheds of the Rogue-Siskiyou National Forest was determined to be "LAA" (USFS 2015). The effects analysis for the USFS (2015) BA is herein incorporated by reference. Similar effects could be expected for suction dredging occurring on BLM lands during the life of the RMP (notwithstanding the soon to be enacted moratorium by the state of Oregon). The adverse effects identified in the 2015 USFS BA (2015) correspond to the following indicators of this BA:

- Sediment/turbidity/substrate (fine sediment delivery to water column and streambed)
- Chemical contamination (from fuel spills and the remobilization of mercury and other trace metals from deep sediments)

Elemental mercury persists in the environment. Remobilization of mercury by suction dredging may result in mercury being delivered to estuaries, where conditions in slow-velocity, fine sediment areas may be conducive to methylation. Methylmercury is the primary form that bioaccumulates in organisms. The ESA-listed fish species in the action area that may be exposed to methylmercury contamination include SONCC coho salmon, Southern DPS green sturgeon and Southern DPS Pacific eulachon.

Adverse effects from suction dredge gold mining were also attributed to effects to forage organisms for rearing ESA-listed fish species as a result of fine sediment reducing their living space on streambed substrate, and from bioaccumulation of methymercury. Direct effects may occur due to the following:

- Entrainment in suction dredge or impingement on screens
- Trampling by wading by NOI operators
- Displacement by dredge tailings (reduction in living space)
- Disturbance during dredge operation
- Spawning on unstable dredge tailings
- Stranding

Consequently, the BLM concludes that the ESA effect determination for effects of the Minerals Program under the PRMP to ESA-listed fish and their designated CH is "LAA." Effects would be minimized by regulations (CFRs), use of management direction, BMPs, PDCs and Terms and Conditions of the Western Oregon Programmatic BO (NMFS 2011), and future ESA consultation.

8. Recreation and Visitors Services

The FEIS states that the BLM would manage recreation to protect habitat for Federal threatened and endangered species. The BMPs that apply to public motorized travel trails and the hiking trail system that would reduce effects to ESA-listed fish habitat and designated CH are displayed in Table 166 in the Trails and Travel Management effects analysis section of this BA. The remaining Recreation BMPs are shown below in Table 162.

Table 162. BMPS for all recreation facilities, and those specific to developed recreation sites, water dependent facilities and dispersed recreation.

BMP Number	BMP Description
All Recreation Facilities	
REC 1	Implement erosion control measures at recreation sites to stabilize exposed soils where water flows or sediment, may reach water bodies.
REC 2	Minimize development of recreation facilities that are not water-dependent (e.g., boat ramps and docks) in the Riparian Reserve.
Developed Recreation Sites	
REC 3	Self-contained sanitary facilities would be used at all developed recreational facilities, unless a sewage system and drain field is approved by the Department of Environmental Quality.
REC 4	When conducting recreation site maintenance, do not cut portions of logs or coarse woody debris that fall across the active stream channel. Keep adequate lengths of material on the banks to anchor it in place. If not

	possible to make the log stable, it may be removed.
Water Dependent Facilities	
REC 5	Construct boat ramps and approaches with hardened surfaces. Minimize riprap to a 4 foot width to protect concrete ramps. Docks must not be wider than 6 feet, and not include any treated wood.
Dispersed Recreation	
REC 32	Site camps for permitted group overnight camping would be greater than 150 feet from surface water.

Because of the way that the BLM has defined its programs in the FEIS, the public motorized travel trails and non-motorized trails systems used for recreation purposes are part of the Trails and Transportation Management program. Consequently, the effects of public motorized travel and non-motorized trails were evaluated in the effects analysis section for the Trails and Transportation Management program, and the reader is directed to that section for the analysis.

Three activity categories of the BLM Recreation and Visitors Services program in the decision area have been evaluated in past programmatic consultations for their effects to ESA-listed Pacific salmon and associated designated CH, and to bull trout. The resultant BOs are known as the Northwest Oregon Programmatic BO (USFWS 2008) and the Western Oregon Programmatic BO (NMFS 2011). Both BOs are currently in effect. Note that the USFWS issued their BO for effects to bull trout in response to a 2008 BA (USDI BLM and USDA FS 2008), while the NMFS issued their BO in response to a 2010 BA. The three activity categories are:

1. Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use
2. Miscellaneous Special Use Permits and Leases
3. Commercial Rafting Permits

The effects analyses for the 2008 and 2010 BAs and BOs are incorporated herein by reference. BLM activities occurring under the three categories would utilize the PDCs of the 2008 and 2010 BAs, and follow the terms and conditions of the 2008 and 2011 BOs, to minimize adverse effects to ESA-listed fish species and designated CH.

The effects analysis presented below summarizes the effects of the three recreation activity categories of the two programmatic consultations. It then combines the effects of the three categories already addressed in the programmatic consultations with that of the public motorized travel trails and non-motorized trails analysis presented in the Trails and Travel Management program effects analysis, to arrive at an effects analysis for the entirety of the Recreation and Visitors Service program.

<u>Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use</u>

This category is described in the Northwest Oregon Programmatic BA (USDI BLM and USDA FS 2008) as providing access to and use of existing public recreational activities (e.g., campgrounds, picnic areas, trails, boat ramps) and existing Federal and Tribal land administration, including safety and property damage reduction. Program activities are described in the BA as:

- Hazard tree management (at developed and dispersed recreation facilities, along trails, at rights-of-way, and for adjacent non-Federal land)
- Facility maintenance, repair, and upgrade
- Trail maintenance and off-highway vehicle trail maintenance, repair, and upgrade (including that of stream crossings; typically using hand tools, hand power tools, small motorized equipment)
- Brushing, tread work, minor realignment, saw-out of downed trees within a trail
- Boulder placement which limit vehicular activity associated with dispersed camp sites
- Construction and maintenance of small bridges in recreation sites and on trails

The BA used the following criteria to determine the ESA effect determination for these actions:

"A determination of LAA will result when maintenance or use activities occur within 150' of LFH when the activity is reasonably certain to result in meaningfully measurable changes to sediment, chemical contaminant, stream temperature, or instream large wood recruitment to LFH, or when routine facilities maintenance occurs within the ordinary high water mark of LFH. Routine trail maintenance is NLAA when the activity is >150' from LFH and/or will not result in meaningfully measurable sediment or chemical delivery, increase in stream temperature or reductions of in-stream large wood recruitment to LFH."

The USWFS BO (USFWS 2008) identified adverse effects to habitat indicators and to bull trout, including harm and harassment. At that time there was no designated CH for bull trout on federal land in northwest Oregon.

The description of this activity category in the Western Oregon Programmatic BA (USDA FS et al., 2010) was slightly different than in the 2008 BA, incorporating a new sub-category of adjusting in-channel hazard trees:

- Tree hazard management at developed and dispersed recreation facilities, trails, rights-of-way, and adjacent non Federal land
- Facility maintenance, repair, and upgrade
- Trail maintenance, repair, and upgrade (including that of stream crossings; typically using hand tools, hand power tools, small motorized equipment)
- Brushing, tread work, and saw-out of downed trees within trail, including adjustment of in-channel hazard trees in streams or rivers regularly used for surface water recreation (e.g. boating, rafting, kayaking, tubing, etc.)

- Boulder placement to limit vehicular activity associated with dispersed camp sites; and
- Maintenance of small bridges in recreation sites and on trails.

The 2010 BA used the same criteria to determine the ESA effect determination as in the 2008 BA, described above. The NMFS BO (NMFS 2011) identified adverse effects to habitat indicators, biological effects to Pacific salmon species and to PCEs of designated CH from Category 1 activities, including harm and harassment.

Miscellaneous Special Use Permits and Leases

This category is described in the Northwest Oregon Programmatic BA (USDI BLM and USDA FS 2008) and the Western Oregon Programmatic BA (USDA FS et. al., 2010) as miscellaneous designated activities authorized or permitted on Federal land. A recreation event is almost any kind of outdoor activity where participants exchange money or pay a fee for the opportunity to hold an event on federal lands. Examples of recreation event activities include: Nordic ski races; bike races; or private club outings, etc. A free permit is required for non-commercial group uses such as weddings, family gatherings or political rallies.

Program activities also include permits for (but not limited to): group recreation; outfitters and guides for non-aquatic activities (such as leading horseback rides); use of Federally owned structures; resort operation on Federal land; and summer home/recreational residence maintenance, including hazard tree removal, and administration; organizational camps; target ranges; fences; and weather stations. Special use permits are issued to members of the public.

Ski area resort operations were specifically excluded from the consultation. The BLM and FS stated that only actions with discountable or non-measurable effects were covered by the BA. Actions that would result in more than discountable or insignificant effects to listed fish would be addressed in separate consultations. This meant that only actions that had NLAA effect determinations were covered in the ESA consultation for this category of action.

The 2008 BA (USDI BLM and USDA FS 2008) and the USFWS BO (USFWS 2008) identified insignificant or discountable negative effects to habitat indicators that may be affected by this recreation category's actions, resulting in an NLAA determination for effects to the species. At that time there was no designated CH for bull trout on federal land in northwest Oregon.

The 2010 BA used the following criteria for arriving at an NLAA effect determination: "Permits are NLAA actions when >150' from LFH and/or when permitted activities are reasonably certain to not result in meaningfully measurable changes to stream temperature, in-stream large wood recruitment potential, or water quality (sediment or chemical contaminant delivery)."

The NMFS BO (NMFS 2010) effects analysis concluded that issuing special use permits for summer homes/recreational residences resorts and organizational camps would result in adverse effects to two habitat indicators: water temperature and large wood. This is a result of press effects on shade-producing vegetation and trees that could grow into the large wood category. The BO also identifies adverse biological effects and adverse effects to PCEs of designated CH from effects to water temperature and large wood. Consequently, NMFS identified a term and condition for this circumstance: "Special use permits or leases involving non-Federal structures,

associated facilities and other areas (e.g., access roads, driveways) that have existing or prospective soil compaction, native vegetation suppression, or native vegetation removal within 150 feet of LFH shall be considered LAA, unless the action agency submits written justification (see 2.l. below) as to how the effects of the permitted activity would be NLAA listed species and critical habitats. NMFS will consider the information provided and respond within 30 days as to the suitability of the permitted activity for inclusion in this programmatic consultation."

Commercial Rafting Permits

This recreation category is described in the 2008 BA as permits for outfitters and guides for surface water recreating (commercial river rafting), and other aquatic activities such as kayaking competitions on Federal land. The 2010 BA describes the category as permits issued to fishing guides, whitewater rafting companies and canoe and kayak clubs. For both BAs, it is stated that permits may include commercial activities over a season or single events such as a weekend rafting race. PDCs require special use permit applications be evaluated by fishery biologists to assure stipulations are included in the permit that reduce or minimize disturbance to ESA listed fish, and impacts to riparian areas and water quality.

The 2008 USFWS BO determined that there were adverse effects to several habitat indicators and adverse biological effects to bull trout, concluding in an LAA effect determination. The 2011 NMFS BO concluded measurable negative localized short-term effects to substrate from fine sediment, as well as biological effects to ESA-listed Pacific salmon species, from this activity.

Public Motorized Travel Trails and Non-motorized trail maintenance and use

The effects of using and maintaining the public motorized travel trails and non-motorized trails systems has been evaluated elsewhere in this BA in the Trails and Travel Management effects analysis section. The conclusion was LAA to the species and to designated CH for Pacific salmon species, Southern DPS green sturgeon, bull trout, shortnose suckers and Lost River suckers.

Table 163 is a synthesis of effects to the indicators from all components of the Recreation and Visitors Service program, including those effects identified in the two programmatic BOs (USWFS 2008, NMFS 2011) and those evaluated for the Trails and Travel Management program elsewhere in this BA.

Table 163. A synthesis of effects to indicators from implementing the Recreation and Visitors Services program as interpreted from the two programmatic consultations BAs and BOs (USDI BLM and USDA FS 2008, USDA FS et. al., 2010, USWFS 2008, NMFS 2011) and the analysis of effects of public motorized travel trails and Non-motorized trails use and maintenance in the Trails and Travel Management section of this BA.

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Measurable negative (adverse), localized
Sediment/turbidity/substrate	Short-term negative (adverse), localized

Water temperature	Measurable negative (adverse), localized
Peak/base flows	Effects to peak/base flows were not evaluated in the programmatic BOs for the recreation activities. However, public motorized travel and non-motorized trail systems are hydrologically connected to stream channels and concentrate flows in a manner similar to roads, but at a smaller scale. The effect would be insignificant negative and localized.
Riparian Reserve function and vegetation diversity	Measurable negative (adverse), localized
Chemical contamination / nutrients	Measurable negative (adverse), localized
Roads within Riparian Reserves	Measurable negative (adverse), localized

Direct Effects to the Species from the Recreation and Visitors Services Program

Some components of the Recreation and Visitors Services program will result in harassment and/or harm of ESA-listed fish species, and will result in an adverse effect to the species. Disturbance of fish from in-water activities by the general public and those under permit (such as commercial rafting, kayaking, etc.) would result in fish moving, potentially increasing stress and vulnerability to predation. People using recreation sites harm some eggs, fry, and juveniles by stepping on redds or on gravels containing rearing fry or juveniles.

Localized increases in turbidity will cause fish to move from preferred sites such as feeding stations and alter behavior patterns for a short time. Localized water temperature increases may occur as a result of loss of shade vegetation at heavily used recreation sites along streams. Water temperature increases cause adverse physiological and behavioral effects to ESA-listed Pacific salmon and bull trout (shortnose and Lost River sucker are more tolerant of temperature increases). Fine sediments reducing interstitial spaces between substrate cobble, and loss of large wood (for example, from removal of instream hazards for boaters) may negatively impact cover for fish, resulting in an increased risk of predation. Fine sediments in substrate will also reduce production of macroinvertebrates utilized as forage, resulting in reduced growth rates for ESA-listed fish.

Summary

The indicator analysis presented above in Table 163 determined that there would be measurable negative (adverse) effects to each of the habitat indicators except for peak/base flows, from a sub-set of actions of the Recreation and Visitors Services Programs. Many of these effects would be localized and short-term. However, some would be long-term, such as effects to water temperature and potential large and small wood recruitment from suppressed vegetation at developed recreation sites. It was also determined that there would be direct effects to the species, resulting in harassment (displacement of fish from territories as a result of turbidity

plumes, fine sediment in interstitial spaces between streambed cobbles or from human disturbance) and potential harm (people using recreation sites may harm some eggs, fry, and juveniles by stepping on redds or on gravels containing rearing fry or juveniles). Harm and harassment constitute adverse effects to the species.

While there are certainly localized impacts associated with BLM-managed campgrounds, the BLM does not anticipate any substantial increases to the number or physical footprint of these facilities. Many of these impacts were present immediately following the original construction of the facilities, and have not measurably changed in several decades. There are a limited number of recreation facilities found in each of the ESU's (see Table 60). The highest number is in the OC coho salmon ESU, which also covers a large geographic area. Given the spatially limited footprint of those facilities, we do not anticipate significant, measurable impacts to ESA-listed fish or to designated CH from their continued operation.

As mentioned previously, the majority of impacts associated with road maintenance and general use are covered in more depth in the Forest Management, and Trails and Travel Management sections of this BA. Road use stemming from recreational driving would represent a relatively small component of a respective road's annual use, and would tend to be spread out over space and time, further limiting the potential impact signature of this use.

9. Special Forest Products

Harvest or gathering of SFP has the potential to affect ESA-listed fish species when the activities occur within Riparian Reserves. The SFP program underwent ESA consultation, concluding in two BOs that remain in effect. The Northwest Oregon Programmatic BO (USFWS 2008) addresses effects to bull trout. The Western Oregon Programmatic BO (NMFS 2011) addressed effects to ESA-listed Pacific salmon species and their designated CH. The effects analyses from both BOs are herein incorporated by reference. The BA includes a Project Design Criterion to limit ESA effects:

> "Fisheries, hydrology or other qualified personnel should review collection areas proposed within riparian areas, and set boundaries or other limits as necessary to ensure that collection activities will not adversely affect riparian and aquatic habitat functions."

Any future SFP activity under the PRMP that would result in ESA effects greater than "NLAA" to the species or designated CH would be subject to an individual ESA consultation.

Effects to Environmental Baseline

Large and Small Wood

A subset of SFP activities would occur within Riparian Reserves. The potential to affect large and small wood recruitment to stream channels is extremely limited. Site excavations for plant transplants typically have a small footprint and rarely impact vegetation. Vegetation that may be affected would primarily be low growing vegetation such as grasses, shrubs and forbs. Firewood collection is often opportunistic, taking a fallen tree by the side of a road. Firewood is also offered from cull log decks left after commercial timber sales are completed. Effects to small and large wood recruitment to streams would be extremely unlikely to occur. Therefore, there would be a discountable negative effect to the indicator.

Summary of effects to large and small wood

The effect to the indicator would be discountable because it is extremely unlikely that any trees would be damaged or removed by site excavation.

Sediment/Turbidity/Substrate

A subset of SFP activities under the PRMP would occur within Riparian Reserves. Many of the activities do not disturb soil, such as collection of boughs, fern fronds, salal, huckleberry, berries, and mosses. Others have a small footprint of soil disturbance such as digging up a plant for transplant, digging for roots, or plucking a mushroom. Firewood gathering, and post and pole collection may also disturb the soil surface, but sites usually occur on relatively flat ground not prone to soil transport by erosion. Duff, down wood, and low lying vegetation between the sites and any stream channels occupied by ESA-listed fish would effectively prevent the delivery of fine sediment to streams. It is extremely unlikely that there would be a quantity of fine sediment reaching streams as a result of these activities that would result in meaningfully measurable effects to turbidity, fine sediment in spawning gravel or fine sediment in the interstitial spaces between cobbles used as habitat by ESA-listed fish. Consequently, there will be a discountable effect to the indicator.

Summary of effects to sediment/turbidity/substrate

The effect to the indicator would be discountable. Soil disturbance typically occurs in small areas and it is extremely unlikely that the amount of fine sediment reaching stream channels occupied by ESA-listed fish would result in meaningfully measurable effects to turbidity, fine sediment in spawning gravel or fine sediment in the interstitial spaces between cobbles used as habitat.

Water Temperature

A subset of SFP activities under the PRMP would occur within Riparian Reserves. Very little vegetation that provides shade to stream channels would be harvested or gathered as SFP. Many of the plants are understory plants that provide little or no shade, and only parts of many of the plants would be collected (fronds, leaves and branches). Firewood, and post and pole collection sites often utilize dead standing trees that do not provide much shade, and are usually located away from stream channels. The potential to affect water temperature by these activities is extremely limited. At most, there would not be meaningfully measurable effects to water temperature. Consequently, there will be an insignificant negative effect to the indicator.

Summary of effects to water temperature

The effect to the indicator would be insignificant negative because little to no shade vegetation would be removed along any streams occupied by ESA-listed fish. Effects would not be meaningfully measured.

Peak and Base Flows

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows are also affected by concentration of flows associated with increases in road connectivity to stream channels.

SFP actions do not include road construction or other flow-concentrating mechanisms or actions at a scale that would affect peak or base flow. Therefore, there would be no effect to the indicator.

Summary of effects to peak and base flows

There would be no effect to the indicator because there is no road construction or other flow-concentrating mechanisms or actions at a scale that would affect peak or base flow.

Riparian Reserve Function and Vegetation Diversity

Many functions of Riparian Reserves are addressed by other indicators used for this effects analysis. The effects to the Large and Small wood indicator, the Sediment/Turbidity/Substrate indicator, the Water Temperature indicator, and the Chemical Contamination and Nutrients indicator (see below) have been determined to be discountable negative, or insignificant negative. There is no mechanism to affect the Roads within Riparian Reserves indicator, as described below.

Because sediment delivery to stream channels in amounts resulting in meaningfully measurable effects is extremely unlikely to occur, there is no mechanism to affect the quality of pools, cause changes to width-depth ratio, affect streambank stability, or change the connectivity of the stream with its floodplain. The diversity of low-growing riparian vegetation may be reduced in the short-term by removal of an occasional plant for transplant or cutting of a Christmas tree, but the effects would be insignificant.

Summary of effects to riparian reserve function and vegetation diversity

There will be a mix of insignificant, discountable and no effects to several functions of Riparian Reserves. Consequently, there will be an overall insignificant negative effect to the indicator.

Chemical Contamination and Nutrients

The only potential for chemical contamination would be an accidental spill of fuel for a chain-saw or wood splitter machine. If it were spilled, it would be in a very small amount; likely a fraction of a gallon. The likelihood that it would reach the stream channel and cause a meaningfully measurable effect to water quality is extremely low. There is no mechanism to affect nutrients. The overall effect would be discountable.

Summary of effects to chemical contamination and nutrients

The effect would be discountable. It is extremely unlikely that the small amount of fuel that may be spilled would reach a stream channel and cause a meaningfully measurable effect to water quality in an area occupied by ESA-listed fish.

Roads within Riparian Reserves

There is no mechanism to affect the indicator. Collecting or harvesting SFP does not affect the quantity of roads, their connectivity with stream channels, or any migration barriers.

Summary of effects to roads within riparian reserves

There is no causal mechanism to affect the indicator.

Direct Effects to the Species from the Special Forest Products Program

There is no mechanism of the SFP program that would result in direct effects to the species. No activities occur within streams, and any collection or harvesting activity would not result in harassment.

Summary

The indicator analysis results are summarized in Table 164.

Table 164. Summary of indicator analysis results for the Special Forest Products Program.

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Discountable
Sediment/turbidity/substrate	Discountable
Water temperature	Insignificant
Peak/base flows	No effect
Riparian Reserve function and vegetation diversity	Insignificant
Chemical contamination / nutrients	Discountable
Roads within Riparian Reserves	No effect

There will be no SFP activities that result in harm or harassment to the species.

10. Sustainable Energy

The three components of the PRMP Sustainable Energy Program are biomass, wind and geothermal. Biomass in the form of slash would be available for the purpose of generating energy under the PRMP. Slash is wood residue such as tree-tops, limbs, cull material and broken pieces from harvested merchantable timber. It can also include non-merchantable hardwoods and sub-merchantable wood material removed from fire-prone stands. Slash is an outcome of the Forest Management program. The effects to ESA-listed fish and designated CH from Forest Management activities under the PRMP are described elsewhere in this section. The effects of removing slash from harvest units and hauling it to a biomass energy production plant would be a subset of those effects to the indicators described for Forest Management activities. The effects to the indicators that are specific to the removal and haul of slash are summarized below.

A second issue addressed in the FEIS is how energy transmission Right-of-Way (ROW) avoidance and exclusion areas affect the potential siting of wind energy developments and sustainable energy corridor designations. The PRMP identifies 564,591 acres of land with designations resulting in avoidance or exclusion from siting wind energy developments and energy transmission ROW. This does not result in any causal mechanisms to affect any fish habitat characteristics or PCE of CH, nor are there any mechanisms to directly impact individual fish.

The third issue addressed in the FEIS is how the PRMP would affect the development of geothermal energy resources. Geothermal energy is managed as a fluid mineral by the BLM, and there is no current geothermal development occurring on BLM-administered lands within the planning area. Under the PRMP, leasable stipulations such as no surface occupancy would negatively affect, though not entirely preclude, the potential for geothermal development on BLM-administered lands. The PRMP leasable stipulations do not result in any causal mechanisms to affect any fish habitat characteristics or PCE of CH, nor are there any mechanisms to directly impact individual fish.

Effects to Environmental Baseline

Slash can be gathered in several ways:

- At landings where there has been whole-tree cable yarding, and the limbing/bucking occurs at the landing
- Where slash is yarded from within the harvest unit by cable to the landing
- From within the unit by ground-based heavy equipment

Large and Small Wood

Slash is a by-product of trees already felled. The mechanism to affect the availability of the tree to serve as current or future large or small wood has already taken place before the slash is created. Besides, trees that are the source of slash are from the outer zone of Riparian Reserves, which is at least 120 feet from fish-bearing or perennial streams. The limbs, tops, cull material

and broken pieces that constitute slash would not be large enough to reach the stream channel from that distance. Therefore, there would be no effect to the indicator from slash removal from timber harvest units.

Summary of effects to large and small wood

There would be no effect to the indicator. It comes from trees that are already felled, and therefore is not a causative mechanism for the current or future availability of large or small wood.

Sediment/Turbidity/Substrate

Activities to gather slash would take place a minimum of 120 feet from fish-bearing or perennial streams, and 50 feet from non-fish bearing, intermittent streams. These are sufficient distances to effectively capture the small amount of fine sediment that may be generated by gathering slash from harvest units. It would be prevented from reaching stream channels by the duff layer and ground cover vegetation of the forest floor. Winter haul of slash has the potential to generate fine sediments off of road surfaces that may reach stream channels. There may be an adverse effect to the indicator from road surface fine sediment.

Summary of effects to sediment/turbidity/substrate

There may be an adverse effect to the indicator from road surface fine sediment during winter haul.

Water Temperature

Slash is a by-product of trees that are already felled. The mechanism to affect shade canopy has already taken place before the slash is created. There would be no effect to shade and water temperature from the gathering and haul of slash.

Summary of effects to water temperature

There would be no effect to the indicator from the gathering and haul of slash.

Peak and Base Flows

Slash is a by-product of trees that are already felled. The mechanism to affect peak or base flows has already taken place before the slash is created. There would be no effect to peak or base flows from the gathering and haul of slash.

Summary of effects to peak/base flows

There would be no effect to the indicator from the gathering and haul of slash.

Riparian Reserve Function and Vegetation Diversity

The gathering and haul of slash has no causal mechanism to affect the Riparian Reserve functions of providing large and small wood, and maintaining shade to streams as described earlier in this section.

Slash gathering occurs in the outer zones of Riparian Reserves and would not affect channel geometry or other habitat-forming processes.

The Riparian Reserve function of filtering sediment, nutrients, and chemical contaminants would not be measurably affected. If slash were left in the harvest unit (and not burned) it would be at least 120 feet away from fish-bearing or perennial streams and 50 feet away from non-fish-bearing intermittent streams. These distances by themselves would be sufficient to maintain filtering functions.

Trees are already felled before slash is created. The mechanism to contribute to vegetation diversity has already taken place before slash is created. The gathering and haul of slash neither contributes to nor detracts from the diversity of riparian vegetation.

Summary of effects to riparian reserve function and vegetation diversity

There would be no measurable effect to the indicator from the gathering and haul of slash. The only function that may be affected is the sediment, nutrient and chemical contamination filtering function, and the effects to it are insignificant.

Chemical Contamination and Nutrients

Contract requirements specify spill containment measures for all machinery and equipment used in timber harvest activities. Heavy equipment is fueled on landings. Spills associated with loading equipment may occur but are also likely to be very small and would occur within the road prism. A fuel spill kit is required of operators in case of accidental spill, to minimize adverse aquatic effects. Chainsaws use minimal amounts of gas and any spills would likely be very small. The no harvest inner zones of Riparian Reserves are sufficient to minimize potential transport of spilled fuels and fluids to stream channels during timber falling and ground-based harvest, reducing any negative effects to the point where they would not be meaningfully measured (insignificant).

The haul component has contract requirements for spill abatement. Experience with past timber haul without incident (communication between trucks is excellent and accidents are rare) reduces the possibility of aquatic habitat contamination to a discountable risk.

The removal of slash from harvest units would reduce the potential for nutrient enrichment of stream channels from decaying or burned slash. This would have an immeasurable (insignificant) beneficial effect to the indicator.

Summary of effects to chemical contamination / nutrients

Effects from heavy equipment use would be insignificant at most due to contract requirements for fueling locations and spill kits. Experience with analogous past timber haul reduces the possibility of aquatic habitat contamination to a discountable risk. Removal of slash would have an immeasurable (insignificant) beneficial effect. Overall, there would be an insignificant effect to the indicator.

Roads within Riparian Reserves

Roads used for the haul of slash would occur on existing roads. There would be neither construction nor decommissioning of roads as a result of slash haul. There would be no effect to the indicator.

Summary of effects to roads within riparian reserves

There would no increase or decrease in roads as a result of slash haul. Therefore, there would be no effect to the indicator.

Direct Effects to the Species from the Sustainable Energy Program

The gathering and haul of timber harvest slash to biomass energy production plants has no causal mechanism that would result in harassment and/or harm of ESA-listed fish species.

Summary

The indicator analysis results for effects of gathering and hauling slash for biomass energy production purposes are summarized in Table 165. The most impacting effect to the indicator is displayed. Where there is an adverse effect to an indicator, there may also be insignificant, discountable or beneficial effects from different components of the program activities.

Table 165. Summary of indicator analysis results for the Sustainable Energy program.

Indicator	Effects to the Indicator (most impacting)
Large and small wood	No effect. There is no causal mechanism to affect potential large or small wood.
Sediment/turbidity/substrate	Adverse (short-term as a result of winter haul). If no winter haul, then the effect would be insignificant negative.
Water temperature	No effect. There is no causal mechanism to affect potential water temperature.
Peak/base flows	No effect. There is no causal mechanism to affect peak or base flows.
Riparian Reserve function and vegetation diversity	Insignificant negative due to filtering capability function for fine sediment, nutrients and chemical contaminants.
Chemical contamination / nutrients	Insignificant negative from possible spills of petroleum products from equipment.
Roads within Riparian Reserves	No effect. There is no causal mechanism to affect the indicator.

It was also determined that there would be no direct effects to the species, resulting in harassment or harm to ESA-listed fish species.

11. Trails and Travel Management

This program includes three components: The road system; public motorized travel designations; and, the trail system. The construction of new roads, the maintenance of existing roads, and the closure of roads under the PRMP are largely connected to the Forest Management program. Because of that nexus, the effects of those activities are addressed in the Forest Management program section of this BA. The effects of new roads constructed within Riparian Reserves for discretionary right-of-way grants is presented in the Lands and Realty program section of this BA. For both programs, the effects of new road construction and/or other road-related activities contributed to an effect determination of "May Affect, Likely to Adversely Affect" the species and to designated CH. Please refer to the Forest Management program and Lands and Realty program sections of this BA for a detailed analysis of the effects of roads. The analysis in this section is focused on the effects of the other two components of the Trails and Travel Management program: public motorized travel designations and the trail system.

There are 21 BMPs that apply to public motorized travel trails that would reduce effects to ESA-listed fish habitat and designated CH (Table 166).

Table 166. BMPS for Public Motorized Travel trails.

BMP Number	BMP Description
REC 6	Locate new OHV trails on stable locations (e.g., ridge tops, benches, and gentle-to-moderate side slopes). Minimize trail construction on steep slopes where runoff could channel to a waterbody.
REC 7	Design, construct, and maintain trail width, grades, curves, and switchbacks suitable to the terrain and designated use. Use and maintain surfacing materials suitable to the site and use, to withstand traffic and to minimize runoff and erosion.
REC 8	Suspend construction or maintenance of trails, where erosion and runoff into water bodies would occur.
REC 9	Locate staging areas outside Riparian Reserve. Design or upgrade staging areas to prevent sediment/pollutant delivery to wetlands, floodplains, and water bodies, (e.g., rocking or hardening, drainage through grading or shaping).
REC 10	Designate class of vehicle suitable for the trail location, width, trail surfaces and waterbody crossings, to prevent erosion and potential sediment delivery.
REC 11	Designate season of use if the trail bed is prone to erosion, rutting, gullying or compaction, due to high soil moisture, standing water or

	snowmelt.
REC 12	Use existing road crossings of streams and floodplains on low-volume roads and partially decommissioned roads that tie with the trail system, where safety permits.
REC 13	Minimize low-water stream crossings for constructed or existing trails. Cross stream on stable substrate, e.g., bedrock, cobble, in areas of low streambanks. Block alternate stream-crossing routes where OHV wheel slippage (acceleration/ braking) would tear down banks or deliver sediment.
REC 14	Avoid OHV use in ponds and wetlands, and navigating up or down streams and side-channels. Use suitable barriers where feasible.
REC 15	Design improved stream crossings (culverts and bridges) for the 100-year flood event. Stream crossings with listed fish must meet ARBO II (NMFS 2013 and USFWS 2013) fish passage design criteria (See Roads and Landings section for stream crossing BMPs).
REC 16	In OHV bridge structures, avoid chemically treated materials at water level contact points where leachate or solids may enter waterbodies.
REC 17	Use a temporary flow diversion bypass to minimize downstream turbidity, when constructing in perennial stream crossings (See Roads and Landings section for Stream Crossing BMPs).
REC 18	When constructing or maintaining trails within Riparian Reserve, do not cut the portion of logs or down woody material that extend into the active stream channel. Provide for adequate stabilization of the logs if not doing so would create a safety hazard.
REC 19	Harden trail approaches to stream crossings using materials such as geotextile fabric and rock aggregate.
REC 20	Hydrologically disconnect trails from waterbodies to the extent practicable. Install drainage features, e.g., drain dips, lead-off ditches, on approaches to stream crossings as needed to divert runoff and reinforce with rock for longevity.
REC 21	Where trails intersect road ditches, provide erosion resistant crossings. Divert water from the trail to keep from reaching wetlands, floodplains, and water bodies.
REC 22	If trail width is too wide for the designated use (such as old roads converted to trails), consider tilling one side of the trail, covering with brush, and seeding or planting.

REC 23	Repair rills and gullies to keep sediment from reaching wetlands, floodplains, and water bodies.
REC 24	Construct and repair water bars, drain dips, and lead-off ditches as needed. These features may need rock reinforcement to promote longevity. Self-maintaining drain dips or lead-off features are the preferred design.
REC 25	Monitor trail condition to identify surface maintenance and drainage needs to prevent or minimize sediment delivery to waterbodies.
REC 26	Close and rehabilitate unauthorized trails, where needed, to protect sensitive areas and water quality.

The BLM assumes that public motorized travel users would operate vehicles consistent with BLM decisions about public motorized travel use. Although the BLM has some site-specific and anecdotal information about illegal public motorized travel use, the BLM does not have a basis for predicting the location or effects of any widespread or systematic illegal public motorized travel use. In addition, much of the decision area has physical limitations to potential illegal public motorized travel use, including dense vegetation, steep slopes, and locked gates. In most of the interior/south, the ability to track numerous different routes across the open spaces can lead to degradation and erosion in a greater proportion than most of the coastal/north. However, the BLM lacks a basis for characterizing current illegal public motorized travel use or forecasting such potential illegal public motorized travel use in the future at this scale of analysis.

The BLM has done a geospatial analysis of trails allowing motorized use. Within the 2,487,106 acres where public motorized travel use is currently designated in western Oregon, there are no crossings of streams with designated CH for any ESA-listed fish species. There appears to be one public motorized travel crossing on a stream with distribution of ESA-listed Upper Willamette River steelhead. The motorized use trail ends just beyond the crossing. The stream is Mohawk Creek, a tributary to Shotgun Creek in the McKenzie River basin.

Hiking Trails

The BLM manages 63 individual trails and trail systems that total over 395 miles in the Western Oregon decision area. Trail-based recreation opportunities within the decision area include trail systems for motorized and non-motorized users, providing a range of available activities across various recreation settings. Popular activities include hiking, mountain biking, horseback riding, and public motorized travel use. Table 167 displays trail BMPs that would reduce effects to ESA-listed fish habitat and designated CH.

Table 167. BMPs for hiking trails and hiking/public motorized travel trail closures.

Hiking Trails	
BMP Number	**BMP Description**

REC 27	When constructing or maintaining trails within Riparian Reserves, do not cut any portion of logs or coarse woody debris that extend into the active stream channel. Use alternative passage options, such as earthen ramps, small notch steps, or slight trail realignments, to facilitate maintenance of intact logs. Cut and stabilize if necessary for safe passage and safety.
Trail Closure	
BMP Number	**BMP Description**
REC 28	Remove existing stream crossings or bridges (See Road Decommissioning. BMPs).
REC 29	Position fill or waste material in a location that would avoid direct or indirect sediment discharge to streams or wetlands.
REC 30	Plant restored stream banks with native vegetation, mulch, and then plant with water-tolerant species where appropriate.
REC 31	Barricade and allow nearby vegetation to grow into closed trails.

The BLM attempted to determine the number of hiking trail crossings on streams with designated CH for ESA-listed Pacific salmon species. However, the CH line work does not correspond well with the line work for the national hydro data set for streams. Consequently, there is limited confidence in any count of trail crossings of streams with designated CH in the planning area. There undoubtedly are hiking trail crossings of streams with designated CH on BLM land. However, the BLM also does not have information on the type of stream crossings on each trail.

Effects to Environmental Baseline

Effects of hiking trail maintenance, public motorized travel trail maintenance and associated public use to bull trout and ESA-listed Pacific salmon species, and their respective designated CH, are addressed in the Northwest Oregon Programmatic Biological Opinion (USFWS 2008) and the Western Oregon Programmatic Biological Opinion (NMFS 2011). The category was more encompassing and titled "*Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use.*" The analyses are incorporated by reference. The effects described in the biological opinions included the effects at boat ramps, campgrounds, day-use sites, etc., as well as hiking and public motorized travel trails. The analysis below interprets the effects in the biological opinions with regard to trails only.

The program activities regarding hiking and public motorized travel trails included:

- Tree hazard management at trails
- Trail maintenance, repair, and upgrade (including that of stream crossings; typically using hand tools, hand power tools, small motorized equipment)

- Brushing, tread work, and saw-out of downed trees within trails
- Maintenance of small bridges on trails
- Public use of trails

The effect determinations in the biological assessments (USFS et al. 2008, USFS et al. 2010) was LAA the species and to designated CH for maintenance or use activities occurring within 150' of listed fish habitat (LFH) when the activity is reasonably certain to result in meaningfully measurable changes to sediment, chemical contaminants, stream temperature, or instream large wood recruitment to listed fish habitat (LFH). The analyses in the biological assessments are incorporated by reference. The effect determinations in the NMFS biological opinion were LAA to both the species and to designated CH. The effect determination in the USFWS biological opinion was LAA to bull trout, but did not address designated CH.

A summary of effects to the indicators utilized in this BA, interpreted from the analysis within the biological assessments (USFS et al. 2008, USFS et al. 2010) and the two biological opinions (USFWS 2008, NMFS 2011), is presented below in Table 168.

Table 168. Effects to indicators for the BLM hiking trails and public motorized travel trails programs as interpreted from the programmatic consultation biological assessments (USFS et al. 2008, USFS et al. 2010) and biological opinions (USFWS 2008, NMFS 2011) for the category of *Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use*.

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Adverse
Sediment/turbidity/substrate	Adverse
Water temperature	Adverse
Peak/base flows	No effect
Riparian Reserve function and vegetation diversity	Adverse
Chemical contamination / nutrients	Adverse
Roads within Riparian Reserves	Insignificant negative

In addition, the USFWS biological opinion stated that high use sites may result in disturbance to fish that may be great enough to cause fish to move to other stream sections, resulting in a low probability of localized adverse impacts. However, this is for high use recreation sites, and the effect at a trail crossing would result in far less disturbance. Consequently, the BLM does not believe that there would be a direct effect to ESA-listed fish resulting in harm or harassment to the species as a result of trail use or maintenance.

The NMFS biological opinion considered non-habitat effects. A conclusion was that people using recreation sites are likely to harm some eggs, fry, and juveniles by stepping on redds or on gravels containing rearing fry or juveniles. The BLM concludes that this would be a very rare event for hiking trails or public motorized travel trails. There is only one documented public motorized travel crossing of a stream with occupancy of ESA-listed fish. That is for UWR steelhead in Mohawk Creek, a tributary to Shotgun Creek in the McKenzie River basin.

Summary of Effects to Environmental Baseline

The effects of managing the BLM road system (construction, maintenance and decommissioning) to fish habitat and to PCEs of designated CH is of much greater magnitude than the effects of the other two components of the Trails and Travel Management program. Public motorized travel use under the PRMP would be limited to designated or existing roads and trails. Effects of use and maintenance of public motorized travel roads and trails under these designations would be similar to that of roads for timber haul, but at a much lower magnitude. In fact, segments of the road system are included in the public motorized travel road system. The use and maintenance of the 395 miles of trails in the decision area have the lowest magnitude of effects of the three components of the program.

The ESA effect determination for the Trail and Travel Management program is based upon the most impacting effect determination for any of its three component parts. It has been determined elsewhere in this BA that the effects of road construction, maintenance and decommissioning for the Forest Management program, and Lands and Realty program, contributed to an LAA effect determination to ESA-listed fish species and to designated CH for each program. There were measurable negative (adverse) effects to habitat indicators and to PCEs of designated CH. It was determined that harm or harassment to the species could occur. The reader is referred to the effects to indicators and to PCEs of CH sections for the Forest Management program and the Lands and Realty program.

The effects of the maintenance and use of hiking trails and public motorized travel trails was evaluated in past ESA programmatic consultations with NMFS and the USFWS. The effects were summarized in Table 168, above and incorporated by reference. There were measurable negative (adverse) effects to several of the habitat indicators used in this biological assessment: Large and small wood; sediment/turbidity/substrate; water temperature; Riparian Reserve function and vegetation diversity; and, chemical contamination/nutrients.

Considering the effects analysis elsewhere in this biological assessment for effects of the roads program, and the effects analysis for the maintenance and use of hiking trails and public motorized travel trails in existing concluded consultations, the overall ESA effect determination for the effects of the PRMP Trails and Travel Management program is LAA to ESA-listed fish species.

The Northwest Oregon Programmatic BO (USFWS 2008) did not address effects of the maintenance and public use of hiking or public motorized travel trails to shortnose or Lost River suckers. The BLM analysis of effects to indicators by the road components of the Forest Management program, and the Lands and Realty program, elsewhere in this section, does apply to effects to shortnose and Lost River suckers. The BLM concludes that the effects analysis of the two concluded programmatic ESA consultations that included effects of the maintenance

and public use of hiking and public motorized travel trails for bull trout and Pacific salmon species, applies in its entirety to the effects to shortnose and Lost River suckers.

12. Wild Horses

The Pokegama Herd Management Area (HMA) is the only HMA within the planning area. It encompasses a total of 85,022 acres in Oregon and California and includes private, state, and Federal lands. About 83 percent of the HMA (70,550 acres) is within the planning area, and about 23 percent of the HMA is on BLM-administered lands managed by the Klamath Falls Field Office. The remainder of the HMA within the planning area is on private land.

The Pokegama herd primarily occupies the private land within the HMA. Private landowners allow wild horses on their lands, if the herd size is maintained within the established appropriate management level, and that the horses do not range outside the HMA. The Pokegama herd spends 94 percent of its time in meadows, open areas, and in tree cover on the edge of meadows (Gottlieb 1993).

The diet of the Pokegama herd is predominantly grasses and grass-like species as determined by analysis of horse fecal material collected from within the HMA between January 1979 and February of 1981 (Table 169) (USDI BLM 2002).

Table 169. Diet of wild horses in the Pokegama Wild Horse Management Area.

Vegetation Type	Winter	Spring	Summer	Fall
Grasses	88%	95.5%	95.0%	95.5%
Shrubs	0%	1.0%	0.4%	0.0%
Forbs	8%	1.8%	3.0%	2.0%
Trees	5%	2.0%	2.0%	2.5%

Their primary water sources include creeks, springs, and reservoirs. Most developed water sources for the Pokegama herd (70-80 percent) are on private land. The BLM and private landowners have constructed several exclosures to protect riparian areas from wild horses.

The Pokegama herd is currently within the appropriate management level of 30 to 50 horses, based on the HMA management plan. Since designation of the HMA in 1971, census counts of the Pokegama wild horse population have ranged from 25 in 1972 to 55 in 2000. The 2012 census counted 24 horses, although the BLM estimates the current herd size is 30 to 40 horses. The BLM completed captures in 1996 and 2000, removing 20 and 18 horses, respectively.

The portion of the HMA within the planning area lies within the boundaries of the Dixie and Edge Creek livestock grazing allotments. There is abundant forage and available water within the two allotments in the HMA.

Critical habitat for shortnose sucker and Lost River sucker is designated in the Klamath River, which forms the east boundary of the Pokegama HMA. BLM Klamath Falls Field Office Fish Biologist Rob Roninger states that the topography of the Klamath River canyon is steep, there are abundant food and water sources above the canyon where the horses are commonly found, and wild horses are rarely seen in the canyon in the Oregon part of the HMA. There are deer trails that wind down to the river in places, and could conceivably be used by horses.

During the spring and summer, the horses are generally in the northern and central portions of the HMA (USDI BLM 2002). Due to the typically high winter snow accumulations in the northern and central portions of the HMA, the horses concentrate in the southern portion (California) from December through March, although they can be found there at any time of the year.

Effects to Environmental Baseline

Large and Small Wood

Trees are not a significant part of the diet of wild horses as indicated by the information in Table 169. USDI BLM (2002) hypothesized that the horses were eating small, tender branches off young or seedling trees – perhaps in tree plantation areas. Wild horses rarely are seen in the Klamath River canyon within the planning area, and they don't target trees for food. These facts lead to the conclusion that an effect to future wood recruitment to the Klamath River would be extremely unlikely to occur. Therefore it is a discountable effect.

Summary of effects to large and small wood

The effect to large and small wood recruitment is discountable negative because wild horses rarely are seen in the Klamath River canyon within the planning area, and trees are not a very small part of the diet of wild horses in the Pokegama HMA.

Sediment/Turbidity/Substrate

Wild horses in the HMA are known to congregate around water sources during the dry summer period. This concentration of use, along with concentrated use by elk and livestock, has caused trampling of streambanks in parts of the HMA (USDI BLM 2002). This led to the construction of exclosures on portions of Wild Gal and Hayden Creek during the 1980s. A portion of Long Prairie Creek was fenced in 2001. These locations are not occupied by shortnose suckers or Lost River suckers, nor are they designated CH. During the winter there are ample water sources, during the season that wild horses are likely to be found in the Klamath River canyon. There should not be concentrated use by wild horses during the winter along the bank of the Klamath River that would lead to meaningfully measured amounts of fine sediment entering the river. Therefore, there would be an insignificant negative effect to the Sediment/Turbidity/Substrate indictor.

Summary of effects to sediment/turbidity/substrate

There would be an insignificant negative effect to the indicator. Wild horse use of the Klamath River canyon within the planning area is rare. During the winter season when they are most likely to enter the canyon, there are ample water sources that would not lead to concentrated use

along riverbanks. Any fine sediment entering the river would not result in meaningfully measurable effects to the indicator.

Water Temperature

The preferred diet of wild horses in the Pokegama HMA includes grasses and forbs. It is 95 to 98 percent of their diet during any season of the year (Table 169). These are not typically shade-producing plants along stream channels, except for the most narrow stream channels. Gottlieb (1993) observed habitat use by wild horses in the Pokegama HMA. Her observation was that wild horses showed a preference for meadow and open areas, remaining in or on the edge of this habitat type. This suggests that they were not concentrated within riparian areas. Considering these facts, and that wild horses are rarely seen in the Klamath River canyon within the planning area, it is extremely unlikely that wild horse use would lead to an increase in water temperature in waters occupied by shortnose sucker or Lost River sucker.

Summary of effects to water temperature

There is a discountable effect to the water temperature indicator. It is extremely unlikely that shade along any stream occupied by shortnose or Lost River sucker would be reduced by wild horses to the point that a detectable change in water temperature would occur.

Peak and Base Flows

As described earlier in the description of the Peak/Base Flow indicator, peak and base flows are influenced by large areas in a catchment where vegetation has been entirely removed (such as roads and landings) or is in early seral stages. The magnitude and frequency of peak flows are also affected by concentration of flows associated with increases in road connectivity to stream channels. There is no mechanism to affect peak or base flows.

Summary of effects to peak and base flows

There is no mechanism to affect peak or base flows.

Riparian Reserve Function and Vegetation Diversity

Many functions of Riparian Reserves are addressed by other indicators used for this effects analysis. As described earlier in this section, there is a discountable negative effect to both the Large and Small wood indicator, and the Water Temperature indicator. There would be an insignificant effect to the Sediment/Turbidity/Substrate indicator as well. In addition, as described below in the effects to the Chemical Contamination and Nutrients indicator, there would be an insignificant effect to that indicator as a result of wild horse urine and fecal matter that would not be concentrated in riparian areas of the Klamath River canyon within the planning area.

The nominal amount of sediment delivery to the Klamath River within the planning area as a result of wild horse use would not measurably affect the quality of pools, cause changes to width-depth ratio, affect streambank stability, or change the connectivity of the river with its floodplain. Some use of riparian plants as forage may occur within the Klamath River canyon within the planning area, but it would not be concentrated and should not reduce the overall

diversity of riparian plants. There is no mechanism of wild horse use to affect the Roads within Riparian Reserves indicator.

Considering the analysis presented above, there would be an insignificant negative effect to the Riparian Reserve function and Vegetation Diversity indicator.

Summary of effects to riparian reserve function and vegetation diversity

There will be a mix of insignificant and discountable negative effects, as well as a “no effect” to several functions of Riparian Reserves. Consequently, the overall effect to the indicator is insignificant negative.

Chemical Contamination and Nutrients

Urine and fecal matter are potential chemical contaminants and sources of nutrients. Wild horses are rarely seen in the Klamath River canyon in the planning area. If they do enter the canyon they would likely be there in the winter when water sources are abundant, thereby not resulting in concentrated use within riparian areas. Therefore, urine and fecal matter should not be concentrated where it may measurably contaminate water in the Klamath River. There is an insignificant negative effect to the indicator.

Summary of effects to chemical contamination and nutrients

Wild horse urine and fecal matter should not be concentrated within riparian areas of the Klamath River to the point where it would lead to meaningfully measurable contamination of the river. This results in an insignificant negative effect to the indicator.

Roads within Riparian Reserves

Wild horse use does not have a mechanism to create or remove roads.

Summary of effects to roads within riparian reserves

Wild horse use does not have a mechanism to create or remove roads.

Direct Effects to the Species from the Wild Horse Program

Any potential interaction between a wild horse and either sucker species would occur in the Klamath River canyon. Horses would only to use the margin of the river occasionally, likely during the winter months, and not in any large numbers. This would lead to a limited number of occasions when either sucker species may notice a horse and move from its location momentarily. This would not rise to the level of harassment or harm.

Summary

The indicator analysis results are summarized in Table 170. The most impacting effect to the indicator is displayed. Where there is an adverse effect to an indicator, there may also be insignificant, discountable or beneficial effects from different components of the program activities.

Table 170. Summary of indicator analysis results for the Wild Horse program.

Indicator	Effects to the Indicator (most impacting)
Large and small wood	Discountable
Sediment/turbidity/substrate	Insignificant negative
Water temperature	Discountable
Peak/base flows	No effect
Riparian Reserve function and vegetation diversity	Insignificant negative
Chemical contamination / nutrients	Insignificant negative
Roads within Riparian Reserves	No effect

Any interaction between a wild horse and either sucker species in the Klamath River canyon would not rise to the level of harm or harassment.

13. Summary of habitat indicator analyses by PRMP program

The potential effects to each habitat indicator by an action of a PRMP program are summarized in **Table 171**. Please read the effects analysis sections above for details regarding the effects by indicator. Note that the effects shown in the table reflect the most impacting effect. Different elements of an action may have a range of effects to an indicator, ranging from no effect, a discountable or insignificant effect, or an adverse affect.

The adverse effects displayed in **Table 171** reflect a sub-set of actions under each program. Depending upon the site-specific proximity to ESA-listed fish habitat, and the exposure of that habitat to the potential effects of an action, the effects for an entire action may be less than adverse.

Table 171. Summary of potential effects by habitat indicator for PRMP programs.

PRMP Program	Potential Effects by Habitat Indicator **A** = adverse, D = discountable, I = insignificant, NE = no effect.						
	Large and Small Wood	**Sediment/ Turbidity/ Substrate**	**Water Temperature**	**Peak/ Base Flows**	**Riparian Reserve Function and Vegetation Diversity**	**Chemical contamination/ nutrients**	**Roads within Riparian Reserves**
1. Cultural Resources	D	I	I	D	I	N	N
2. Fire and Fuels	I	**A**	**A**	**A**	**A**	I	I
3. Fisheries	I	**A**	D	I	**A**	I	I
4. Forest Management	**A**	**A**	D	**A**	**A**	**A**	I
5. Hydrology	I	**A**	D	I	**A**	I	I
6. Invasive species	I	**A**	D[1]	I	**A**	**A**	I
7. Lands and Realty	**A**	**A**	I	I	**A**	I	**A**
8. Livestock grazing[2]	I	**A**	**A**	**A**	**A**	**A**	N
9. Minerals[3]	N	**A**	I	N	N	**A**	N
10. Paleontological Resources	D	I	I	D	I	N	N
11. Recreation & Visitors Services	**A**	**A**	**A**	I	**A**	**A**	**A**
12. Soil Resources	I	**A**	D	I	**A**	I	I
13. Special Forest Products	D	D	I	N	I	D	N

14. Sustainable Energy[4]	NE	**A**	NE	NE	I	I	NE
15. Trails & Travel Management	**A**	**A**	**A**	I	**A**	**A**	I
16. Wildlife	I	**A**	D	I	**A**	I	I
17. Wild Horses	D	I	D	NE	I	I	NE

[1]Effects are discountable except for the category of Sudden Oak Death Treatments where the effect is measurable negative (adverse).

[2]Effects are for a subset of allotments within the SONCC coho salmon ESU and the shortnose sucker and Lost River sucker recovery units. The only livestock grazing under the PRMP in the OC coho salmon ESU takes place under a Cooperative Management Agreement. It has undergone ESA consultation with NMFS concurrence on a NLAA effect determination. There were no adverse effects to any indicators in that consultation.

[3]The effects depicted for the Minerals program are for use of rock quarries (salable mineral) and for suction dredge gold mining (locatable mineral). Use of rock quarries was addressed in a programmatic consultation (USDA FS et al. 2010, NMFS 2011). The effects of approving NOI for suction gold dredge mining on the Rogue-Siskiyou NF was addressed in a BA (USDA FS 2015). The effects depicted in the table are a synthesis of the effects analyses for both types of minerals mining. Note that suction dredge gold mining within the planning area occurs within the OC coho salmon ESU and SONCC coho salmon ESU nearly exclusively. The adverse effects to the Chemical Contamination / Nutrients indicator is for methylmercury contamination in estuaries. It does not affect other ESU/DPS/RUs including McKenzie River bull trout. The effects of the leasable minerals aspect of the Minerals program, or any other mining activity, was not evaluated because the range of possible actions is so large that it would be a speculative analysis and there are no proposals before the BLM at this time. Future minerals actions would require, when appropriate, NEPA analysis and Section 7 consultation.

[4]The effects of the Sustainable Energy program displayed in the table are for gathering and transporting residual slash from timber harvest to biomass energy plants. Adverse effects are for winter haul only. Other aspects of the Sustainable Energy program in the FEIS are: 1) how energy transmission Right-of-Way (ROW) avoidance and exclusion areas affect the potential siting of wind energy developments and sustainable energy corridor designations; and, 2) how leasable stipulations such as no surface occupancy would negatively affect, though not entirely preclude, the potential for geothermal development on BLM-administered lands. Neither of the last two aspects of the PRMP Sustainable Energy program have any causal mechanisms to affect any fish habitat characteristics or PCE of designated CH, nor are there any mechanisms to directly impact individual fish.

14. Effects to bull trout population indicators

The four bull trout subpopulation indicators are: Subpopulation Size; Growth and Survival; Life History Diversity and Isolation; and, Persistence and Genetic Integrity. The distribution of bull trout in the planning area is limited. There is 0.84 mile of bull trout designated CH that occurs adjacent to or within land managed by the BLM, and it is located in the mainstem McKenzie River. It is 0.3 percent of the total bull trout designated CH within the planning area. The proximity of BLM lands to the 0.84 mile of designated CH does not imply that the effects of BLM activities are restricted to that specific 0.84 mile of designated CH. It is understood that effects may be transmitted downstream for some distance from the initiation point of the effect. The USFWS has typed bull trout occupied habitat associated with BLM lands in the McKenzie River basin as "Foraging, Migration and Overwintering" or FMO habitat. There is no spawning and rearing habitat.

The summary of the effects to the habitat indicators by PRMP program in **Table 171** reveals that there are adverse effects to several habitat indicators by multiple programs. Effects described below may occur from a sub-set of actions by PRMP program.

Adverse effects to the Large and Small Wood (LSW) indicator may occur by implementing actions of the Forest Management, Lands and Realty, Recreation and Visitors Services, and Trails and Travel Management programs. For the Forest Management program, the adverse effect is from yarding corridors and the rare road construction within a Riparian Reserve. For the Lands and Realty program, it is from road construction as a result of a discretionary right-of-way grant. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (Lightcap, pers. comm. 2015). Effects to the LSW indicator from the Recreation and Visitors Services program would be from removal of trees from recreation sites and suppression of new trees by trampling, as well as removal of trees from the McKenzie River that are hazardous to boaters. The adverse effect from the Trails and Travel Management program it would be from hiking and public motorized travel trails within Riparian Reserves. Each of these is a localized effect.

Adverse effects to the Sediment/Turbidity/Substrate indicator may occur by implementing actions of 12 PRMP programs. The effects of five of the programs (Fisheries, Hydrology, Invasive species, Soil Resources and Wildlife) are from restoration actions that would have localized, short-term adverse effects. With the possible exception of the Wildlife program, there would also be long-term benefits to the indicator. For the remaining seven programs (Fire and Fuels, Forest Management, Lands and Realty, Minerals, Recreation and Visitors Services, Sustainable Energy (from winter haul only), and Trails and Travel Management, effects are anticipated to be localized. Effects would be short-term, and in some cases recurring and short-term (e.g. turbidity from roads and trails draining to stream channels).

Adverse effects to the Water Temperature indicator may occur by implementing actions of the Fire and Fuels, Recreation and Visitors Services, and the Trails and Travel Management Program. These would be localized effects. Effects from use of pump chances for Fire and Fuels actions would also be short-term.

Adverse effects to the Peak/Base flow indicator may occur by implementing actions of the Fire and Fuels, Forest Management, and the Trails and Travel Management Program. These would be localized effects, and short-term in the case of effects to base flow from use of pump chances.

Adverse effects to the Riparian Reserve Function and Vegetation Diversity indicator may occur by implementing actions of 10 PRMP programs. The effects of five of the programs (Fisheries, Hydrology, Invasive species, Soil Resources and Wildlife) are from restoration actions that would have localized, short-term adverse effects and long-term benefits to the indicator. For the remaining five programs (Fire and Fuels, Forest Management, Lands and Realty, Recreation and Visitors Services, and Trails and Travel Management), effects are anticipated to be localized.

Adverse effects to the Chemical Contamination / Nutrients indicator may occur by implementing actions of four PRMP programs in the McKenzie River basin. While Table 162 indicates an adverse effect from the Mineral Program, it is not applicable to bull trout because the effects are specifically for methylmercury contamination as a result of suction dredge mining. No suction dredge mining takes place within the McKenzie River basin on BLM land. The effects of the Invasive Species program are from chemicals used to kill invasive plants. Effects attributed to Forest Management are from petroleum product contamination from heavy equipment use during culvert replacements in streams. For the Recreation and Visitors Services, and Trails and Travel Management programs, adverse effects may occur from use and maintenance of treated wood on trails and structures. These effects are localized, and with the exception of effects from treated wood, are short-term.

Adverse effects to the Roads within Riparian Reserves indicator may occur from implementing the Lands and Realty, and Recreation and Visitors Services programs. Effects would be localized.

Direct effects to the species resulting in harm or harassment may occur when implementing actions for several PRMP programs. The effects include:

- Temporary displacement in response to physical disturbance by recreationists, individuals during surveys for restoration actions, individuals placing salmon carcasses, and during the set-up and use of yarding corridors across streams.

- Temporary displacement due to short-term turbidity

- The potential to be injured or killed by: impingement on water drafting pump screens, heavy equipment during instream restoration activities or fish passage culvert replacements, handling during fish salvage in support of instream restoration or fish passage culvert replacements, being stranded when stream reaches are dewatered for a restoration project, when capturing bull trout during projects to remove non-native fish species, stress in response to localized water temperature increases, increased risk of predation because fine sediment has reduced interstitial spaces in substrate, recreationists stepping on redds or on gravels containing rearing fry or juveniles.

There would not be meaningfully measured effects to the Subpopulation Size or Growth and Survival indicators for the following reasons:

- Exposure of bull trout to adverse effects of BLM activities in the basin is very limited. There are only 0.84 miles of designated CH in the mainstem McKenzie River adjacent to BLM land.

- Most of the adverse effects are short-term and localized.

- BLM activities will be distributed in time and space, and only a sub-set may affect habitat occupied by bull trout

- The USFWS has typed bull trout occupied habitat associated with BLM lands in the McKenzie River basin as "Foraging, Migration and Overwintering" or FMO habitat. There is no spawning and rearing habitat.

- While there is the potential for harm or harassment to individual bull trout from a sub-set of actions, the exposure of individual bull trout to these actions is limited.

There is no mechanism of the action to affect migratory corridors/connectivity (barriers) between subpopulations, so there would be no effect to the Life History and Isolation, and Persistence and Genetic Integrity indicators.

Summary of effects to bull trout population characteristics

There would be insignificant negative effects to the Subpopulation Size or Growth and Survival indicators. Exposure of bull trout to adverse effects to indicators and to direct effects is very limited due to their distribution with respect to BLM land ownership. Most adverse effects are short-term and localized, actions will be distributed in time and space, and BLM activities will not affect habitat typed as spawning or rearing. There would be no effect to the Life History and Isolation, and Persistence and Genetic Integrity indicators because there is no mechanism of the action to affect migratory corridors/connectivity between subpopulations.

B. Effects to Designated Critical Habitat

The effects to the PCEs of designated CH are presented by species (or groups of species if effects are similar). This format facilitates a comprehensive understanding of the effects of each program by itself and of implementing the PRMP in its entirety, to designated CH. Each PCE analysis is informed by the analysis for the effects to habitat indicators presented above in section V.A. For some of the PCE analyses shown below, the analysis is also informed by concluded ESA consultations, and in the case for the Minerals program, a current BA regarding effects of suction gold dredge mining (USDA FS 2015). Note that the most impacting effect is described in column three of each table. Different components of the action may also have insignificant, discountable or beneficial effects to a PCE. The effects to PCEs are a result of that sub-set of program activities that occur within Riparian Reserves where the adjacent stream has designated CH.

The effects to the PCEs assume that appropriate PRMP BMPs and management direction will be utilized for all activities. Similarly, the BLM would employ Project Design Criteria, Aquatic Conservation Measures, and Terms and Conditions of concluded ESA consultations for activities, when applicable. These all serve to reduce or eliminate negative impacts to designated CH from PRMP activities.

1. Lower Columbia River Chinook salmon, Lower Columbia River coho salmon, Lower Columbia River steelhead, Upper Willamette River Chinook salmon, Oregon Coast coho salmon

a. Cultural and Paleontological Resources

Table 172 displays the PCE for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon that apply to the ESA action area, and summarizes the effects of the Cultural and Paleontological program.

Table 172. PCE of critical habitat for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon applicable to the ESA action area and summary of the effects of the Cultural and Paleontological program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Freshwater spawning	Substrate	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to the quality of spawning gravels.
	Water quality	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity. There is no causal mechanism to introduce chemicals or nutrients to stream flows.
	Water quantity	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected.
Freshwater rearing	Floodplain connectivity	No effect. There is no causal mechanism in the programs' activities to decouple floodplains from streams.
	Forage	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to the production of macroinvertebrates that serve as food sources.
	Natural cover	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to cover/shelter.
	Water quality	Insignificant negative. The very small amount of

		sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity. There is no causal mechanism to introduce chemicals or nutrients to stream flows.
	Water quantity	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected.
Freshwater migration	Free of artificial obstruction	No effect. There is no causal mechanism for the program's activities to affect fish passage.
	Natural cover	Insignificant negative. There will be an insignificant effect to the sediment/turbidity/substrate indicator. There would not be a measurable negative effect to the interstitial spaces between cobbles that would be used as cover. Even it there was, it is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile coho salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Water quality	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity. There is no causal mechanism to introduce chemicals or nutrients to stream flows.
	Water quantity	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected.

b. Fire and Fuels

Table 173 displays the PCE for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon that apply to the ESA action area, and summarizes the effects of the Fire and Fuels program.

Table 173. PCE of critical habitat for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon applicable to the ESA action area and summary of the effects of the Fire and Fuels program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Freshwater	Substrate	Insignificant negative. While some fine sediment may be

spawning		deposited on spawning gravels, it would be removed by increased stream flows during the fall/winter. Fines on spawning gravels prior to flows with sufficient shear stress to mobilize it would be at levels that would be removed by ESA-listed female Pacific salmon during redd construction.
	Water quality	Insignificant negative. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to spawning.
	Water quantity	Discountable. It is extremely unlikely that the spawning habitat water quantity PCE would be affected by any water withdrawals at pump chances. Spawning is typically triggered by increased flow levels.
Freshwater rearing	Floodplain connectivity	No effect. There is no mechanism in the program's activities to decouple floodplains from streams.
	Forage	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Natural cover	Adverse. Short-term, localized effects to natural cover would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water quality	Adverse. It is a result of short-term, localized increases in turbidity and nutrients (phosphorus/nitrogen).
	Water quantity	Adverse. A short-term effect may occur when water is withdrawn at pump chances where there is designated CH. No more than 10 percent of the stream flow at a pump chance may be removed.
Freshwater migration	Free of artificial obstruction	No effect. There is no mechanism of the program's activities to affect fish passage.
	Natural cover	Insignificant negative. It is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile ESA-listed Pacific salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Pacific salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Water quality	Insignificant negative. In the context of migration corridors, slight increases in turbidity against background levels, and increased nutrients, would not affect ability of migration habitat.
	Water quantity	Adverse. A short-term effect may occur when water is withdrawn at pump chances where there is designated CH. No more than 10 percent of the stream flow at a pump chance may be removed. It is more likely to affect juvenile out-migration than adult migration, as adult migration typically is triggered by rising stream flows.

c. Fisheries, Hydrology, Invasive Species, Soils and Wildlife

Activities of the Fisheries, Hydrology, Invasive Species, Soils and Wildlife programs with mechanisms to affect PCEs of designated critical habitat are habitat restoration actions. In addition to the short-term negative effects to PCEs described below, habitat restoration actions have long-term benefits to PCEs of designated CH.

The ARBA II (USDA et al. 2013) described effects to PCEs of critical habitat by presenting tables that were cross-walks between the habitat indicators of NMFS (1996) and the PCEs, without a narrative description of the effects to each PCE. The rationale for an overall effect determination of LAA to PCEs of critical habitat was based upon the outcomes for effects to the MPI indicators and the cross-walk.

The NMFS ARBO II (NMFS 2013) describes the effects to PCEs in a narrative for all Pacific salmon species. SONCC coho salmon have slightly different PCEs than that for other Pacific salmon species in the action area. The effect to PCEs of designated critical habitat of SONCC coho salmon is inclusive of effects to the one set of PCEs for the other Pacific salmon species. The description of effects to PCEs in the NMFS ARBO II is reproduced in its entirety below.

1. Freshwater spawning sites
    a. Water quantity – Brief reduction in flow due to short-term construction needs, reduced riparian permeability, increased riparian runoff, and reduced late season flows; slight longer-term increase based on improved riparian function and floodplain connectivity.
    b. Water quality – Short-term increase in total suspended solids, dissolved oxygen demand, and temperature due to riparian and channel disturbance; longer-term improvement due to improved riparian function and floodplain connectivity.
    c. Substrate – Short-term reduction in quality due to increased compaction and sedimentation; long-term increase in quality due to gravel placement, and increased sediment storage from boulders and LW.
2. Freshwater rearing sites
    a. Water quantity – as above.
    b. Floodplain connectivity – Short-term decrease due to increased compaction and riparian disturbance; long-term improvement due to off- and side channel habitat restoration, set-back of existing berms, dikes, and levees, and removal of water control structures.
    c. Water quality – as above.
    d. Forage – Short-term decrease due to riparian and channel disturbance, and water quality impairments; long-term improvement due to improved habitat diversity and complexity, and improved riparian function and floodplain connectivity, and increased litter retention.
    e. Natural cover – Short-term decrease due to riparian and channel disturbance; long-term increase due to improved habitat diversity and complexity, improved riparian function and floodplain connectivity, and off- and side channel habitat restoration.

3. Freshwater migration corridors
    a. Free passage – Short-term decrease due to decreased water quality and in-water work isolation; long-term increase due to improved water quantity and quality, habitat diversity and complexity, forage to support juvenile migration, and natural cover.
    b. Water quantity – as above.
    c. Water quality – as above.
    d. Natural cover – as above.
4. Estuarine areas
    a. Free passage – as above.
    b. Water quality – as above.
    c. Water quantity – as above.
    d. Salinity – no effect.
    e. Natural cover – as above.
    f. Forage – as above.

The overall effect determination was LAA. The NMFS stated in their summary of effects to PCEs of critical habitat that ARBO II projects are likely to have some short-term impacts, but none of those impacts would be severe enough to impair the ability of critical habitat to support recovery. The frequency of disturbance will usually be limited to a single event or, at most, a few projects within the same watershed.

d. Forest Management

Table 174 displays the PCE for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon that apply to the ESA action area, and summarizes the effects of the Forest Management program.

Table 174. PCE of critical habitat for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon applicable to the ESA action area and summary of the effects of the Forest Management program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Freshwater spawning	Substrate	Insignificant. While some fine sediment may be deposited on spawning gravels, it would be removed by increased stream flows during the fall/winter. Fines on spawning gravels prior to flows with sufficient shear stress to mobilize it would be at levels that would be removed by female salmon/steelhead during redd construction.
	Water quality	Insignificant. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to spawning. Chemical contamination from petroleum products may occur as a result of heavy equipment

		operation during culvert replacement operations in fish-bearing streams, but this would only take place during the instream work window, which does not overlap spawning periods. There is a discountable probability of a water temperature increase from thinning within Riparian Reserves of fish-bearing or perennial streams (see indicator analysis for a detailed discussion of the 0 to 8.8 miles of stream by ESU/DPS that are susceptible of the total miles of stream).
	Water quantity	Insignificant. This effect conclusion is the result of a combination of a discountable effect to peak flows, an insignificant negative effect to flows as a result of use of pump chances during the spawning period (Pacific salmon are typically spawning when flows are increased from freshets and any withdrawal would not result in a meaningfully measurable effect to the spawning water quantity PCE at that time) and a beneficial effect to base flows. There is a very low probability of a detectable peak flow response from Forest Management activities. Only 0 to 2 subwatersheds with BLM land ownership in each ESU/DPS would be susceptible to a detectable peak flow response from harvest and new roads. See indicator analysis for details. It is likely that there would be some small catchments (<100 hectares) with increased summer base flows for a number of years as a result of Forest Management actions under the PRMP. This would be a beneficial effect to the PCE for the juvenile rearing life history stage, but is not relevant to the spawning life history stage.
Freshwater rearing	Floodplain connectivity	No effect. There is no causal mechanism in the program's activities to decouple floodplains from streams.
	Forage	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Natural cover	Adverse. Short-term, localized effects to natural cover would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water quality	Adverse. There would be short-term, localized increases in turbidity. Chemical contamination from petroleum products may occur as a result of heavy equipment operation during culvert replacement operations in fish-bearing streams. There is a discountable probability of a water temperature increase from thinning or road construction within Riparian Reserves of fish-bearing or perennial streams.
	Water quantity	Adverse. The adverse effect is solely from the use of pump chances to draw water from streams with designated CH. This is anticipated to be a relatively rare

		occurrence, as there are alternative water sources than selecting from a stream with designated CH, and there is a disincentive in BMP R 60 (it allows drawing a maximum of 10% of stream flow in or within 1,500 feet of listed fish habitat, while allowing a maximum of 50% of flow elsewhere). Indicator analysis indicates a discountable effect to peak flows from timber harvest and road construction. Only 0 to 2 subwatersheds with BLM land ownership in each ESU/DPS would be susceptible to a detectable peak flow response from harvest and new roads. See indicator analysis for details. It is likely that there would be some small catchments (<100 hectares) with increased summer base flows for a number of years as a result of timber harvest under the PRMP. This would have a beneficial effect to the PCE.
Freshwater migration	Free of artificial obstruction	Beneficial effect. Some culverts that are partial barriers to fish migration would be replaced.
	Natural cover	Insignificant. It is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile salmon/steelhead. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult salmon/steelhead would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Water quality	Insignificant. In the context of migration corridors, slight increases in turbidity against background levels, and small increases in nutrients, would not affect the utility of migration habitat. Chemical contamination from heavy equipment during culvert replacement projects would only occur during the instream work window, which does not occur during either juvenile outmigration or adult upstream migration periods. The effect to water temperature is discountable, so it is not a concern for water quality during migration periods..
	Water quantity	Adverse. As described above for Freshwater Spawning and Freshwater Rearing.

e. Lands and Realty

Table 175 displays the PCE for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon that apply to the ESA action area, and summarizes the effects of the Lands and Realty Program. Note that the PCE analysis below is specifically for the case of a discretionary road right-of-way within a Riparian Reserve adjacent to a stream with designated CH. While possible, this would be an extremely rare event. Based

upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (Lightcap, pers. comm. 2015).

Table 175. PCE of critical habitat for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon applicable to the ESA action area and summary of the effects of the Lands and Realty program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Freshwater spawning	Substrate	Insignificant negative. While some fine sediment may be deposited on spawning gravels, it would be removed by increased stream flows during the fall/winter. Fines on spawning gravels prior to flows with sufficient shear stress to mobilize it would be at levels that would be removed by female Pacific salmon during redd construction.
	Water quality	Insignificant negative. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to spawning.
	Water quantity	Insignificant negative. Short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6th field watersheds.
Freshwater rearing	Floodplain connectivity	Measurable negative (adverse). A road right-of-way within a portion of a Riparian Reserve may be within a floodplain. Dependent upon the specific right-of-way location, it may affect the connectivity of a stream with its floodplain.
	Forage	Measurable negative (adverse). Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Natural cover	Measurable negative (adverse). Short-term, localized effects to natural cover would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water quality	Measurable negative (adverse). It is a result of short-term, localized increases in turbidity.
	Water quantity	Insignificant negative. Short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6th field watersheds.
Freshwater migration	Free of artificial obstruction	No effect. There is no causal mechanism of the program's activities to affect fish passage.
	Natural cover	Insignificant negative. It is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile Pacific salmon. They may be too large to utilize interstitial

		spaces between cobbles as cover. Cover for upstream migrating adult salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Water quality	Insignificant negative. In the context of migration corridors, slight increases in turbidity against background levels would not measurably affect the utility of habitat for migration.
	Water quantity	Insignificant negative. Short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6th field watersheds.

f. Livestock Grazing

Of these ESUs and DPSs, the livestock grazing program only occurs in the Oregon Coast coho ESU. Table 176 displays the PCE for OC Coho Salmon that apply to the ESA action area, and summarizes the effects of the proposed action. Note that this PCE analysis is specific to the one allotment that may affect PCEs of designated CH on the New River and an outlet stream of Floras Lake. The Coos Bay BLM District has consulted on the effects of that action and the NMFS concurred on a NLAA effect determination for effects to the species (NMFS 2002, consultation number 2002/01058). The PCE analysis below is a synthesis of the indicator effects analysis in the BA and LOC.

Table 176. PCE of critical habitat OC Coho Salmon applicable to the ESA action area and summary of the effects of the Livestock Grazing program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Freshwater spawning	Substrate	Insignificant negative. The only stream substrate that could be affected is at the two water gaps and they are located on sand substrate
	Water quality	Insignificant negative. Turbidity at the two water gaps in the fence would be minimized because the substrate is sand. Excess nutrients from cattle urine and feces would be limited because the fence along New River is set back a minimum of 50 feet and from the outlet stream to Floras Lake, a minimum of 25 feet. The 2002 BA stated that livestock exclusion from most of the riparian area would eventually lead to channel narrowing and deepening from vegetative recovery. It would likely result in water temperature reductions in the long-term. The two 25 foot wide water gaps are not expected to result in a measurable increase in water temperatures.
	Water quantity	Insignificant negative. The small amount of water consumed by livestock compared to total stream flow would not have a meaningfully measurable effect to the

		PCE.
Freshwater rearing	Floodplain connectivity	No effect. There is no mechanism in the program's activities to decouple floodplains from streams. Fencing limits livestock access to streambanks.
	Forage	Insignificant negative. Access to New River is limited to two water gaps where the substrate is sand. Macroinvertebrate production on sand substrates is very limited.
	Natural cover	No effect. The sandy bottom areas at the two water gaps are not expected to be used by coho salmon as cover.
	Water quality	Insignificant negative. Increased turbidity is limited by the sandy bottom at the two water gaps. Nutrients entering the water from cattle urine or feces at the water gaps would be limited in quantity and diluted. The 2002 BA stated that livestock exclusion from most of the riparian area would eventually lead to channel narrowing and deepening from vegetative recovery. It would likely result in water temperature reductions in the long-term. The two 25 foot wide water gaps are not expected to result in a measurable increase in water temperatures
	Water quantity	Insignificant negative. The small amount of water consumed by livestock compared to total stream flow would not have a meaningfully measurable effect to the PCE.
Freshwater migration	Free of artificial obstruction	No effect. There is no causal mechanism of the program's activities to affect fish passage.
	Natural cover	No effect. The sandy bottom areas at the two water gaps are not expected to be used by coho salmon as cover.
	Water quality	Insignificant negative. Any increase in turbidity is limited by the sandy bottom at the two water gaps. Nutrients entering the water from cattle urine or feces at the water gaps would be limited in quantity and diluted. Migration also occurs at times when flows are higher than base flows, allowing for dilution of nutrients. The 2002 BA stated that livestock exclusion from most of the riparian area would eventually lead to channel narrowing and deepening from vegetative recovery. It would likely result in water temperature reductions in the long-term. The two 25 foot wide water gaps are not expected to result in a measurable increase in water temperatures.
	Water quantity	Insignificant negative. The small amount of water consumed by livestock compared to total stream flow during the time periods for adult or juvenile migration would not have a meaningfully measurable effect to the PCE.

g. Minerals

Table 177 displays the PCE for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC coho salmon that apply to the ESA action area, and summarizes the effects of the proposed action. The analysis that follows is a synthesis of the PCE effects analysis of the NMFS programmatic biological opinion (NMFS 2011, consultation number 2010/02700 (BLM) that addressed the category "*Rock Quarry Operations"* and the PCE analyses of a biological assessment prepared by the Rogue-Siskiyou National Forest on the effects of responding to Notices of Intent for suction dredge gold mining and high-banking (USDA FS 2015). The analyses are incorporated by reference. Please refer to each document for details regarding effects to PCEs.

The effect determination in NMFS (2011) for *Rock Quarry Operations* was based on the following: the nature of the environmental disturbance that will be caused by the action, and the proximity of the environmental disturbance to LFH. Activities that cause or sustain the following types of disturbance in the following locations shall be considered LAA listed species and their critical habitats, and subject to pre-activity notification and annual reporting; actions that do not cause or sustain these types of disturbance, or that occur outside of the following locations shall be considered NLAA. The appropriate PDCs for each activity shall apply.

- Nature of the environmental disturbance. The following types of disturbance shall lead to a determination of LAA when they occur in proximity to LFH:
    - erosion or compaction of riparian soils, stream banks, or channel substrates;
    - removal or suppression of native riparian vegetation;
    - runoff containing sediment, nutrients, pesticide, salts, or other pollutants that are delivered to LFH through a system of culverts, ditches or channels; or
    - removal of water
- Proximity of the environmental disturbance to LFH. An environmental disturbance shall be considered in proximity to LFH when it occurs in the following locations:
    - any area within 150 feet (slope distance) of LFH;
    - any area within 150 feet (slope distance) of any stream that is up to 300 feet upstream of LFH;
    - any area that is physically connected to LFH by a system of ditches, channels or culverts such that runoff or sediment delivered from that area into the drainage system will eventually be delivered to LFH without being intercepted and immobilized by a riparian or vegetation buffer and
    - for removal of water only, any stream reach within LFH or within 1,500 feet of LFH.

Table 177. PCE of critical habitat LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC coho salmon applicable to the ESA action area and summary of the effects of the Minerals program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Freshwater spawning	Substrate	Measurable negative (adverse). Quality of spawning gravel may be reduced in the short-term by deposition of fine sediments from dredge turbidity plumes.

	Water quality	Insignificant negative. Suspended sediments from dredge operations and potential drainage from quarry operations would not measurably affect the spawning PCE.
	Water quantity	No effect.
Freshwater rearing	Floodplain connectivity	No effect.
	Forage	Measurable negative (adverse). Fine sediment deposition on substrate can reduce macroinvertebrate production in the short-term. Dredge operations entrain macroinvertebrates making them available to juvenile coho, but also result in a loss of macroinvertebrate production until substrate is recolonized.
	Natural cover	Measurable negative (adverse). Fine sediment from quarry operations and dredge mining would reduce interstitial spaces in substrate, reducing cover for juveniles. Sediment plumes from dredge operations can be used as cover by juveniles. Temporary pools created by dredging may be used as cover by juveniles.
	Water quality	Measurable negative (adverse). Suspended sediments from dredge operations and potential drainage from quarry operations would negatively affect the PCE. Legacy mercury from dredging may negatively affect rearing and spawning. Chemical contaminants such as petroleum products from equipment use in quarries and potential fuel spills from dredging would have insignificant effects to the PCE.
	Water quantity	No effect.
Freshwater migration	Free of artificial obstruction	Insignificant negative. Turbidity from dredging would not measurably affect the PCE.
	Natural cover	Insignificant negative. It is not known what the effects from fine sediment deposition causing loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile coho salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover.There would be a positive effect to the natural cover PCE from created pools and turbidity plumes during migration.
	Water quality	Measurable negative (adverse). Suspended sediments from dredge operations and potential drainage from quarry operations would negatively affect the PCE. Legacy mercury from dredging may negatively affect rearing and spawning. Chemical contaminants such as petroleum products from equipment use in quarries and potential fuel spills from dredging would have insignificant effects to the PCE.

	Water quantity	No effect.

h. Recreation and Visitors Services

Table 178 displays the PCE for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon that apply to the ESA action area, and summarizes the effects of the Recreation and Visitors Services program.

Table 178. PCE of critical habitat for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon applicable to the ESA action area and summary of the effects of the Recreation and Visitors Services program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Freshwater spawning	Substrate	Insignificant negative. While some fine sediment may be deposited on spawning gravels, it would be removed by increased stream flows during the fall/winter. Fines on spawning gravels prior to flows with sufficient shear stress to mobilize it would be at levels that would be removed by ESA-listed female Pacific salmon during redd construction.
	Water quality	Adverse. Potential for chemical contamination from legacy treated wood, and maintenance activities on that wood, on trail bridges and walkways. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to spawning. Loss of vegetation at streamside campgrounds is unlikely to affect water temperatures during spawning periods when flows are typically higher and water temperatures are lower.
	Water quantity	Insignificant negative effect to peak flows from concentration of flow on sections of public motorized travel and non-motorized use trails that connect to stream channels.
Freshwater rearing	Floodplain connectivity	Insignificant negative. Public motorized travel and non-motorized trails within riparian areas typically do not isolate streams from floodplains.
	Forage	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Natural cover	Adverse. Short-term localized effects would occur as a result of fine sediment in interstitial spaces between

		substrate particles, reducing cover/ shelter. There would also be a small, localized adverse effect as a result of removal of in-channel trees that are a hazard to boaters, and hazard trees that may fall into stream channels.
	Water quality	Adverse. Potential for chemical contamination from legacy treated wood, and maintenance activities on that wood, on trail bridges and walkways. Localized, measurable increases in turbidity would occur. Water temperature may measurably increase in localized stream reaches adjacent to campgrounds where shade vegetation has been removed by trampling and soil compaction.
	Water quantity	Insignificant negative effect to peak flows from concentration of flow on sections of public motorized travel and non-motorized use trails that connect to stream channels.
Freshwater migration	Free of artificial obstruction	No effect. There is no mechanism of the program's activities to affect fish passage.
	Natural cover	Adverse. Localized result of removing in-channel trees that are a hazard to boaters. This is a rare event. It is not known what the effects from fine sediment deposition causing loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile coho salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Water quality	Adverse. Potential for chemical contamination from legacy treated wood, and maintenance activities on that wood, on trail bridges and walkways may negatively affect water quality during migration periods. In the context of migration corridors, slight increases in turbidity against background levels would not affect the utility of migration habitat. Water temperature may measurably increase in localized stream reaches adjacent to campgrounds where shade vegetation has been removed by trampling and soil compaction. This would have the potential to adversely affect the PCE during the latter part of the juvenile outmigration period, and early spawning fall fish (although adult migration is often triggered by increased flows during storm events that would reduce water temperatures).
	Water quantity	Insignificant negative effect to peak flows from concentration of flow on sections of public motorized travel and non-motorized use trails that connect to stream channels.

i. Special Forest Products

Table 179 displays the PCE for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon that apply to the ESA action area, and summarizes the effects of the Special Forest Products program.

Table 179. PCE of critical habitat for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon applicable to the ESA action area and summary of the effects of the proposed action.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Freshwater spawning	Substrate	Insignificant. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable effect to the quality of spawning gravels.
	Water quality	Insignificant overall. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable increase in turbidity. Any accidental fuel spills would be in a very small amount; likely a fraction of a gallon. The likelihood that it would reach the stream channel and cause a meaningfully measurable effect to water quality is extremely low (discountable). There is no causal mechanism to introduce nutrients to stream flows (no effect).
	Water quantity	No effect. The activity would not add or remove roads, create other flow-concentrating paths to stream channels, or remove vegetation or forest cover at a scale that would affect peak or base flows.
Freshwater rearing	Floodplain connectivity	No effect. There is no causal mechanism in the programs' activities to decouple floodplains from streams.
	Forage	Insignificant. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable effect to the production of macroinvertebrates that serve as food sources.
	Natural cover	Insignificant. The very small amount of sediment delivery to stream channels, if any, from special forest product activities, would not result in a measurable effect to natural cover.
	Water quality	Insignificant overall. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable increase in turbidity. Any accidental fuel spills would be in a very small amount; likely a fraction of a gallon. The likelihood that it would reach the stream channel and cause a meaningfully measurable effect to water quality is extremely low (discountable). There is no causal

		mechanism to introduce nutrients to stream flows (no effect).
	Water quantity	No effect. The activity would not add or remove roads, create other flow-concentrating paths to stream channels, or remove vegetation or forest cover at a scale that would affect peak or base flows.
Freshwater migration	Free of artificial obstruction	No effect. There is no causal mechanism of the program's activities to affect fish passage.
	Natural cover	Insignificant negative. There will an insignificant effect to the sediment/turbidity/substrate indicator. There would not be a measurable negative effect to the interstitial spaces between cobbles that would be used as cover. Even it there was, it is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile salmon or steelhead. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult salmon or steelhead would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Water quality	Insignificant overall. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable increase in turbidity. Any accidental fuel spills would be in a very small amount; likely a fraction of a gallon. The likelihood that it would reach the stream channel and cause a meaningfully measurable effect to water quality is extremely low (discountable). There is no mechanism to introduce nutrients to stream flows (no effect).
	Water quantity	No effect. The activity would not add or remove roads, create other flow-concentrating paths to stream channels, or remove vegetation or forest cover at a scale that would affect peak or base flows.

j. Sustainable Energy

Table 180 displays the PCE for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon that apply to the ESA action area, and summarizes the effects of the Sustainable Energy program. Note that the effect analysis is based upon the gathering and transportation of slash from Forest Management activities that provides fuel for biomass energy plants. Adverse effects in the table are attributed to winter haul.

Table 180. PCE of critical habitat for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon applicable to the ESA action area and summary of the effects of the Sustainable Energy program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Freshwater spawning	Substrate	Insignificant negative. While some fine sediment may be deposited on spawning gravels, it would be removed by increased stream flows during the fall/winter. Fines on spawning gravels prior to flows with sufficient shear stress to mobilize it would be at levels that would be removed by ESA-listed female Pacific salmon during redd construction.
	Water quality	Insignificant negative. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to spawning.
	Water quantity	No effect. There is no causal mechanism to affect the PCE.
Freshwater rearing	Floodplain connectivity	No effect. There is no mechanism in the programs' activities to decouple floodplains from streams.
	Forage	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Natural cover	Adverse. Short-term, localized effects to natural cover would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water quality	Adverse. It is a result of short-term, localized increases in turbidity.
	Water quantity	No effect. There is no causal mechanism to affect the PCE.
Freshwater migration	Free of artificial obstruction	No effect. There is no mechanism of the program's activities to affect fish passage.
	Natural cover	Insignificant negative. It is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile ESA-listed Pacific salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Pacific salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Water quality	Insignificant negative. In the context of migration corridors, slight increases in turbidity against background levels would not affect ability of migration habitat.
	Water quantity	No effect. There is no causal mechanism to affect the PCE.

k. Trails and Travel Management

Table 181 displays the PCE for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon that apply to the ESA action area, and summarizes the effects of the Trails and Travel Management program. This analysis is informed by the analysis for the effects to habitat indicators presented above in V.A of this chapter. It is also informed by the PCE effects analysis of the NMFS programmatic biological opinion that addressed the category "*Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use*." It addressed the effects of the maintenance and use of hiking and public motorized travel trails. The PCE analysis for effects of new road construction, maintenance and decommissioning is included in the overall effects of the Forest Management Program, located elsewhere in this section.

Table 181. PCE of critical habitat for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon applicable to the ESA action area and summary of the effects of the proposed action.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Freshwater spawning	Substrate	Insignificant negative. While some fine sediment may be deposited on spawning gravels, it would be removed by increased stream flows during the fall/winter. Fines on spawning gravels prior to flows with sufficient shear stress to mobilize it would be at levels that would be removed by female coho salmon during redd construction.
	Water quality	Insignificant negative. Slight increases in turbidity against background levels are unlikely to affect the utility of migration habitat. Any water temperature increases for short sections of stream are unlikely to occur during the spawning period. Chemical contamination may occur downstream from a few crossings where treated wood is used, but it would be very diluted with higher flows during the spawning period, and is unlikely to measurably affect spawning.
	Water quantity	Insignificant negative. Trails may concentrate flows for short distances that deliver to stream channels, but it is unlikely to result in meaningfully measured increases in peak flows in areas where there is designated CH. Base flows are not affected by the action.
Freshwater rearing	Floodplain connectivity	No effect. There is no causal mechanism in the program's activities to decouple floodplains from streams.
	Forage	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Natural cover	Adverse. Short-term, localized effects to natural cover would occur as a result of fine sediment in interstitial spaces between substrate particles.

	Water quality	Adverse. There would be short-term, localized increases in turbidity. Chemical contamination may occur at small stream segments where treated wood Is used at trail crossings. There may be localized increases in water temperature at a few stream crossings where shade vegetation has been removed by extensive use.
	Water quantity	Insignificant negative. Trails may concentrate flows for short distances that deliver to stream channels, but it is unlikely to result in meaningfully measured increases in peak flows in areas where there is designated CH. Base flows are not affected by the action.
Freshwater migration	Free of artificial obstruction	No effect. There are no culverts affecting ESA-listed fish passage on hiking or public motorized travel trails.
	Natural cover	Insignificant negative. It is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile salmon/steelhead. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult salmon/steelhead would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Water quality	Insignificant negative. In the context of migration corridors, slight increases in turbidity against background levels are unlikely to affect the utility of migration habitat. Any water temperature increases for short sections of stream are unlikely to occur during juvenile or adult migration periods. Chemical contamination may occur downstream from a few crossings where treated wood is used, but it would be very diluted with higher flows during juvenile and adult migration periods, and is unlikely to measurably affect migration.
	Water quantity	Insignificant negative. As described above for Freshwater Spawning and Freshwater Rearing.

2. Southern Oregon / Northern California Coasts coho salmon

a. Cultural and Paleontological Resources

Table 182 displays the PCE for SONCC coho salmon that apply to the ESA action area, and summarizes the effects of the Cultural and Paleontological Resources program.

Table 182. PCE of critical habitat for SONCC coho salmon applicable to the ESA action area and summary of the effects of the Cultural and Paleontological Resources program.

Primary Constituent Elements		Effect of the Proposed Action (Most Impacting)
Site Type	**Site Attribute**	
Spawning and juvenile rearing areas	Cover/shelter	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to cover/shelter. It would not affect cover for adult spawners at all.
	Food (juvenile rearing)	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to the production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Insignificant negative. Few excavations would occur within true riparian vegetation. That which would occur would remove primarily low-growing vegetation from a very small footprint.
	Space	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to loss of interstitial spaces between streambed particles with fine sediment.
	Spawning gravel	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to the quality of spawning gravels.
	Water quality	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity. There is no causal mechanism to introduce chemicals or nutrients to stream flows.
	Water quantity	Discountable negative. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected.
	Water temperature	Insignificant negative. There is very little vegetation removed on a small footprint of land at excavated sites. Most of it is understory vegetation that does not provide shade.

Adult and juvenile migration corridors	Cover/shelter	Insignificant negative. There will an insignificant effect to the sediment/turbidity/substrate indicator. There would not be a measurable negative effect to the interstitial spaces between cobbles that would be used as cover. Even it there was, it is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile coho salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Food (juvenile)	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to the production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Insignificant negative. Please see description above for effects to riparian vegetation for spawning and juvenile rearing areas.
	Safe passage	No effect. There is no causal mechanism to affect barriers.
	Space	Insignificant negative. See effects to cover/shelter, above.
	Substrate	Insignificant negative. Please see description of effect to cover/shelter in this sub-section.
	Water quality	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity. There is no causal mechanism to introduce chemicals or nutrients to stream flows.
	Water quantity	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected.
	Water temperature	Insignificant negative. There is very little vegetation removed on a small footprint of land at excavated sites. Most of it is understory vegetation that does not provide shade.
	Water velocity	No effect. There is no causal mechanism to affect water velocity.

b. Fire and Fuels

Table 183 displays the PCE for SONCC coho salmon that apply to the ESA action area, and summarizes the effects of the Fire and Fuels program.

Table 183. PCE of critical habitat for SONCC coho salmon applicable to the ESA action area and summary of the effects of the Fire and Fuels program.

Primary Constituent Elements		Effect of the Proposed Action (Most Impacting)
Site Type	**Site Attribute**	
Spawning and juvenile rearing areas	Cover/shelter	Adverse. Short-term localized effects would occur as a result of fine sediment in interstitial spaces between substrate particles, reducing cover/shelter for juveniles, but not affecting adult cover/shelter.
	Food (juvenile rearing)	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Insignificant. Fuel reduction projects within Riparian Reserves will remove vegetation, but true riparian vegetation in the inner zone will be less impacted. Project design including BMPs, Program Direction and ARBA II ACM/PDC (for prescribed fire) and the physical features of near stream areas (damp soil/duff, high humidity) that reduce burn intensity, will result in greater vegetation loss at distances from the stream than at its edge. A study of a prescribed fire ignited in a riparian area determined that only 4.4% of trees were killed (Bêche et al. 2005).
	Space	Adverse. There will be short-term, localized loss of interstitial spaces between streambed particles with fine sediment. This would affect juvenile rearing areas but not adult spawning areas.
	Spawning gravel	Insignificant. While some fine sediment may be deposited on spawning gravels, it would be removed by increased stream flows during the fall/winter. Fines on spawning gravels prior to flows with sufficient shear stress to mobilize it would be at levels that would be removed by female coho salmon during redd construction.
	Water quality	Adverse. It is a result of short-term, localized increases in turbidity and nutrients (phosphorus/nitrogen). This would affect rearing but not spawning habitat.
	Water quantity	Adverse. A short-term effect may occur when water is withdrawn at pump chances where there is designated CH. No more than 10 percent of the stream flow at a

		pump chance may be removed. The effect would be adverse to juvenile rearing habitat, but the spawning habitat aspect is unlikely to be affected as spawning is typically triggered by increased flow levels.
	Water temperature	Insignificant. Bêche et al. (2005) concluded that low to moderate intensity prescribed fire that was actively ignited in the riparian area did not result in a measurable decrease in riparian canopy cover.
Adult and juvenile migration corridors	Cover/shelter	Insignificant. It is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile coho salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Food (juvenile)	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Insignificant. Please see description above for effects to riparian vegetation for spawning and juvenile rearing areas.
	Safe passage	No effect. There is no mechanism to affect barriers.
	Space	Insignificant. See effects to cover/shelter, above.
	Substrate	Insignificant. Please see description of effect to cover/shelter in this sub-section.
	Water quality	Insignificant. In the context of migration corridors, slight increases in turbidity against background levels, and increased nutrients, would not affect the utility of migration habitat.
	Water quantity	Adverse. A short-term effect may occur when water is withdrawn at pump chances where there is designated CH. No more than 10 percent of the stream flow at a pump chance may be removed. More likely to affect juvenile out-migration than adult migration, as adult migration typically is triggered by rising stream flows.
	Water temperature	Insignificant. Bêche et al. (2005) concluded that low to moderate intensity prescribed fire that was actively ignited in the riparian area did not result in a measurable decrease in riparian canopy cover.
	Water velocity	Discountable. The only change in water velocity would

		occur during use of a pump chance. It is extremely unlikely that a migrating juvenile coho salmon would be affected as they are large enough to avoid the pump nozzle. Pump nozzle velocities would not affect migrating adults.

c. Fisheries, Hydrology, Invasive Species, Soils and Wildlife

Activities of the Fisheries, Hydrology, Invasive Species, Soils and Wildlife programs with mechanisms to affect PCEs of designated critical habitat are habitat restoration actions. In addition to the short-term negative effects to PCEs described below, habitat restoration actions have long-term benefits to PCEs of designated CH.

The ARBA II (USDA FS et al. 2013) described effects to PCEs of critical habitat by presenting tables that were cross-walks between indicators of Table 1 (Matrix of Pathways and Indicators) of NMFS (1996) and the PCEs, without a narrative description of the effects to each PCE. The rationale for an overall effect determination of LAA to PCEs of critical habitat was based upon the outcomes for effects to the MPI indicators and the cross-walk.

The NMFS ARBO II (NMFS 2013) describes the effects to PCEs in a narrative for all Pacific salmon species. SONCC coho salmon have slightly different PCEs than that for other Pacific salmon species in the action area. The effect to PCEs of designated critical habitat of SONCC coho salmon is inclusive of effects to the one set of PCEs for the other Pacific salmon species. The description of effects to PCEs in the NMFS ARBO II is reproduced in its entirety below.

1. Freshwater spawning sites
    g. Water quantity – Brief reduction in flow due to short-term construction needs, reduced riparian permeability, increased riparian runoff, and reduced late season flows; slight longer-term increase based on improved riparian function and floodplain connectivity.
    h. Water quality – Short-term increase in total suspended solids, dissolved oxygen demand, and temperature due to riparian and channel disturbance; longer-term improvement due to improved riparian function and floodplain connectivity.
    i. Substrate – Short-term reduction in quality due to increased compaction and sedimentation; long-term increase in quality due to gravel placement, and increased sediment storage from boulders and LW.
5. Freshwater rearing sites
    a. Water quantity – as above.
    b. Floodplain connectivity – Short-term decrease due to increased compaction and riparian disturbance; long-term improvement due to off- and side channel habitat restoration, set-back of existing berms, dikes, and levees, and removal of water control structures.
    c. Water quality – as above.
    d. Forage – Short-term decrease due to riparian and channel disturbance, and water quality impairments; long-term improvement due to improved habitat diversity and complexity, and improved riparian function and floodplain connectivity, and

increased litter retention.

e. Natural cover – Short-term decrease due to riparian and channel disturbance; long-term increase due to improved habitat diversity and complexity, improved riparian function and floodplain connectivity, and off- and side channel habitat restoration.

6. Freshwater migration corridors
    a. Free passage – Short-term decrease due to decreased water quality and in-water work isolation; long-term increase due to improved water quantity and quality, habitat diversity and complexity, forage to support juvenile migration, and natural cover.
    b. Water quantity – as above.
    c. Water quality – as above.
    d. Natural cover – as above.
7. Estuarine areas
    a. Free passage – as above.
    b. Water quality – as above.
    c. Water quantity – as above.
    d. Salinity – no effect.
    e. Natural cover – as above.
    f. Forage – as above.

The overall effect determination was LAA. The NMFS stated in their summary of effects to PCEs of critical habitat that ARBO II projects are likely to have some short-term impacts, but none of those impacts would be severe enough to impair the ability of critical habitat to support recovery. The frequency of disturbance will usually be limited to a single event or, at most, a few projects within the same watershed.

d. Forest Management

Table 184 displays the PCE for SONCC coho salmon that apply to the ESA action area, and summarizes the effects of the Forest Management program.

Table 184. PCE of critical habitat for SONCC coho salmon applicable to the ESA action area and summary of the effects of the Forest Management program.

Primary Constituent Elements		Effect of the Proposed Action (Most Impacting)
Site Type	**Site Attribute**	
Spawning and juvenile rearing areas	Cover/shelter	Adverse. Short-term localized effects would occur as a result of fine sediment in interstitial spaces between substrate particles, reducing cover/shelter for juveniles, but not affecting adult cover/shelter.
	Food (juvenile rearing)	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Insignificant. Effects to vegetation from Forest

		Management activities would primarily occur in the outer zones of the Riparian Reserves (beyond 120 feet for fish-bearing or perennial streams). True riparian vegetation in the inner zone will only be impacted by cable yarding corridors or by tree-tipping.
	Space	Adverse. There will be short-term, localized loss of interstitial spaces between streambed particles by fine sediment. This would affect juvenile rearing areas but not adult spawning areas.
	Spawning gravel	Insignificant. While some fine sediment may be deposited on spawning gravels, it would be removed by increased stream flows during the fall/winter. Fines on spawning gravels prior to flows with sufficient shear stress to mobilize it would be at levels that would be removed by female coho salmon during redd construction.
	Water quality	Adverse. There would be short-term, localized increases in turbidity. This would affect the rearing life cycle stage of the PCE but not spawning. Chemical contamination from petroleum products may occur as a result of heavy equipment operation during culvert replacement operations in fish-bearing streams. There is a discountable probability of a water temperature increase from thinning or road construction within Riparian Reserves of fish-bearing or perennial streams.
	Water quantity	Adverse. The adverse effect is solely from the use of pump chances to draw water from streams with designated CH. This is anticipated to be a relatively rare occurrence, as there are alternative water sources than selecting from a stream with designated CH, and there is a disincentive in BMP R 60 (it allows drawing a maximum of 10% of stream flow in or within 1,500 feet of listed fish habitat, while allowing a maximum of 50% of flow elsewhere). Indicator analysis indicates a discountable effect to peak flows from timber harvest and road construction. Only 1 of 146 subwatersheds with BLM land ownership in the ESU would be susceptible to a detectable peak flow response from harvest and new roads. That is North Fork Silver Creek (in the 1st two decades. It is likely that there would be some small catchments (<100 hectares) with increased summer base flows for a number of years as a result of timber harvest actions under the PRMP. This would have a beneficial effect to the PCE for the juvenile rearing life history stage, but is

		not relevant to the spawning life history stage.
	Water temperature	Discountable. Analysis results indicate that about 25 miles of about 1,050 miles of fish-bearing or perennial streams in the ESU would be susceptible to water temperature increases by thinning in the outer zone of Riparian Reserves in the 1st two decades. Not all of these stream miles are likely to affect stream reaches with designated CH.
Adult and juvenile migration corridors	Cover/shelter	Insignificant. It is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile coho salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Food (juvenile)	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Insignificant. Please see description above for effects to riparian vegetation for spawning and juvenile rearing areas.
	Safe passage	Insignificant. There will be a beneficial effect when culverts are replaced that eliminate partial barriers to migration for coho salmon.
	Space	Insignificant. See effects to cover/shelter, above.
	Substrate	Insignificant. Please see description of effect to cover/shelter in this sub-section.
	Water quality	Insignificant. In the context of migration corridors, slight increases in turbidity against background levels, and small increases in nutrients, would not affect the utility of migration habitat. Chemical contamination from petroleum products used by heavy equipment during culvert replacement projects would only occur during the instream work window, which does not occur during either juvenile outmigration or adult upstream migration periods. The effect to water temperature is discountable, so it is not a concern for water quality during migration periods.
	Water quantity	Adverse. As described above for spawning and juvenile rearing areas.
	Water temperature	Discountable. As described above for spawning and

		juvenile rearing areas.
	Water velocity	Discountable. The only change in water velocity would occur during culvert replacement actions in fish-bearing streams. This is unlikely to affect downstream migrating juveniles or adult upstream migrants because of the timing of the instream work windows. The work windows avoid the migration periods.

e. Lands and Realty

Table 185 displays the PCE for SONCC coho salmon that apply to the ESA action area, and summarizes the effects of the Lands and Realty program. Note that the PCE analysis below is specifically for the case of a discretionary road right-of-way within a Riparian Reserve adjacent to a stream with designated CH. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (Lightcap, pers. comm. 2015).

Table 185. PCE of critical habitat for SONCC coho salmon applicable to the ESA action area and summary of the effects of the Lands and Realty program.

Primary Constituent Elements		Effect of the Proposed Action (Most Impacting)
Site Type	**Site Attribute**	
Spawning and juvenile rearing areas	Cover/shelter	Measurable negative (adverse). Short-term localized effects would occur as a result of fine sediment in interstitial spaces between substrate particles, reducing cover/shelter for juveniles, but not affecting adult cover/shelter.
	Food (juvenile rearing)	Measurable negative (adverse). Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Measurable negative (adverse). Vegetation would be removed within the road right-of-way. The magnitude of effects to riparian vegetation would be dependent upon the specific location of the road right-of-way within the Riparian Reserve.
	Space	Measurable negative (adverse). There will be short-term, localized loss of interstitial spaces between streambed particles with fine sediment. This would affect juvenile rearing areas but not adult spawning areas.
	Spawning gravel	Insignificant negative. While some fine sediment may be deposited on spawning gravels, it would be removed by

		increased stream flows during the fall/winter. Fines on spawning gravels prior to flows with sufficient shear stress to mobilize it would be at levels that would be removed by female coho salmon during redd construction.
	Water quality	Measurable negative (adverse). It is a result of short-term, localized increases in turbidity. This would affect rearing but not spawning habitat.
	Water quantity	Insignificant negative. Short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6th field watersheds.
	Water temperature	Insignificant negative. A road right-of-way typically has shade vegetation between it and stream channels except at a stream crossing. The magnitude of shade loss should not result in meaningfully measurable effects to water temperature.
Adult and juvenile migration corridors	Cover/shelter	Insignificant negative. It is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile coho salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Food (juvenile)	Measurable negative (adverse). Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Measurable negative (adverse). Vegetation would be removed within the road right-of-way. The magnitude of effects to riparian vegetation would be dependent upon the specific location of the road right-of-way within the Riparian Reserve.
	Safe passage	No effect. There is no causal mechanism to affect barriers.
	Space	Insignificant. Physical space for migrating adults and juveniles would not be affected. See effects to cover/shelter, above.
	Substrate	Insignificant. Please see description of effect to cover/shelter, above.
	Water quality	Insignificant negative. In the context of migration

		corridors, slight increases in turbidity against background levels would not measurably affect the utility of habitat for migration.
	Water quantity	Insignificant negative. Short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6th field watersheds.
	Water temperature	Insignificant negative. A road right-of-way typically has shade vegetation between it and stream channels except at a stream crossing. The magnitude of shade loss should not result in meaningfully measurable effects to water temperature.
	Water velocity	No effect. There is no causal mechanism to affect water velocity.

f. Livestock Grazing

Table 186 displays the PCE for SONCC coho salmon that apply to the ESA action area, and summarizes the effects of the Livestock Grazing program.

Table 186. PCE of critical habitat for SONCC coho salmon applicable to the ESA action area and summary of the effects of the proposed action.

Primary Constituent Elements		Effect of the Proposed Action (Most Impacting)
Site Type	**Site Attribute**	
Spawning and juvenile rearing areas	Cover/shelter	Measurable negative (adverse). Short-term localized effects would occur as a result of fine sediment in interstitial spaces between substrate particles, reducing cover/shelter for juveniles, but not affecting adult cover/shelter.
	Food (juvenile rearing)	Measurable negative (adverse). Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Measurable negative (adverse). Riparian vegetation is grazed and trampled. Grazing practices allow for recovery post-grazing before the next grazing period.
	Space	Measurable negative (adverse). There will be short-term, localized loss of interstitial spaces between streambed particles with fine sediment. This would affect juvenile

		rearing areas but not adult spawning areas.
	Spawning gravel	Insignificant negative. While some fine sediment may be deposited on spawning gravels, it would be removed by increased stream flows during the fall/winter. Fines on spawning gravels prior to flows with sufficient shear stress to mobilize it would be at levels that would be removed by female coho salmon during redd construction.
	Water quality	Measurable negative (adverse). It is a result of short-term, localized increases in turbidity and reduced dissolved oxygen levels in streams with low flows as a result of nutrient enrichment from livestock urine/dung. This would affect rearing but not spawning habitat. Spawning is typically triggered by higher flow levels that would dilute excess nutrients, and adult coho salmon are adapted to seasonal turbidity events.
	Water quantity	Measurable negative (adverse). There is the potential for a measurable negative effect to base flows by livestock drinking directly from small streams that have designated CH at summer low flows. This would affect rearing but not spawning, as spawning is usually triggered by increased flows.
	Water temperature	Measurable negative (adverse). Grazing of narrow streams with grass or grass-like species providing the shade is likely to reduce the shade to a point where a measurable stream temperature increase would result. This would be a measurable negative (adverse) effect.
Adult and juvenile migration corridors	Cover/shelter	Insignificant negative. It is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile coho salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Food (juvenile)	Measurable negative (adverse). Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Measurable negative (adverse). Please see description above for effects to riparian vegetation for spawning and juvenile rearing areas.
	Safe passage	No effect. There is no causal mechanism to affect

		barriers.
	Space	Insignificant negative. See effects to cover/shelter, above.
	Substrate	Insignificant negative. Please see description of effect to cover/shelter in this sub-section.
	Water quality	Insignificant negative. In the context of migration corridors, slight increases in turbidity against background levels, and dilution of nutrients at higher flows during migration periods, would not affect the utility of migration habitat.
	Water quantity	Measurable negative (adverse) in specific circumstances. There is the potential for a measurable negative effect to base flows by livestock drinking directly from small streams (with low flows) that have designated CH. However, the juvenile coho salmon outmigration period typically does not coincide with summer base flows. There may be situations in drought years where the outmigration period coincides with low flows in small streams in late Spring. Spawning migration would not be affected as it is usually triggered by increased flows, and cattle use would not result in a measurable negative effect at those flows.
	Water temperature	Insignificant negative. Water temperatures during spring outmigration of juvenile coho would not likely be measurably affected by grazing of near stream shade vegetation. Water temperatures during adult coho migration periods in the fall are also not likely to be measurably affected.
	Water velocity	No effect. There is no causal mechanism of lifestock grazing to affect water velocity

g. Minerals

Table 187 displays the PCE for SONCC coho salmon that apply to the ESA action area, and summarizes the effects of the proposed action. The analysis that follows is a synthesis of the PCE effects analysis of the NMFS programmatic biological opinion (NMFS 2011, consultation number 2010/02700 (BLM) that addressed the category "*Rock Quarry Operations"* and the PCE analyses of a biological assessment prepared by the Rogue-Siskiyou National Forest on the effects of responding to Notices of Intent for suction dredge gold mining and high-banking (USDA FS 2015). The analyses are incorporated by reference. Please refer to each document for details regarding effects to PCEs.

The effect determination in NMFS (2011) for *Rock Quarry Operations* was based on the following: the nature of the environmental disturbance that will be caused by the action, and the proximity of the environmental disturbance to LFH. Activities that cause or sustain the following types of disturbance in the following locations shall be considered LAA listed species and their critical habitats, and subject to pre-activity notification and annual reporting; actions that do not cause or sustain these types of disturbance, or that occur outside of the following locations shall be considered NLAA. The appropriate PDCs for each activity shall apply.

- Nature of the environmental disturbance. The following types of disturbance shall lead to a determination of LAA when they occur in proximity to LFH:
    - erosion or compaction of riparian soils, stream banks, or channel substrates;
    - removal or suppression of native riparian vegetation;
    - runoff containing sediment, nutrients, pesticide, salts, or other pollutants that are delivered to LFH through a system of culverts, ditches or channels; or
    - removal of water
- Proximity of the environmental disturbance to LFH. An environmental disturbance shall be considered in proximity to LFH when it occurs in the following locations:
    - any area within 150 feet (slope distance) of LFH;
    - any area within 150 feet (slope distance) of any stream that is up to 300 feet upstream of LFH;
    - any area that is physically connected to LFH by a system of ditches, channels or culverts such that runoff or sediment delivered from that area into the drainage system will eventually be delivered to LFH without being intercepted and immobilized by a riparian or vegetation buffer and
    - for removal of water only, any stream reach within LFH or within 1,500 feet of LFH.

Note that the most impacting effect is described in column three of the table. Different components of the action may also have insignificant, discountable or beneficial effects to the PCE. The effects to PCEs are a result of that sub-set of program activities that occur within Riparian Reserves where the adjacent stream has designated CH.

Table 187. PCE of critical habitat for SONCC coho salmon applicable to the ESA action area and summary of the effects of the proposed action.

Primary Constituent Elements		Effect of the Proposed Action (Most Impacting)
Site Type	**Site Attribute**	
Spawning and juvenile rearing areas	Cover/shelter	Measurable negative (adverse). Fine sediment from quarry operations and dredge mining would reduce interstitial spaces in substrate, reducing cover for juveniles. Sediment plumes from dredge operations can be used as cover by juveniles. Temporary pools created by dredging may be used as cover by juveniles.
	Food (juvenile rearing)	Measurable negative (adverse). Fine sediment deposition on substrate can reduce macroinvertebrate production.

		Dredge operations entrain macroinvertebrates making them available to juvenile coho, but also result in a loss of macroinvertebrate production until substrate is recolonized.
	Riparian vegetation	Discountable.
	Space	Measurable negative (adverse). See cover/shelter discussion, above.
	Spawning gravel	Measurable negative (adverse). Quality of spawning gravel may be reduced in the short-term by deposition of fine sediments from dredge turbidity plumes.
	Water quality	Measurable negative (adverse). Suspended sediments from dredge operations and potential drainage from quarry operations would negatively affect rearing but not spawning. Chemical contaminants such as petroleum products from equipment use in quarries would have insignificant effects to rearing, and no effect to spawning, Legacy mercury from dredging may negatively affect rearing and spawning.
	Water quantity	No effect.
	Water temperature	Insignificant. A measurable positive effect would occur when cold water from hyporheic flow is intercepted by dredging and enters the bottom of dredge holes.
Adult and juvenile migration corridors	Cover/shelter	Insignificant. It is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile coho salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover. There would be a positive effect to the natural cover PCE from created pools and turbidity plumes during migration.
	Food (juvenile)	Measurable negative (adverse). See food discussion, above.
	Riparian vegetation	Discountable.
	Safe passage	Insignificant. Turbidity from dredging would not measurably affect the PCE.
	Space	Insignificant. See above for Cover/shelter.
	Substrate	Insignificant. It is not known to what degree increases in fine sediments and embeddedness of the streambed for

		short reaches of stream would affect the utility of migration habitat for juvenile coho out-migrants. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Salmon would not be impacted, as they are too large to use spaces between cobbles for cover.
	Water quality	Measurable negative (adverse). See water quality discussion, above.
	Water quantity	No effect.
	Water temperature	Insignificant. See water temperature discussion, above.
	Water velocity	Discountable.

h. Recreation and Visitors Services

Table 188 displays the PCE for SONCC coho salmon that apply to the ESA action area, and summarizes the effects of the Recreation and Visitors Services program.

Table 188. PCE of critical habitat for SONCC coho salmon applicable to the ESA action area and summary of the effects of the Recreation and Visitors Services program.

Primary Constituent Elements		Effect of the Proposed Action (Most Impacting)
Site Type	**Site Attribute**	
Spawning and juvenile rearing areas	Cover/shelter	Adverse. Short-term localized effects would occur as a result of fine sediment in interstitial spaces between substrate particles, reducing cover/shelter for juveniles, but not affecting adult cover/shelter. There would also be a small, localized adverse effect as a result of removal of in-channel trees that are a hazard to boaters, and hazard trees that may fall into stream channels.
	Food (juvenile rearing)	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Adverse. Riparian vegetation at campgrounds along streams is trampled and soil compaction reduces riparian vegetation growth. Vegetation is permanently removed from public motorized travel trails and non-motorized vehicle trails within riparian areas. These are localized effects.
	Space	Adverse. There will be short-term, localized loss of interstitial spaces between streambed particles caused by fine sediment deposition. This would affect juvenile

		rearing areas but not adult spawning areas.
	Spawning gravel	Insignificant. While some fine sediment may be deposited on spawning gravels, it would be removed by increased stream flows during the fall/winter. Fines on spawning gravels prior to flows with sufficient shear stress to mobilize it would be at levels that would be removed by female coho salmon during redd construction.
	Water quality	Adverse. Potential for chemical contamination from legacy treated wood, and maintenance activities on that wood, on trail bridges and walkways. Localized increases in turbidity would affect rearing but not spawning habitat.
	Water quantity	Insignificant. Immeasurable effect to peak flows from concentration of flow on sections of public motorized travel and non-motorized use trails that connect to stream channels.
	Water temperature	Adverse. Water temperature may measurably increase in localized stream reaches adjacent to campgrounds where shade vegetation has been removed by trampling and soil compaction.
Adult and juvenile migration corridors	Cover/shelter	Adverse. Localized result of removing in-channel trees that are a hazard to boaters. This is a rare event. It is not known what the effects from fine sediment deposition causing loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile coho salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Food (juvenile)	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Adverse. Please see description above for effects to riparian vegetation for spawning and juvenile rearing areas.
	Safe passage	No effect. There is no mechanism to affect barriers.
	Space	Insignificant. See effects to cover/shelter regarding use of interstitial spaces for cover, above.
	Substrate	Insignificant. Please see description of effects to substrate in the cover/shelter discussion above.

	Water quality	Adverse. Potential for chemical contamination from legacy treated wood, and maintenance activities on that wood, on trail bridges and walkways may negatively affect water quality during migration periods. In the context of migration corridors, slight increases in turbidity against background levels would not affect the utility of migration habitat.
	Water quantity	Insignificant. Immeasurable effect to peak flows from concentration of flow on sections of public motorized travel and non-motorized use trails that connect to stream channels.
	Water temperature	Adverse. Water temperature may measurably increase in localized stream reaches adjacent to campgrounds where shade vegetation has been removed by trampling and soil compaction.
	Water velocity	No effect. There is no mechanism of the action that would affect water velocity.

i. Special Forest Products

Table 189 displays the PCE for SONCC coho salmon that apply to the ESA action area, and summarizes the effects of the Special Forest Products program.

Table 189. PCE of critical habitat for SONCC coho salmon applicable to the ESA action area and summary of the effects of the proposed action.

Primary Constituent Elements		Effect of the Proposed Action (Most Impacting)
Site Type	**Site Attribute**	
Spawning and juvenile rearing areas	Cover/shelter	Insignificant. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable effect to cover/shelter. It would not affect cover for adult spawners at all.
	Food (juvenile rearing)	Insignificant. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable effect to the production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Insignificant. The few riparian plants that would be removed for transplant would have an insignificant effect to the PCE. Some harvest of parts of riparian plants such as boughs, fronds and leaves would occur, but would not have a meaningfully

		measurable effect to the PCE.
	Space	Insignificant. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable effect to loss of interstitial spaces between streambed particles with fine sediment.
	Spawning gravel	Insignificant. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable effect to the quality of spawning gravels.
	Water quality	Insignificant overall. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable increase in turbidity. Any accidental fuel spills would be in a very small amount; likely a fraction of a gallon. The likelihood that it would reach the stream channel and cause a meaningfully measurable effect to water quality is extremely low (discountable). There is no causal mechanism to introduce nutrients to stream flows (no effect).
	Water quantity	No effect. The activity would not add or remove roads, create other flow-concentrating paths to stream channels, or remove vegetation or forest cover at a scale that would affect peak or base flows.
	Water temperature	Insignificant. There is very little vegetation removed on a small footprint of land at SFP sites. Most of it is understory vegetation that does not provide shade.
Adult and juvenile migration corridors	Cover/shelter	Insignificant. There will an insignificant effect to the sediment/turbidity/substrate indicator. There would not be a measurable negative effect to the interstitial spaces between cobbles that would be used as cover. Even it there was, it is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile coho salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult salmon would not be affected, as they are too large to use spaces between cobbles for cover.
	Food (juvenile)	Insignificant. The very small amount of sediment

		delivery to stream channels, if any, from special forest products activities would not result in a measurable effect to the production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Insignificant. Please see description above for effects to riparian vegetation for spawning and juvenile rearing areas.
	Safe passage	No effect. There is no causal mechanism to affect barriers.
	Space	Insignificant. See effects to cover/shelter, above.
	Substrate	Insignificant. Please see description of effect to cover/shelter in this sub-section.
	Water quality	Insignificant overall. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable increase in turbidity. Any accidental fuel spills would be in a very small amount; likely a fraction of a gallon. The likelihood that it would reach the stream channel and cause a meaningfully measurable effect to water quality is extremely low (discountable). There is no mechanism to introduce nutrients to stream flows (no effect).
	Water quantity	No effect. The activity would not add or remove roads, create other flow-concentrating paths to stream channels, or remove vegetation or forest cover at a scale that would affect peak or base flows.
	Water temperature	Insignificant. There is very little vegetation removed on a small footprint of land at SFP sites. Most of it is understory vegetation that does not provide shade.
	Water velocity	No effect. There is no causal mechanism to affect water velocity.

j. Sustainable Energy

Table 190 displays the PCE for SONCC coho salmon that apply to the ESA action area, and summarizes the effects of the Sustainable Energy program. Note that the effect analysis is based upon the gathering and transportation of slash from Forest Management activities that provides fuel for biomass energy plants.

Table 190. PCE of critical habitat for SONCC coho salmon applicable to the ESA action area and summary of the effects of the Sustainable Energy program.

Primary Constituent Elements		Effect of the Proposed Action (Most Impacting)
Site Type	**Site Attribute**	
Spawning and juvenile rearing areas	Cover/shelter	Adverse, but only as a result of fine sediment delivery from winter haul. Short-term localized effects would occur as a result of fine sediment in interstitial spaces between substrate particles, reducing cover/shelter for juveniles, but not affecting adult cover/shelter.
	Food (juvenile rearing)	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	No effect. Gathering and hauling slash would not affect riparian vegetation.
	Space	Adverse. There will be short-term, localized loss of interstitial spaces between streambed particles with fine sediment. This would affect juvenile rearing areas but not adult spawning areas.
	Spawning gravel	Insignificant negative. While some fine sediment may be deposited on spawning gravels, it would be removed by increased stream flows during the fall/winter. Fines on spawning gravels prior to flows with sufficient shear stress to mobilize it would be at levels that would be removed by female coho salmon during redd construction.
	Water quality	Adverse. It is a result of short-term, localized increases in turbidity from winter haul. This would affect rearing but would not measurably affect spawning habitat.
	Water quantity	No effect. There is no causal mechanism to affect the PCE.
	Water temperature	No effect. There is no causal mechanism to affect the PCE.
Adult and juvenile migration corridors	Cover/shelter	Insignificant. It is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile coho salmon. They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Salmon would not be negatively impacted, as they

		are too large to use spaces between cobbles for cover.
	Food (juvenile)	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	No effect. Gathering and hauling slash would not affect riparian vegetation.
	Safe passage	No effect. There is no mechanism to affect barriers.
	Space	Insignificant. Physical space for migrating adults and juveniles would not be affected. See effects to cover/shelter, above.
	Substrate	Insignificant. Please see description of effect to cover/shelter in this sub-section.
	Water quality	Insignificant negative. In the context of migration corridors, slight increases in turbidity against background levels would not affect the utility of migration habitat.
	Water quantity	No effect. There is no causal mechanism to affect the PCE.
	Water temperature	No effect. There is no causal mechanism to affect the PCE.
	Water velocity	No effect. There is no mechanism to affect water velocity.

k. Trails and Travel Management

Table 191 displays the PCE for SONCC coho salmon that apply to the ESA action area, and summarizes the effects of the proposed action. This analysis is informed by the analysis for the effects to habitat indicators presented above in V.A. It is also informed by the PCE effects analysis of the NMFS programmatic biological opinion that addressed the category "*Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use.*" It addressed the effects of the maintenance and use of hiking and public motorized travel trails. The PCE analysis for effects of new road construction, maintenance and decommissioning is included in the overall effects of the Forest Management Program, located elsewhere in this section.

Table 191. PCE of critical habitat for SONCC coho salmon applicable to the ESA action area and summary of the effects of the proposed action.

Primary Constituent Elements		Effect of the Proposed Action (Most Impacting)
Site Type	**Site Attribute**	
Spawning	Cover/shelter	Adverse. Short-term localized effects would occur as a

and juvenile rearing areas		result of fine sediment in interstitial spaces between substrate particles, reducing cover/shelter for juveniles, but not affecting adult cover/shelter.
	Food (juvenile rearing)	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Insignificant negative. A few hazard trees may be removed along hiking and public motorized travel trails. Vegetation encroaching on trails would be trimmed. There would be some loss of vegetation by trampling at hiking trail areas of heavy use at stream crossings.
	Space	Adverse. There will be short-term, localized loss of interstitial spaces between streambed particles by fine sediment. This would affect juvenile rearing areas but not adult spawning areas.
	Spawning gravel	Insignificant negative. While some fine sediment may be deposited on spawning gravels, it would be removed by increased stream flows during the fall/winter. Fines on spawning gravels prior to flows with sufficient shear stress to mobilize it would be at levels that would be removed by female coho salmon during redd construction.
	Water quality	Adverse. There would be short-term, localized increases in turbidity. This would affect the rearing life cycle stage of the PCE but not spawning. Chemical contamination may occur at small stream segments where treated wood Is used at trail crossings. There may be localized increases in water temperature at a few stream crossings where shade vegetation has been removed by extensive use.
	Water quantity	Insignificant negative. Trails may concentrate flows for short distances that deliver to stream channels, but it is unlikely to result in meaningfully measured increases in peak flows in areas where there is designated CH. Base flows are not affected by the action
	Water temperature	Adverse. There may be localized increases in water temperature at a few trail stream crossings where shade vegetation has been removed by extensive use.
Adult and juvenile migration corridors	Cover/shelter	Insignificant negative. It is not known to what degree the loss of interstitial space between cobbles in the streambed for short reaches of stream would affect the utility of migration habitat for out-migrating juvenile coho salmon.

		They may be too large to utilize interstitial spaces between cobbles as cover. Cover for upstream migrating adult Salmon would not be negatively impacted, as they are too large to use spaces between cobbles for cover.
	Food (juvenile)	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Riparian vegetation	Insignificant negative. Please see description above for effects to riparian vegetation for spawning and juvenile rearing areas.
	Safe passage	No effect. There are no culverts affecting ESA-listed fish passage on hiking or public motorized travel trails.
	Space	Insignificant negative. See effects to cover/shelter, above.
	Substrate	Insignificant negative. Please see description of effect to cover/shelter in this sub-section.
	Water quality	Insignificant negative. In the context of migration corridors, slight increases in turbidity against background levels are unlikely to affect the utility of migration habitat. Any water temperature increases for short sections of stream are unlikely to occur during juvenile or adult migration periods. Chemical contamination may occur downstream from a few crossings where treated wood is used, but it would be very diluted with higher flows during juvenile and adult migration periods, and is unlikely to measurably affect migration.
	Water quantity	Insignificant negative. Trails may concentrate flows for short distances that deliver to stream channels, but it is unlikely to result in meaningfully measured increases in peak flows in areas where there is designated CH. Base flows are not affected by the action.
	Water temperature	Insignificant negative. Any water temperature increases for short sections of stream are unlikely to occur during juvenile or adult migration periods.
	Water velocity	No effect. There is no causal mechanism of the maintenance and use of hiking or public motorized travel trails that would affect water velocity.

3. Bull trout

a. Cultural and Paleontological Resources

Table 192 displays the PCE for bull trout that apply to the ESA action area, and summarizes the effects of the Cultural and Paleontological Resources program. The USFWS has typed bull trout critical habitat associated with BLM lands in the McKenzie River basin as "Foraging, Migration and Overwintering" or FMO habitat. There is no spawning and rearing habitat. A conversation with Paul Bridges, USFWS biologist (Bridges pers. comm. 2015) suggests evaluating the rearing and migratory PCEs in the context of FMO use. That is the approach taken in the table below.

Table 192. PCE of critical habitat for bull trout and summary of the effects of the Cultural and Paleontological program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	No effect
	Water quality	No effect
	Water quantity	No effect
	Natural hydrograph	No effect
Rearing	Complex aquatic environments and processes	Insignificant negative. There would be insignificant effects to LWD/SWD recruitment, and to near stream riparian vegetation. Channel morphology would not be measurably affected. There would be discountable effects to peak/base flows.
	Food base	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to the production of macroinvertebrates that serve as food sources.
	Substrate	There will an insignificant negative effect to the sediment/turbidity/substrate indicator. There would not be a measurable negative effect to the interstitial spaces between cobbles.
	Water quality	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity. There is no causal mechanism to introduce chemicals or nutrients to stream flows. Little to no vegetation that provides shade to stream channels would be removed during site excavations, resulting in immeasurable effects to water temperature.
	Water quantity	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected.
	Natural hydrograph	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak

		or base flows would be affected.
Migration	Minimal physical, biological or water quality impediments	Insignificant negative. There is no causal mechanism to affect physical barriers (such as culverts). The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity that would affect bull trout migration. There is no causal mechanism to introduce chemicals or nutrients to stream flows that would cause a water quality impediment. Little to no vegetation that provides shade to stream channels would be removed during site excavations, resulting in immeasurable effects to water temperature.
Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	There are no causal mechanisms of the action to affect occurrence of non-native predatory fish species or competing fish species.

b. Fire and Fuels

Table 193 displays the PCE for bull trout that apply to the ESA action area, and summarizes the effects of the Fire and Fuels Program. The USFWS has typed bull trout critical habitat associated with BLM lands in the McKenzie River basin as "Foraging, Migration and Overwintering" or FMO habitat. There is no spawning and rearing habitat. A conversation with Paul Bridges, USFWS biologist (Bridges pers. comm. 2015) suggests evaluating the rearing and migratory PCEs in the context of FMO use. That is the approach taken in the table below.

Table 193. PCE of critical habitat for bull trout and summary of the effects of the Fire and Fuels program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	No effect.
	Water quality	No effect.
	Water quantity	No effect.
	Natural hydrograph	No effect
Rearing	Complex aquatic environments and processes	Insignificant negative. There would be insignificant effects to LWD/SWD recruitment, and to near stream riparian vegetation. Channel morphology would not be measurably affected. The flow regime would not be measurably affected.
	Food base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. This will

		also impact other juvenile fish that are prey items for larger bull trout (for example, Chinook salmon).
	Substrate	Adverse. Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water quality	Adverse. It is a result of short-term, localized increases in turbidity and nutrients (phosphorus/nitrogen). Any water withdrawal at a pump chance on BLM land would have an insignificant effect where there is designated CH on the mainstem McKenzie River. The amount withdrawn in context of the flow of the McKenzie River would result in an immeasurable effect to water temperature.
	Water quantity	Insignificant negative. Any water withdrawal at a pump chance on BLM land would have an insignificant effect where there is designated CH on the mainstem McKenzie River. The amount withdrawn in context of the flow of the McKenzie River would result in an immeasurable effect to the PCE.
	Natural hydrograph	Discountable. Analysis of peak/base flow indicator determined that It is extremely unlikely that wildfire suppression or fuels treatment activities will impact vegetation such that peak or base flows would be measurably affected at the scale of 6th field subwatersheds or larger.
Migration	Minimal physical, biological or water quality impediments	Insignificant negative. There is no mechanism in the action to create or mitigate physical barriers. Turbidity increases and nutrient increases should not measurably affect migration. There would be an immeasurable negative effect to water temperature.
Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	There are no mechanisms of the action to affect occurrence of non-native predatory fish species or competing fish species.

c. Fisheries, Hydrology, Invasive Species, Soils and Wildlife

Activities of the Fisheries, Hydrology, Invasive Species, Soils and Wildlife programs with mechanisms to affect PCEs of designated critical habitat are habitat restoration actions. In addition to the short-term negative effects to PCEs described below, habitat restoration actions have long-term benefits to PCEs of designated CH. The ARBA II described effects to PCEs of critical habitat by presenting tables that were cross-walks between USFWS MPI indicators and the PCEs, without a narrative description of the effects to each PCE. The rationale for an overall effect determination of LAA to PCEs of critical habitat was based upon the outcomes for effects to the MPI indicators and the cross-walk.

The USFWS ARBO II (USFWS 2013) listed the bull trout PCEs. A table was used to identify the cross-walk between the PCEs and pathways/indicators of the USFWS MPI, and also described the effects to PCEs in a narrative. The list and a reproduction of Table 25 follow (

Table 194). The reader is directed to USFWS (2014) to read the extensive narrative description of effects to the grouped PCEs that are summarized in Table 25.

PCEs:

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.
2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.
3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as LW, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.
8. Water temperatures ranging from 36 °F to 59 °F (2 °C to 15 °C), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.
9. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.
10. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.
11. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
12. Sufficiently low levels of occurrence of non-native predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

Table 194. Effects to PCE of bull trout designated critical habitat from restoration activities of ARBA II (after Table 26 in USFWS (2014)).

PCE	MPI Indicators	Construction Activities[1]	Instream Activities[2]	Vegetation Treatments[3]	Other Projects[4]	Effects Determination
1	Floodplain connectivity	-S	-I	N	N	**LAA**
	Change in peak/base flows	-S	-I	-S	N	
2	Physical barriers	B	N	N	N	**LAA**
	Chemical contaminants/ nutrients, temperature	-S	-I	-S	B	
	Change in peak/base flows	-S	-I	-S	N	
3	All	-S	-I	-S	N	**LAA**
4	Large wood, pool frequency and quality, large pools, off channel habitat, refugia	N	B	-S	N	**LAA**
	Wetted width/ maximum depth ratio, streambank condition, floodplain connectivity	N	B	N	N	
5	Temperature	N	N	-I	N	**NLAA**
6	Sediment	-S	-I	-S	N	**LAA**
	Substrate embeddedness	-S	-I	-S	N	
7	Change in peak/base flows	-S	N	-S	N	**LAA**
8	Chemical contaminants / nutrients	-S	N	-S	B	**LAA**
9	Life History Diversity and Isolation, Persistence and Genetic Integrity	B	N	N	N	**NLAA**

Key: -S = negative effects significant magnitude, -I =negative effects insignificant magnitude or duration, N = neutral effect, B = beneficial effect	Overall Effects Determination **LAA**

Notes:
[1] Construction activities includes categories:
1. Fish Passage Restoration (Stream Simulation Culvert and Bridge Projects; Headcut and Grade Stabilization; Fish Ladders; Irrigation Diversion Replacement/Relocation and Screen Installation/Replacement),
3. Dam, Tide gate, and Legacy Structure Removal
4. Channel Reconstruction/Relocation

5. Off- and Side-Channel Habitat Restoration
6. Streambank Restoration
7. Set-back or Removal of Existing Berms, Dikes, and Levees
8. Reduction/Relocation of Recreation Impacts
9. Livestock Fencing, Stream Crossings and Off-Channel Livestock Watering facilities
10. Piling and other Structure Removal
12. Road and Trail Erosion Control and Decommissioning

[2] Instream activities includes categories:
2. Large Wood (LW), Boulder, and Gravel Placement (LW and Boulder Projects; Engineered Logjams; Porous Boulder Weirs and Vanes, Gravel Augmentation; Tree Removal for LW Projects)
17. Bull Trout Protection

[3] Vegetation treatments includes categories:
13. Non-native Invasive Plant Control
14. Juniper Removal
15. Riparian Vegetation Treatment (controlled burning)
16. Riparian Vegetative Planting
18. Beaver Habitat Restoration
19. Sudden Oak Death (SOD) Treatments

[4]Other projects includes categories:
11. In-channel Nutrient Enhancement
20. Fisheries, Hydrology, Geomorphology Wildlife, Botany, and Cultural Surveys in Support of Aquatic Restoration.

d. Forest Management

Table 195 displays the PCE for bull trout that apply to the ESA action area, and summarizes the effects of the Forest Management program. The USFWS has typed bull trout critical habitat associated with BLM lands in the McKenzie River basin as "Foraging, Migration and Overwintering" or FMO habitat. There is no spawning and rearing habitat. A conversation with Paul Bridges, USFWS biologist (Bridges pers. comm. 2015) suggests evaluating the rearing and migratory PCEs in the context of FMO use. That is the approach taken in the table below.

Table 195. PCE of critical habitat for bull trout and summary of the effects of the Forest Management program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	No effect.
	Water quality	No effect.
	Water quantity	No effect.
	Natural hydrograph	No effect.
Rearing	Complex aquatic environments and processes	Insignificant negative. There would be a small but measurable effect to LWD/SWD recruitment from the rare new road construction within Riparian Reserves. However, this would not occur adjacent to streams with designated CH. Channel morphology would not be measurably affected. There would be an insignificant effect to the flow regime from an increase in base flows

		in some small catchments that may not be detectable where designated CH is present.
	Food base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. This will also impact other juvenile fish that are prey items for larger bull trout (for example, Chinook salmon).
	Substrate	Adverse. Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water quality	Adverse. There would be short-term, localized increases in turbidity. The risk of chemical contamination from petroleum products use by heavy equipment is extremely low, as there are no culverts that would be replaced in a stream with designated CH. Model results indicate there are no miles of stream susceptible to water temperature increases as a result of thinning or road construction in the outer zone of Riparian Reserves on fish-bearing or perennial streams in the McKenzie River basin.
	Water quantity	Insignificant negative and positive. Model results indicate that there are no subwatersheds with BLM land ownership in the McKenzie River basin that are susceptible to a detectable change in peak flow response. Any water withdrawal at a pump chance on BLM land would have an insignificant effect where there is designated CH on the mainstem McKenzie River. The amount withdrawn in context of the flow of the McKenzie River would result in an immeasurable effect to the PCE. It is likely that there would be some small catchments (<100 hectares) with increased summer base flows for a number of years as a result of Forest Management actions under the PRMP. This may not be detectable where designated CH is present, but may be a beneficial effect to the PCE.
	Natural hydrograph	Insignificant positive. See analysis above for water quantity.
Migration	Minimal physical, biological or water quality impediments	Insignificant negative. There are no culvert barriers for bull trout on BLM land. Turbidity increases should not measurably affect migration. The risk of chemical contamination from heavy equipment is extremely low, as there are no culverts that would be replaced in a stream with designated CH. Model results indicate there are no miles of stream susceptible to water temperature increases as a result of thinning the outer zone of Riparian Reserves on fish-bearing or perennial streams in the McKenzie River basin. Any water withdrawal at a pump chance on BLM land would have an insignificant effect where there

		is designated CH on the mainstem McKenzie River. The amount withdrawn in context of the flow of the McKenzie River would result in an immeasurable effect to the PCE.
Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	No effect. There are no causal mechanisms of the action to affect occurrence of non-native predatory fish species or competing fish species.

e. Lands and Realty

Table 196 displays the PCE for bull trout that apply to the ESA action area, and summarizes the effects of the Lands and Realty program. Note that the PCE analysis below is specifically for the case of a discretionary road right-of-way within a Riparian Reserve adjacent to a stream with designated CH. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (Lightcap, pers. comm. 2015).

The USFWS has typed bull trout critical habitat associated with BLM lands in the McKenzie River basin as "Foraging, Migration and Overwintering" or FMO habitat. There is no spawning and rearing habitat. A conversation with Paul Bridges, USFWS biologist (Bridges pers. comm. 2015) suggests evaluating the rearing and migratory PCEs in the context of FMO use. That is the approach taken in the table below.

Table 196. PCE of critical habitat for bull trout and summary of the effects of the Lands and Realty program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	No effect
	Water quality	No effect
	Water quantity	No effect
	Natural hydrograph	No effect
Rearing	Complex aquatic environments and processes	Measurable negative (adverse). There would be measurable negative effects to LWD/SWD recruitment and to near stream riparian vegetation, dependent upon the specific location of the right-of-way. Channel morphology would not be measurably affected. The flow regime would not be measurably affected.
	Food base	Measurable negative (adverse). Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. This will also impact other juvenile fish that are

		prey items for larger bull trout (for example, Chinook salmon).
	Substrate	Measurable negative (adverse). Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water quality	Measurable negative (adverse). It is a result of short-term, localized increases in turbidity). There would be immeasurable negative (insignificant) effects to water temperature and to chemical contamination.
	Water quantity	Insignificant negative. Short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6th field watersheds.
	Natural hydrograph	Insignificant negative. Analysis of peak/base flow indicator determined that short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6th field watersheds.
Migration	Minimal physical, biological or water quality impediments	Insignificant negative. There is no mechanism in the action to create or mitigate physical barriers. Turbidity increases should not measurably affect migration. There would be immeasurable negative (insignificant) effects to water temperature and to chemical contamination.
Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	There are no causal mechanisms of the action to affect occurrence of non-native predatory fish species or competing fish species.

f. Minerals

There are no mining claims on BLM land in the McKenzie River basin according to a search of a BLM GIS layer. Eugene BLM District Fish biologist Brett Blundon states that he has not seen any suction dredges in the mainstem McKenzie River that has the only bull trout designated CH in the basin (Blundon, pers. comm. 2015). Consequently, there are no effects to the PCEs of bull trout designated CH from suction dredge gold mining on BLM land in the McKenzie River basin.

The USFWS issued an amendment to their 2008 programmatic BO in 2011 to address effects to bull trout designated CH (USFWS 2011, tracking number 11-307). The effect determination was NLAA for the category of *Road Maintenance and Storm Proofing* that included the use of rock quarries. The analysis in the original BO did not split out effects to the habitat indicators for the use of rock quarries nested within the effects of the rest of the Road Maintenance and Storm Proofing category. Consequently, the BLM cannot identify which PCEs may be affected.

However, because the effect determination was NLAA, it follows that there are no effects to PCEs that exceed a discountable or insignificant level.

g. Recreation and Visitors Services

Table 197 displays the PCE for bull trout that apply to the ESA action area, and summarizes the effects of the Recreation and Visitors Services program. The USFWS has typed bull trout critical habitat associated with BLM lands in the McKenzie River basin as "Foraging, Migration and Overwintering" or FMO habitat. There is no spawning and rearing habitat. A conversation with Paul Bridges, USFWS biologist (Bridges pers. comm. 2015) suggests evaluating the rearing and migratory PCEs in the context of FMO use. That is the approach taken in the table below.

Table 197. PCE of critical habitat for bull trout and summary of the effects of the Recreation and Visitors Services program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	No effect.
	Water quality	No effect
	Water quantity	No effect
	Natural hydrograph	No effect
Rearing	Complex aquatic environments and processes	Measurable negative (adverse). There would be a small, localized adverse effect as a result of removal of in-channel trees that are a hazard to boaters, and hazard trees that may fall into stream channels.
	Food base	Measurable negative (adverse). Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. This will also impact other juvenile fish that are prey items for larger bull trout (for example, Chinook salmon).
	Substrate	Measurable negative (adverse). Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water quality	Insignificant negative. There is potential for chemical contamination from legacy treated wood, and maintenance activities on that wood, at the viewing platform at the Silver Creek boat landing Watchable Wildlife site. There is also a small bridge crossing at Silver Creek at that location. However, the mainstem river flow has high volume at that location and the dilution factor would result in immeasurable effects. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to overwintering use and as foraging habitat. There is a

		discountable probability that vegetation loss at BLM campgrounds, day use sites, boat ramps or trails from vegetation trampling would result in a water temperature increase of the mainstem McKenzie River.
	Water quantity	Insignificant negative effect to peak flows from concentration of flow on sections of public motorized travel and non-motorized use trails that connect to stream channels.
	Natural hydrograph	Insignificant negative effect to peak flows from concentration of flow on sections of public motorized travel and non-motorized use trails that connect to stream channels.
Migration	Minimal physical, biological or water quality impediments	Insignificant negative. There is no causal mechanism in the action to create or mitigate physical barriers. Short-term, localized turbidity increases should not measurably affect migration. There is a discountable probability that vegetation loss at BLM campgrounds, day use sites, boat ramps or trails from vegetation trampling would result in a water temperature increase of the mainstem McKenzie River. There is potential for chemical contamination from legacy treated wood, and maintenance activities on that wood, at the viewing platform at the Silver Creek boat landing Watchable Wildlife site. There is also a small bridge crossing at Silver Creek at that location. However, the mainstem river flow has high volume at that location and the dilution factor would result in immeasurable effects.
Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	There are no causal mechanisms of the action to affect occurrence of non-native predatory fish species or competing fish species.

h. Special Forest Products

Table 198 displays the PCE for bull trout that apply to the ESA action area, and summarizes the effects of the Special Forest Products program. The USFWS has typed bull trout critical habitat associated with BLM lands in the McKenzie River basin as “Foraging, Migration and Overwintering” or FMO habitat. There is no spawning and rearing habitat. A conversation with Paul Bridges, USFWS biologist (Bridges pers. comm. 2015) suggests evaluating the rearing and migratory PCEs in the context of FMO use. That is the approach taken in the table below.

Table 198. PCE of critical habitat for bull trout and summary of the effects of the Special Forest Products program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	No effect
	Water quality	No effect
	Water quantity	No effect
	Natural hydrograph	No effect
Rearing	Complex aquatic environments and processes	Insignificant negative. There would be insignificant negative effects to LWD/SWD recruitment, and to near stream riparian vegetation. Channel morphology would not be measurably affected. There would be discountable effects to peak/base flows.
	Food base	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable effect to the production of macroinvertebrates that serve as food sources. Consequently, there would be no measurable effect to other juvenile fish that are prey items for larger bull trout (for example, Chinook salmon).
	Substrate	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from special forest product activities, would not result in a measurable effect to substrate.
	Water quality	Insignificant negative overall. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable increase in turbidity. Any accidental fuel spills would be in a very small amount; likely a fraction of a gallon. The likelihood that it would reach the stream channel and cause a meaningfully measurable effect to water quality is extremely low (discountable). There is no mechanism to introduce nutrients to stream flows (no effect).
	Water quantity	No effect. The activity would not add or remove roads, create other flow-concentrating paths to stream channels, or remove vegetation or forest cover at a scale that would affect peak or base flows.
	Natural hydrograph	No effect. The activity would not add or remove roads, create other flow-concentrating paths to stream channels, or remove vegetation or forest cover at a scale that would affect peak or base flows.
Migration	Minimal physical, biological or water quality impediments	Insignificant negative overall. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable increase in turbidity that would affect bull trout migration. There is no mechanism to affect physical barriers such as culverts (No effect). There is a discountable probability of chemical contamination from

		a fuel spill affecting water quality, so it would not create a migration barrier. Little to no vegetation that provides shade to the mainstem McKenzie River would be removed, resulting in immeasurable effects to water temperature.
Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	There are no causal mechanisms of the action to affect occurrence of non-native predatory fish species or competing fish species.

i. Sustainable Energy

Table 199 displays the PCE for bull trout that apply to the ESA action area, and summarizes the effects of the proposed action. The USFWS has typed bull trout critical habitat associated with BLM lands in the McKenzie River basin as "Foraging, Migration and Overwintering" or FMO habitat. There is no spawning and rearing habitat. A conversation with Paul Bridges, USFWS biologist (Bridges pers. comm. 2015) suggests evaluating the rearing and migratory PCEs in the context of FMO use. That is the approach taken in the table below.

Note that the effects analysis is based upon the gathering and transportation of slash from Forest Management activities that provides fuel for biomass energy plants. Adverse effects are attributed to winter haul.

Table 199. PCE of critical habitat for bull trout and summary of the effects of the Sustainable Energy program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	No effect
	Water quality	No effect
	Water quantity	No effect
	Natural hydrograph	No effect
Rearing	Complex aquatic environments and processes	No effect. There would be no effect to LWD/SWD recruitment, to near stream riparian vegetation, channel morphology or peak and base flows.
	Food base	Measurable negative (adverse). Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. This will also impact other juvenile fish that are prey items for larger bull trout (for example, Chinook salmon).
	Substrate	Measurable negative (adverse). Short-term, localized effects to substrate would occur as a result of fine

		sediment in interstitial spaces between substrate particles.
	Water quality	Measurable negative (adverse). There would be short-term, localized increases in turbidity, but only from winter haul. The risk of chemical contamination from petroleum products use by heavy equipment or trucks during haul is discountable. There is no mechanism to affect water temperature.
	Water quantity	No effect. There is no causal mechanism to affect the indicator.
	Natural hydrograph	No effect. There is no causal mechanism to affect peak or base flows.
Migration	Minimal physical, biological or water quality impediments	Insignificant negative. There are no culvert barriers for bull trout on BLM land. Turbidity increases (from winter haul only) should not measurably affect migration. The risk of chemical contamination from petroleum products use by heavy equipment is insignificant and the risk from trucks during haul is discountable. There is no causal mechanism to affect water temperature.
Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	There are no causal mechanisms of the action to affect occurrence of non-native predatory fish species or competing fish species.

j. Trails and Travel Management

Table 200 displays the PCE for bull trout that apply to the ESA action area, and summarizes the effects of the Trails and Travel Management program. The USFWS has typed bull trout critical habitat associated with BLM lands in the McKenzie River basin as “Foraging, Migration and Overwintering” or FMO habitat. There is no spawning and rearing habitat. A conversation with Paul Bridges, USFWS biologist (Bridges pers. comm. 2015) suggests evaluating the rearing and migratory PCEs in the context of FMO use. That is the approach taken in the table below.

Table 200. PCE of critical habitat for bull trout and summary of the effects of the Trails and Travel Management program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	No effect.
	Water quality	No effect.
	Water quantity	No effect.
	Natural hydrograph	No effect.
Rearing	Complex aquatic environments and processes	Measurable negative (adverse). There would be a small but measurable effect to LWD/SWD recruitment. Channel morphology would not be measurably affected. Trails may concentrate flows for short distances that deliver to stream channels, but it is unlikely to result in meaningfully measured increases in peak flows in areas where there is designated CH. Base flows are not affected by the action.
	Food base	Measurable negative (adverse). Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. This will also impact other juvenile fish that are prey items for larger bull trout (for example, Chinook salmon).
	Substrate	Measurable negative (adverse). Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water quality	Measurable negative (adverse). There would be short-term, localized increases in turbidity. There may be localized increases in water temperature at a few stream crossings where shade vegetation has been removed by extensive use. The BLM does not have any trail crossings with treated wood, so there is no risk of chemical contamination.
	Water quantity	Insignificant negative. Trails may concentrate flows for short distances that deliver to stream channels, but it is unlikely to result in meaningfully measured increases in peak flows in areas where there is designated CH. Base flows are not affected by the action.
	Natural hydrograph	Insignificant negative. See above for Water Quantity.
Migration	Minimal physical, biological or water quality impediments	Insignificant negative. There are no culvert barriers for bull trout on hiking or public motorized travel trails. Slight increases in turbidity should not measurably affect migration. Any water temperature increases for short sections of stream are unlikely to occur in streams that are designated CH.

Occurrence of non-native predatory fish species or competing fish species	Low levels that, if present, are adequately temporally and spatially isolated from bull trout	No effect. There are no causal mechanisms of the action to affect occurrence of non-native predatory fish species or competing fish species.

4. Lost River Sucker and shortnose sucker

a. Cultural and Paleontological Resources

Table 201 displays the PCE for Lost River sucker and shortnose sucker and summarizes the effects of the Cultural and Paleontological Resources program.

Table 201. PCE of critical habitat for Lost River and shortnose sucker and summary of the effects of the Cultural and Paleontological Resources program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to the quality of spawning gravels.
	Water quality and depth	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity. There is no causal mechanism to introduce chemicals or nutrients to stream flows. Water depths are not affected by the action.
	Stream velocity	No effect. There is no causal mechanism to affect water velocity.
Rearing	Emergent vegetation adjacent to open water areas	No effect. There is no causal mechanism in the action to affect emergent vegetation.
	Forage base	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to the production of macroinvertebrates that serve as food sources.
	Substrate	There will be an insignificant negative effect to the sediment/turbidity/substrate indicator. There would not be a measurable negative effect to the interstitial spaces between cobbles. It is uncertain how this would affect the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with with sand, mud, gravel, and cobble substrates (Buettner and Scoppettone 1990).

	Water quality	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity. There is no mechanism to introduce chemicals or nutrients to stream flows.
	Water quantity and depth	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected. Water depths are not affected by the action.
	Natural flow regimes	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected.
Connectivity	Minimal physical, biological or water quality impediments	No effect. There is no causal mechanism to affect physical barriers (such as culverts). The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity that would affect sucker migration. There is no mechanism to introduce chemicals or nutrients to stream flows that would cause a water quality impediment.

b. Fire and Fuels

Table 202 displays the PCE for Lost River sucker and shortnose sucker that apply to the ESA action area, and summarizes the effects of the Fire and Fuels program.

Table 202. PCE of critical habitat for Lost River and shortnose sucker and summary of the effects of the Fire and Fuels program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Spawning	Substrate	Discountable. The timing of spawning (February – May) would occur when fines on spawning gravels in streams from activities the year before would have been mobilized by spring run-off.
	Water quality and depth	Insignificant negative. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to spawning. Suckers are more tolerant to turbidity than other fish species. There would be very small increases in nutrients delivered to streams as a result of the action that would not measurably affect the water quality/spawning PCE. There would be an insignificant effect to water temperature from the minimal loss of shade vegetation during fuels treatments. The Western Oregon Programmatic BO (USFWS 2008) stated that effects to water temperature would be negligible because of localized removal of vegetation at pump chance sites. The risk of chemical contamination from pumper trucks was not determined to result in adverse effects in the Western Oregon Programmatic BO. Water depths are not affected by the action.
	Stream velocity	Discountable. The only change in water velocity would occur during use of a pump chance. It is extremely unlikely that spawning Lost River or shortnose suckers would be affected as they are large enough to avoid the pump nozzle and screen.
Rearing	Emergent vegetation adjacent to open water areas	Insignificant negative. Management direction would not allow ignition of fuels within 60 feet of fish-bearing streams or perennial streams. Any fire that backs into emergent vegetation at the water's edge would not have a measurable impact on the PCE. Typically, fuels treatment within riparian areas results in patchy burning of fuels progressively towards the water's edge.
	Forage base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. Effects to zooplankton are difficult to determine. It is possible that phosphorus and nitrogen entering the water column may result in increased primary production that would increase zooplankton availability.
	Substrate	Insignificant negative. Short-term, localized effects to stream substrate would occur as a result of fine sediment

		in interstitial spaces between substrate particles. It is uncertain how this would affect rearing habitat for the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with with sand, mud, gravel, and cobble substrates (Buettner and Scoppettone 1990).
	Water quality	Insignificant negative. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect this sucker PCE. Suckers are more tolerant to turbidity than other fish species. There would be very small increases in nutrients delivered to streams as a result of the action that would not measurably affect the water quality/rearing PCE. There would be an insignificant effect to water temperature from the minimal loss of shade vegetation during fuels treatments. The Western Oregon Programmatic BO (USFWS 2008) stated that effects to water temperature would be negligible because of localized removal of vegetation at pump chance sites. The risk of chemical contamination from pumper trucks was not determined to result in adverse effects in the Western Oregon Programmatic BO. Water depths are not affected by the action.
	Water quantity and depth	Adverse. A short-term effect may occur when water is withdrawn at pump chances where there is designated CH. No more than 10 percent of the stream flow at a pump chance may be removed.
	Natural flow regimes	Discountable. Analysis of the peak/base flow indicator determined that It is extremely unlikely that wildfire suppression or fuels treatment activities will impact vegetation such that peak or base flows would be measurably affected at the scale of 6th field subwatersheds or larger.
Connectivity	Minimal physical, biological or water quality impediments	Insignificant negative. There is no mechanism in the action to create or mitigate physical barriers. Turbidity increases and nutrient increases should not measurably affect migration

c. Fisheries, Hydrology, Invasive Species, Soils and Wildlife

Activities of the Fisheries, Hydrology, Invasive Species, Soils and Wildlife programs with mechanisms to affect PCEs of designated critical habitat are habitat restoration actions. In addition to the short-term negative effects to PCEs described below, habitat restoration actions have long-term benefits to PCEs of designated CH. The ARBA II described effects to PCEs of critical habitat by presenting tables that were cross-walks between USFWS MPI indicators and the PCEs, without a narrative description of the effects to each PCE. The rationale for an overall

effects determination of LAA to PCEs of critical habitat was based upon the outcomes for effects to the MPI indicators and the cross-walk.

The USFWS ARBO II (USFWS 2013) listed the Lost River sucker and shortnose sucker PCEs. A table was used to identify the cross-walk between the PCEs and pathways/indicators of the USFWS MPI, and also described the effects to PCEs in a narrative. The list and a reproduction of Table 26 follow (Table 203). The reader is directed to USFWS (2014) to read the extensive narrative description of effects to the PCEs on pages 283-286 that are summarized in Table 26 of the USWFS BO. The overall effects determination to the PCEs of critical habitat was LAA.

PCEs:

1. Space for individual and population growth and for normal behavior;
2. Food, water, air, light, minerals, or other nutritional or physiological requirements;
3. Cover or shelter;
4. Sites for breeding, reproduction, or rearing (or development) of offspring; and,
5. Habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species.

Table 203. Effects to the PCEs of Lost River and shortnose sucker critical habitat (after Table 26 in USFWS (2014)).

PCE	MPI Indicators	Construction Activities[1]	Instream Activities[2]	Vegetation Treatments[3]	Other Projects[4]	Effects Determination
1	Physical barriers	-I	N	N	N	**LAA**
	Change in peak/base flows	-S	-I	-S	N	
2	All habitat elements indicators	-S	-I	-S	B	**LAA**
	Chemical contaminants/ nutrients, temperature	-S	-I	-S	B	
3	Refugia	-S	-I	-S	N	**LAA**
4	Large pools, off-channel habitat, refugia	-S	-I	-S	N	**LAA**
	Wetted width/ maximum depth ratio, streambank condition, floodplain connectivity	-S	-I	N	N	
5	Disturbance history, disturbance regime	B	N	N	N	**NLAA**
Key: -S = negative effects significant magnitude, -I =negative effects insignificant magnitude or duration,				Overall Effects Determination		

N = neutral effect, B = beneficial effect	**LAA**

Notes:

[1] Construction activities includes categories:

1. Fish Passage Restoration (Stream Simulation Culvert and Bridge Projects; Headcut and Grade Stabilization; Fish Ladders; Irrigation Diversion Replacement/Relocation and Screen Installation/Replacement),
3. Dam, Tide gate, and Legacy Structure Removal
4. Channel Reconstruction/Relocation
5. Off- and Side-Channel Habitat Restoration
6. Streambank Restoration
7. Set-back or Removal of Existing Berms, Dikes, and Levees
8. Reduction/Relocation of Recreation Impacts
9. Livestock Fencing, Stream Crossings and Off-Channel Livestock Watering facilities
10. Piling and other Structure Removal
12. Road and Trail Erosion Control and Decommissioning

[2] Instream activities includes categories:

2. Large Wood (LW), Boulder, and Gravel Placement (LW and Boulder Projects; Engineered Logjams; Porous Boulder Weirs and Vanes, Gravel Augmentation; Tree Removal for LW Projects)
17. Bull Trout Protection

[3] Vegetation treatments includes categories:

13. Non-native Invasive Plant Control
14. Juniper Removal
15. Riparian Vegetation Treatment (controlled burning)
16. Riparian Vegetative Planting
18. Beaver Habitat Restoration
19. Sudden Oak Death (SOD) Treatments

[4] Other projects includes categories:

11. In-channel Nutrient Enhancement
20. Fisheries, Hydrology, Geomorphology Wildlife, Botany, and Cultural Surveys in Support of Aquatic Restoration.

d. Forest Management

Table 204 displays the PCE for Lost River sucker and shortnose sucker that apply to the ESA action area, and summarizes the effects of the Forest Management program.

Table 204. PCE of critical habitat for Lost River and shortnose sucker and summary of the effects of the proposed action.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Spawning	Substrate	Discountable. The timing of spawning (February – May) would occur when fines on spawning gravels in streams from activities the year before would have been mobilized by shear stress of fall/winter storm flows.
	Water quality and depth	Insignificant negative. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to spawning. There is no risk of chemical contamination from petroleum products that may occur as a result of heavy equipment operation during culvert replacement operations in fish-bearing streams, as there are no BLM culverts on streams with designated CH that would be replaced. There would be no effect to water temperature in designated CH west of Highway 97, as analysis determined there are no subwatersheds with BLM land that are susceptible to water temperature increases from thinning in the outer zone of Riparian Reserves on fish-bearing or perennial streams. Water temperatures would be maintained in the Eastside LUA by the following management direction: "Retain and promote long-term site-potential shade conditions." Water depths are not affected by the action.
	Stream velocity	No effect. There is no causal mechanism to affect stream velocity.
Rearing	Emergent vegetation adjacent to open water areas	No effect. There is no mechanism in the action to affect emergent vegetation.
	Forage base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Substrate	Insignificant negative. Short-term, localized effects to stream substrate would occur as a result of fine sediment in interstitial spaces between substrate particles. It is uncertain how this would affect the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with with sand, mud, gravel, and cobble substrates (Buettner and Scoppettone 1990).
	Water quality	Insignificant negative. There may be short-term, localized increases in turbidity that may be undetectable against background levels. There is no risk of chemical contamination from petroleum products that may occur as a result of heavy equipment operation during culvert replacement operations in fish-bearing streams, as there

		are no BLM culverts on streams with designated CH that would be replaced. There would be no effect to water temperature in designated CH west of Highway 97, as analysis determined there are no subwatersheds with BLM land that are susceptible to water temperature increases from thinning in the outer zone of Riparian Reserves on fish-bearing or perennial streams. Water temperatures would be maintained in the Eastside LUA by the following Management Direction: "Retain and promote long-term site-potential shade conditions."
	Water quantity and depth	Adverse. The shot-term adverse effect is solely from the use of pump chances to draw water from streams with designated CH. This is anticipated to be a relatively rare occurrence, as there are alternative water sources than selecting from a stream with designated CH, and there is a disincentive in BMP R 60 (it allows drawing a maximum of 10% of stream flow in or within 1,500 feet of listed fish habitat, while allowing a maximum of 50% of flow elsewhere). Model results indicate that there are no subwatersheds with BLM land ownership in the Lost RU that that are susceptible to a detectable change in peak flow response. There is one subwatershed in the Upper Klamath RU (Fall Creek-Klamath River, 180102060502) that is susceptible to a detectable change in peak flow response but does not have ESA-listed sucker designated CH. It is likely that there would be some small catchments (<100 hectares) with increased summer base flows for a number of years as a result of Forest Management actions under the PRMP. This may not be detectable where designated CH is present, but may be a beneficial effect to the PCE. There is no causal mechanism of the action to affect water depth.
	Natural flow regimes	Insignificant negative. A short-term reduction in flow due to use of pump chances would not have a meaningfully measurable effect to the natural flow regiment.
Connectivity	Minimal physical, biological or water quality impediments	Insignificant negative. There may be short-term, localized increases in turbidity that may be undetectable against background levels. There is no risk of chemical contamination from petroleum products that may occur as a result of heavy equipment operation during culvert replacement operations in fish-bearing streams, as there are no BLM culverts on streams with designated CH that would be replaced. There would be no effect to water temperature in designated CH west of Highway 97, as analysis determined there are no subwatersheds with

		BLM land that are susceptible to water temperature increases from thinning in the outer zone of Riparian Reserves on fish-bearing or perennial streams. Water temperatures would be maintained in the Eastside LUA by the following Management Direction: "Retain and promote long-term site-potential shade conditions." The only potential negative effect to connectivity would be turbidity, but suckers are relatively tolerant of turbidity.

e. Lands and Realty

Table 205 displays the PCE for Lost River sucker and shortnose sucker that apply to the ESA action area, and summarizes the effects of the Lands and Realty program. Note that the PCE analysis below is specifically for the case of a discretionary road right-of-way within a Riparian Reserve adjacent to a stream with designated CH. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (Lightcap, pers. comm. 2015).

Table 205. PCE of critical habitat for Lost River and shortnose sucker and summary of the effects of the Lands and Realty program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	Discountable. The timing of spawning (February – May) would occur when fines on spawning gravels in streams from activities the year before would have been mobilized by shear stress of fall/winter stormflows.
	Water quality and depth	Insignificant negative. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to spawning. The two sucker species are more tolerant to turbidity than other fish species. Water depths are not affected by the action.
	Stream velocity	No effect. There is no causal mechanism of the action that would affect water velocity.
Rearing	Emergent vegetation adjacent to open water areas	No effect. There is no causal mechanism in the action to affect emergent vegetation.
	Forage base	Measurable negative (adverse). Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. Effects to zooplankton are difficult to determine.
	Substrate	Insignificant negative. Short-term, localized effects to stream substrate would occur as a result of fine sediment in interstitial spaces between substrate particles. It is uncertain how this would affect the two sucker species.

		Juvenile suckers use a variety of substrates in lakes, including those with sand, mud, gravel, and cobble substrates (Buettner and Scoppettone 1990).
	Water quality	Insignificant negative. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect this sucker PCE.
	Water quantity and depth	Insignificant negative. Short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6th field watersheds. There is no causal mechanism to affect water depth.
	Natural flow regimes	Insignificant negative. Short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6th field watersheds.
Connectivity	Minimal physical, biological or water quality impediments	Insignificant negative. There is no mechanism in the action to create or mitigate physical barriers. Turbidity increases should not measurably affect migration.

f. Livestock Grazing

Table 206 displays the PCE for shortnose and Lost River sucker that apply to the ESA action area, and summarizes the effects of the Livestock Grazing program. While there is no Lost River critical habitat within the action area, Lost River suckers do occupy portions of the Klamath River within the action area. Therefore, effects to Lost River suckers will be evaluated using the PCE. The analysis for shortnose suckers is informed by the analysis for the effects to habitat indicators presented above in section V.A. of this biological assessment, and by the PCE analysis contained in the biological opinion for effects of livestock grazing on shortnose sucker on the BLM Lakeview District Klamath Falls Resource Area (USFWS 2014).

Table 206. PCE of critical habitat for Lost River and shortnose sucker and summary of the effects of the Livestock Grazing program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Spawning	Substrate	SNS: Adverse (measurable negative). It would occur every 3rd year in 0.05 mile of Ben Hall Creek when the rotation allows use of Dry Prairie Pasture during the spawning period in May.
		LRS: Insignificant (Immeasurable negative). Distance and topography preclude the likelihood of measurable effects.
	Water quality and depth	Insignificant negative. Short-term, localized increases in turbidity may be undetectable against background levels and would not measurably affect water quality with respect to spawning. Suckers are more tolerant to turbidity than other fish species. Increases in nutrients from cattle urine/feces would be diluted at flows typically found during the spawning period. Water depths are not affected by the action.
	Stream velocity	No effect. There is no mechanism of livestock grazing to affect stream velocity.
Rearing	Emergent vegetation adjacent to open water areas	SNS: Adverse. A measurable negative effect occurs to emergent vegetation when drawdown of Dry Prairie Reservoir allows grazing by livestock.
		LRS: Discountable. It is remotely possible that livestock could enter the Klamath River canyon, but very unlikely.
	Forage base	SNS: Insignificant negative. The 2014 USFWS BO states that food availability is probably not a limiting factor for shortnose sucker in Ben Hall Creek or Dry Prairie Reservoir.
		LRS: No effect. Distance and topography preclude the possibility of effects to this indicator.
	Substrate	SNS: Insignificant negative. Short-term, localized effects to stream substrate would occur as a result of fine sediment in interstitial spaces between substrate particles in Ben Hall Creek. However, the 2014 USFWS BO states that excess sediment is expected to be flushed away during spring run-off. It is uncertain how this would affect rearing habitat for the shortnose sucker. Juvenile suckers use a variety of substrates in lakes, including those with sand, mud, gravel, and cobble substrates (Buettner and Scoppettone 1990).

		LRS: Insignificant negative. Distance and topography from most livestock grazing will limit the amount of fine sediment delivered to LRS to immeasurable quantities. Any effects would be extremely localized.
	Water quality	SNS: Insignificant negative. Short-term, localized increases in turbidity may be undetectable against background levels. Suckers are more tolerant to turbidity than other fish species. The 2014 USFWS BO states that no specific data exists concerning nutrient concentrations (from cattle urine or feces) in Dry Prairie Reservoir or Ben Hall Creek. However, the Service believes this is probably not a limiting factor for the shortnose sucker since populations are viable and there is no information to indicate that it is limiting the recovery function of the water PCE.
		LRS: Insignificant negative. Immeasurable increases in turbidity and ammonia could occur, but because of the distance and topography any effects would be highly localized and quickly diffused once entering LRS habitat.
	Water quantity and depth	SNS: Adverse (measurable negative). The 2014 USFWS BO states that there is the potential that cattle drinking from Dry Prairie Reservoir and Ben Hall Creek during low water years, particularly when the reservoir is greatly reduced in size, would measurably affect water quantity.
		LRS: Discountable. Because of the distance and topography the likelihood that livestock could affect water depths is highly unlikely to occur.
	Natural flow regimes	SNS: Adverse (measurable negative), due to cattle drinking from Ben Hall Creek during low water years. There would be a measurable negative effect to base flow.
		LRS: Insignificant (immeasurable negative). The only mechanism that would exist is through livestock drinking from streams that flow into LRS habitat or through an occasional animal that somehow enetered the Klamath River corridor. This consumption of water would be so small that the effects could not be measured.
Connectivity	Minimal physical, biological or water quality impediments	Insignificant negative. There is no mechanism in the action to create or mitigate physical barriers. Turbidity increases and nutrient increases should not measurably affect migration for either species.

g. Minerals

There are no mining claims on BLM land in waters with Lost River sucker of shortnose sucker designated CH within the planning area according to a search of a BLM GIS layer. The BLM Klamath Falls Resource Area Fish Biologist Rob Roninger states that he has not seen any suction dredge mining in any Lost River sucker or shortnose sucker designated CH (Roninger, pers. comm. 2015). There are no BLM rock quarries that drain to critical habitat for either sucker species. The BLM concludes that there is no effect to the PCE of designated CH for either sucker species from use of rock quarries or from suction dredge gold mining.

h. Recreation and Visitors Services

Table 207 displays the PCE for Lost River sucker and shortnose sucker that apply to the ESA action area, and summarizes the effects of Recreation and Visitors Services program.

Table 207. PCE of critical habitat for Lost River and shortnose sucker and summary of the effects of the Recreation and Visitors Services program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	Discountable negative. The timing of spawning (February – May) would occur when fines on spawning gravels in streams from activities the year before would have been mobilized by spring run-off.
	Water quality and depth	Adverse. Potential for chemical contamination from legacy treated wood, and maintenance activities on that wood, on trail bridges and walkways. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect water quality with respect to spawning. Suckers are more tolerant to turbidity than other fish species. Loss of vegetation at streamside campgrounds is unlikely to affect water temperatures during spawning periods when flows are typically higher and water temperatures are lower. Water depths are not affected by the action.
	Stream velocity	No effect. There is no mechanism of the action that would affect water velocity.
Rearing	Emergent vegetation adjacent to open water areas	Insignificant negative. There may be some trampling of emergent vegetation adjacent to heavily used recreation areas.
	Forage base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources. Effects to zooplankton are difficult to determine.
	Substrate	Insignificant negative. Short-term, localized effects to stream substrate would occur as a result of fine sediment in interstitial spaces between substrate particles. It is uncertain how this would affect rearing habitat for the two sucker species. Juvenile suckers use a variety of

		substrates in lakes, including those with with sand, mud, gravel, and cobble substrates (Buettner and Scoppettone 1990).
	Water quality	Adverse. Potential for chemical contamination from legacy treated wood, and maintenance activities on that wood, on trail bridges and walkways. Short-term, localized increases in turbidity that may be undetectable against background levels would not measurably affect this sucker PCE. Suckers are more tolerant to turbidity than other fish species.
	Water quantity and depth	Insignificant negative effect to peak flows from concentration of flow on sections of public motorized travel and non-motorized use trails that connect to stream channels. Water depths are not affected by the action.
	Natural flow regimes	Insignificant negative. The effect to peak flows from concentration of flow on sections of public motorized travel and non-motorized use trails that connect to stream channels would not be meaningfully measured.
Connectivity	Minimal physical, biological or water quality impediments	Adverse. Potential for chemical contamination from legacy treated wood, and maintenance activities on that wood, on trail bridges and walkways may negatively affect water quality during migration periods. In the context of migration corridors, slight increases in turbidity against background levels would not affect the utility of migration habitat. Suckers are more tolerant of turbidity than salmonids. Water temperature may measurably increase in localized stream reaches adjacent to campgrounds where shade vegetation has been removed by trampling and soil compaction. This would have the potential to adversely affect the PCE.

i. Special Forest Products

Table 208 displays the PCE for Lost River sucker and shortnose sucker that apply to the ESA action area, and summarizes the effects of the Special Forest Products (SFP) program.

Table 208. PCE of critical habitat for Lost River and shortnose sucker and summary of the effects of the Special Forest Products program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from special forest products activities would not result in a measurable effect to the quality of spawning gravels.
	Water quality and depth	Insignificant negative overall. The very small amount of sediment delivery to stream channels, if any, from special forest products activities would not result in a measurable increase in turbidity. The two sucker species are more tolerant to turbidity than other fish species. There is a discountable probability of chemical contamination from a fuel spill affecting water quality There is no causal mechanism to introduce nutrients to stream flows. Water depths are not affected by the action.
	Stream velocity	No effect. There is no causal mechanism to affect water velocity.
Rearing	Emergent vegetation adjacent to open water areas	Insignificant negative. There would be a minimal amount of emergent vegetation that is within designated CH that may serve as habitat for juvenile suckers that would be collected as a SFP. The effects to the PCE would be insignificant. Native American use would be as a treaty right and therefore would not be discretionary.
	Forage base	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from SFP activities would not result in a measurable effect to the production of macroinvertebrates or to zooplankton that serve as food sources.
	Substrate	There will an insignificant negative effect to the sediment/turbidity/substrate indicator. There would not be a measurable negative effect to the interstitial spaces between cobbles. Even if it were meaningfully measurable, it is uncertain how this would affect the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with with sand, mud, gravel, and cobble substrates (Buettner and Scoppettone 1990).
	Water quality	Insignificant negative overall. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable increase in turbidity. Any accidental fuel spills would be in a very small amount; likely a fraction of a gallon. The likelihood that it would reach the stream channel and cause a meaningfully measurable effect to water quality is extremely low (discountable). There is no mechanism

		to introduce nutrients to stream flows (no effect).
	Water quantity and depth	No effect. The activity would not add or remove roads, create other flow-concentrating paths to stream channels, or remove vegetation or forest cover at a scale that would affect peak or base flows. Water depths are not affected by the action.
	Natural flow regimes	No effect. The activity would not add or remove roads, create other flow-concentrating paths to stream channels, or remove vegetation or forest cover at a scale that would affect peak or base flows.
Connectivity	Minimal physical, biological or water quality impediments	Insignificant negative overall. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable increase in turbidity that would affect sucker migration. There is no causal mechanism to affect physical barriers such as culverts (no effect). There is a discountable probability of chemical contamination from a fuel spill affecting water quality, so it would not create a migration barrier.

j. Sustainable Energy

Table 209 displays the PCE for Lost River sucker and shortnose sucker that apply to the ESA action area, and summarizes the effects of the Sustainable Energy program. Note that the effect analysis is based upon the gathering and transportation of slash from Forest Management activities that provides fuel for biomass energy plants. Adverse effects are attributed to winter haul.

Table 209. PCE of critical habitat for Lost River and shortnose sucker and summary of the effects of the Sustainable Energy program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	Insignificant negative. The timing of spawning (February – May) occurs when fines on spawning gravels in streams are likely to be mobilized by shear stress of fall/winter stormflows.
	Water quality and depth	Measurable negative (adverse). There would be short-term, localized increases in turbidity, but only from winter haul. The two sucker species are more tolerant to turbidity than other fish species. The risk of chemical contamination from petroleum products used by heavy equipment or trucks during haul is discountable. There is no mechanism to affect water temperature. Water depths are not affected by the action.
	Stream velocity	No effect. There is no causal mechanism to affect water velocity.

Rearing	Emergent vegetation adjacent to open water areas	No effect. There is no causal mechanism in the action to affect emergent vegetation.
	Forage base	Measurable negative (adverse). Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates and phytoplankton that serve as food sources.
	Substrate	Measurable negative (adverse). Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles. It is uncertain how this would affect the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with with sand, mud, gravel, and cobble substrates (Buettner and Scoppettone 1990).
	Water quality	Measurable negative (adverse). See water quality discussion, above.
	Water quantity and depth	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. Water depths are not affected by the action.
	Natural flow regimes	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels.
Connectivity	Minimal physical, biological or water quality impediments	Insignificant negative. Turbidity increases (from winter haul only) should not measurably affect migration. The risk of chemical contamination from petroleum products use by heavy equipment is insignificant and the risk from trucks during haul is discountable. There is no causal mechanism to affect water temperature.

k. Trails and Travel Management

Table 210 displays the PCE for Lost River sucker and shortnose sucker that apply to the ESA action area, and summarizes the effects of the Trails and Travel Management program.

Table 210. PCE of critical habitat for Lost River and shortnose sucker and summary of the effects of the Trails and Travel Management program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	Discountable. The timing of spawning (February – May) would occur when fines on spawning gravels in streams from activities the year before would have been mobilized by shear stress of fall/winter stormflows.
	Water quality and depth	Insignificant negative. Slight increases in turbidity against background levels are unlikely to affect the utility of migration habitat. Any water temperature increases for short sections of stream are unlikely to occur during the spawning period. Chemical contamination may occur downstream from a few crossings where treated wood is used, but it would be very diluted with higher flows during the spawning period, and is unlikely to measurably affect spawning. Water depths are not affected by the action.
	Stream velocity	No effect. There is no causal mechanism to affect stream velocity.
Rearing	Emergent vegetation adjacent to open water areas	No effect. There is no mechanism in the action to affect emergent vegetation adjacent to open water areas.
	Forage base	Adverse. Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates that serve as food sources.
	Substrate	Insignificant negative. Short-term, localized effects to stream substrate would occur as a result of fine sediment in interstitial spaces between substrate particles. It is uncertain how this would affect the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with with sand, mud, gravel, and cobble substrates (Buettner and Scoppettone 1990).
	Water quality	Adverse. There may be short-term, localized increases in turbidity that may be undetectable against background levels. Suckers are more tolerant to turbidity than other fish species. Chemical contamination may occur at small stream segments where treated wood Is used at trail crossings. There may be localized increases in water temperature at a few stream crossings where shade vegetation has been removed by extensive use.
	Water quantity and depth	Insignificant negative. Trails may concentrate flows for short distances that deliver to stream channels, but it is unlikely to result in meaningfully measured increases in peak flows in areas where there is designated CH. Base flows are not affected by the action. There is no causal mechanism of the action to affect water depth.

	Natural flow regimes	Insignificant negative. See analysis above for the effects to rearing Water Quantity and Depth.
Connectivity	Minimal physical, biological or water quality impediments	Adverse. This is a conservative effect determination. Chemical contamination may occur at small stream segments where treated wood Is used at trail crossings. There may be localized increases in water temperature at a few stream crossings where shade vegetation has been removed by extensive use. There is no mechanism in the action to create or mitigate physical barriers. Turbidity increases should not measurably affect migration.

I. Wild Horses

Table 211 displays the PCE for Lost River sucker and shortnose sucker that apply to the ESA action area, and summarizes the effects of the Wild Horses program. The program is located in the Pokegama Herd Management Area. All effects to PCEs are discountable or insignificant negative. The effect determination for designated CH is "May Affect, Not Likely to Adversely Affect."

Table 211. PCE of critical habitat for Lost River and shortnose sucker and summary of the effects of the Wild Horses program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Spawning	Substrate	Insignificant negative. The very small amount of sediment delivery to the Klamath River, if any, from wild horse activity would not result in a measurable increase in fine sediment on spawning substrate.
	Water quality and depth	Insignificant negative overall. The very small amount of sediment delivery to the Klamath River, if any, from wild horse activity would not result in a measurable increase in turbidity. Suckers are more tolerant of turbidity than other fish species. Urine and fecal matter should be widely distributed and would not lead to meaningfully measurable affects to water quality of the Klamath River. Water depths are not affected by the action.
	Stream velocity	No effect. There is no mechanism to affect water velocity.
Rearing	Emergent vegetation adjacent to open water areas	Insignificant negative. There would be very limited grazing by wild horses on emergent vegetation of the Klamath River that could serve as habitat for juvenile suckers. This would not result in a meaningfully measured effect to the PCE.
	Forage base	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from wild horse activity would not result in a measurable effect to the production of macroinvertebrates that serve as food sources in the Klamath River. Zooplankton availability

		should not be affected.
	Substrate	There will an insignificant negative effect to the sediment/turbidity/substrate indicator. There would not be a measurable negative effect to the interstitial spaces between cobbles of the Klamath River. Even if it were meaningfully measurable, it is uncertain how this would affect the two sucker species. Juvenile suckers use a variety of substrates in lakes, including those with with sand, mud, gravel, and cobble substrates (Buettner and Scoppettone 1990).
	Water quality	Insignificant negative overall. The very small amount of sediment delivery to the Klamath River, if any, from wild horse activity would not result in a measurable increase in turbidity. Suckers are more tolerant to turbidity than other fish species. Urine and fecal matter should be widely distributed and would not lead to meaningfully measurable affects to water quality of the Klamath River.
	Water quantity and depth	Insignificant negative. The only mechanism of wild horse use to affect water quantity would be horses drinking from the Klamath River, and that level of use in the winter (when they are most likely to be in the canyon) would not result in a meaningfully measurable effect to water quantity. Water depths are not affected.
	Natural flow regimes	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that the small amount of vegetation eaten would affect peak or base flows.
Connectivity	Minimal physical, biological or water quality impediments	Insignificant negative overall. The very small amount of sediment delivery to the Klamath River, if any, from wild horse use would not result in a measurable increase in turbidity that would affect sucker migration. Suckers are more tolerant to turbidity than other fish species. There is no mechanism to affect physical barriers such as culverts (No Effect). There is no mechanism for chemical contamination that would be a water quality barrier to migration.

5. Southern DPS green sturgeon

There is very limited BLM land adjacent to or immediately downstream from Southern DPS green sturgeon designated CH. There are only 0.07 miles of designated CH adjacent to BLM land. This may overstate the actual mileage as the CH line work is inconsistent with the NHD high-resolution stream network line work. The analysis below describe potential effects to Southern DPS green sturgeon designated CH from PRMP programs.

a. Cultural and Paleontological Resources

Table 212 displays the PCE for Southern DPS Green Sturgeon that apply to the ESA action area, and summarizes the effects of the Cultural and Paleontological Resources programs.

Table 212. PCE of critical habitat for Southern DPS green sturgeon applicable to the ESA action area and summary of the effects of the Cultural and Paleontological programs.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Freshwater riverine system	Food resources	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable effect to the production of macroinvertebrates, and other food sources higher on the food chain for sturgeon that are dependent upon macroinvertebrates.
	Migratory corridor	No effect. There is no causal mechanism to affect fish passage.
	Sediment quality	There will an insignificant negative effect to the sediment/turbidity/substrate indicator. There would not be a measurable negative effect to sediment quality
	Substrate type or size	There will an insignificant negative effect to the sediment/turbidity/substrate indicator. There would not be a measurable negative effect to substrate type.
	Water depth	No effect. There is no causal mechanism to affect water depth.
	Water flow	Discountable. The activity would not add or remove roads, or create other flow-concentrating paths to stream channels. It is extremely unlikely that site excavation of small surface areas will impact vegetation such that peak or base flows would be affected.
	Water quality	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from the typical site excavation would not result in a measurable increase in turbidity. There is no causal mechanism to introduce chemicals or nutrients to stream flows. Little to no vegetation that provides shade to stream channels would be removed during site excavations, resulting in immeasurable effects to water temperature.
Estuarine areas	Food resources	No effect
	Migratory corridor	No effect.
	Sediment quality	No effect.
	Water depth	No effect.
	Water flow	No effect.
	Water quality	No effect.

b. Fire and Fuels

Table 213 displays the PCE for Southern DPS Green Sturgeon that apply to the ESA action area, and summarizes the effects of the Fire and Fuels program.

Table 213. PCE of critical habitat for Southern DPS green sturgeon applicable to the ESA action area and summary of the effects of the Fire and Fuels program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Freshwater riverine system	Food resources	Adverse. Short-term, localized increases in fine sediments in substrate will result in a measurable effect to the production of macroinvertebrates, and other food sources for sturgeon higher on the food chain that are dependent upon macroinvertebrates.
	Migratory corridor	No effect. There is no causal mechanism to affect fish passage.
	Sediment quality	Adverse. Short-term, localized effects to sediment quality would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Substrate type or size	Adverse. Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water depth	No effect. There is no causal mechanism to affect water depth.
	Water flow	Adverse. A short-term effect may occur when water is withdrawn at pump chances where there is designated CH. No more than 10 percent of the stream flow at a pump chance may be removed.
	Water quality	Adverse. It is a result of short-term, localized increases in turbidity and nutrients (phosphorus/nitrogen).
Estuarine areas	Food resources	No effect
	Migratory corridor	No effect.
	Sediment quality	No effect.
	Water depth	No effect.
	Water flow	No effect.
	Water quality	No effect.

c. Fisheries, Hydrology, Invasive Species, Soils and Wildlife

Activities of the Fisheries, Hydrology, Invasive Species, Soils and Wildlife programs with mechanisms to affect PCEs of designated critical habitat are habitat restoration actions. The NMFS ARBO II (NMFS 2013) concluded that the effect determination for restoration activities was NLAA for Southern DPS green sturgeon designated CH. The only known site for a restoration activity that may affect Southern DPS green sturgeon designated CH is in the New River ACEC managed by the Coos Bay District. The NLAA effect determination of ARBO II is consistent with the effect determination for designated CH for a wildlife habitat restoration

project for snowy plover habitat in the New River ACEC (NMFS 2009, consultation number 2008/07031). The NLAA determination for effects to designated CH was based upon the conclusion that effects to water quality, water temperature, natural cover, and space for green sturgeon were expected to be insignificant.

d. Forest Management

Forest management activities on two BLM parcels may affect Southern DPS green sturgeon designated CH. Each parcel is surrounded by private land.

The first BLM parcel is located adjacent to Butler Creek, a tributary to the lower Umpqua River. The parcel is approximately 50 acres in size. There is Riparian Reserve between the HLB acreage and the CH. The distance to CH is approximately 220 feet from HLB acreage. The second is a BLM parcel on Big Elk Creek, a tributary to the Yaquina River. The BLM parcel is approximately 70 acres in size. There is Riparian Reserve between the HLB acreage and the CH. The distance to CH from HLB is approximately 180 feet. Table 214 displays the PCE for Southern DPS Green Sturgeon that apply to the two BLM parcels, and summarizes the effects of the Forest Management program.

Table 214. PCE of critical habitat for Southern DPS green sturgeon applicable to the ESA action area and summary of the effects of the Forest Management program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Freshwater riverine system	Food resources	Measurable negative (adverse). Short-term, localized increases in fine sediments in substrate will reduce production of macroinvertebrates, and other food sources higher on the food chain for sturgeon that are dependent upon macroinvertebrates.
	Migratory corridor	No effect. There is no causal mechanism to affect fish passage.
	Sediment quality	Measurable negative (adverse). There would be short-term, localized increases in fine sediments in substrate.
	Substrate type or size	Measurable negative (adverse). There would be short-term, localized increases in fine sediments in substrate.
	Water depth	No effect. There is no causal mechanism to affect water depth in Butler Creek or Big Elk Creek.
	Water flow	Adverse. The adverse effect is solely from the use of pump chances to draw water from streams with designated CH. This is anticipated to be a relatively rare occurrence, as there are alternative water sources than selecting from a stream with designated CH, and there is a disincentive in BMP R 60 (it allows drawing a maximum of 10% of stream flow in or within 1,500 feet of listed fish habitat, while allowing a maximum of 50% of flow elsewhere). Indicator analysis indicates a discountable effect to peak flows from timber harvest and road construction. The

		BLM land parcels where these acions may occur are very small in contrast to the total acreage in each subwatershed. It is likely that there may be some small catchments (<100 hectares) with increased summer base flows for a number of years as a result of timber harvest under the PRMP. This would have a beneficial effect to the PCE.
	Water quality	Measurable negative (adverse). There would be short-term, localized increases in turbidity. There is an insignificant negative effect from chemical contamination due to fuel spills. There is a discountable probability of a water temperature increase from thinning within Riparian Reserves of fish-bearing or perennial streams.
Estuarine areas	Food resources	No effect
	Migratory corridor	No effect.
	Sediment quality	No effect.
	Water depth	No effect.
	Water flow	No effect.
	Water quality	No effect.

e. Lands and Realty

Table 215 displays the PCE for Southern DPS Green Sturgeon that apply to the ESA action area, and summarizes the effects of the Lands and Realty program. Note that the PCE analysis below is specifically for the case of a discretionary road right-of-way within a Riparian Reserve adjacent to a stream with designated CH. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (Lightcap, pers. comm. 2015).

Table 215. PCE of critical habitat for Southern DPS green sturgeon applicable to the ESA action area and summary of the effects of the Lands and Realty program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Freshwater riverine system	Food resources	Adverse. Short-term, localized increases in fine sediments in substrate will result in a measurable effect to the production of macroinvertebrates, and other food sources for sturgeon higher on the food chain that are dependent upon macroinvertebrates.
	Migratory corridor	No effect. There is no causal mechanism to affect fish passage.
	Sediment quality	Adverse. Short-term, localized effects to sediment quality would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Substrate type or size	Adverse. Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces

		between substrate particles.
	Water depth	No effect. There is no causal mechanism to affect water depth.
	Water flow	Insignificant negative. Short sections of road constructed for a right-of-way that are designed with minimal stream connectivity would not have measurable effects to peak or base flows at the scale of 6th field watersheds.
	Water quality	Adverse. It is a result of short-term, localized increases in turbidity.
Estuarine areas	Food resources	No effect
	Migratory corridor	No effect.
	Sediment quality	No effect.
	Water depth	No effect.
	Water flow	No effect.
	Water quality	No effect.

f. Minerals

Table 216 displays the PCE for Southern DPS Green Sturgeon that apply to the ESA action area, and summarizes the effects of the Minerals program. The only effect to Southern DPS green sturgeon designated CH from the Minerals program would be an adverse effect the sediment quality and food resources PCEs from methymercury in estuary environments. It would be a result of legacy mercury mobilized from deep streambed sediment upstream by suction gold dredge mining.

This is a very conservative effect determination because the following is unknown:

- How much elemental mercury reaches estuary areas as a result of suction dredge mining on BLM land
- How much of that becomes methylmercury
- The degree to which it enters the food chain
- There is no information on methylmercury levels in the tissues of Southern DPS green sturgeon taken from individuals of the species in the potentially affected estuaries in Oregon

Table 216. PCE of critical habitat for Southern DPS green sturgeon applicable to the ESA action area and summary of the effects of the Minerals program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Freshwater riverine system	Food resources	No effect.
	Migratory corridor	No effect.
	Sediment quality	No effect.
	Substrate type or size	No effect.
	Water depth	No effect.
	Water flow	No effect.
	Water quality	No effect.
Estuarine areas	Food resources	Measurable negative (adverse). Methymercury bioaccumulation in food items negatively affects the PCE.
	Migratory corridor	No effect.
	Sediment quality	Measurable negative (adverse). Methymercury contamination in estuary sediments negatively affects the PCE.
	Water depth	No effect.
	Water flow	No effect.
	Water quality	No effect.

g. New River Breaching Project

The BLM received a BO from NMFS on November 16, 2011 on the New River Breaching Project (NMFS 2011, consultation number 2009/05787). The project is located in Curry County in southern Oregon. The BLM allows breaching New River across the foredune to the ocean on BLM land between the New Lake outlet and the Croft Lake outlet. The breach could occur annually depending on storm events and flooding.

The NMFS concluded that the effects determination for Southern DPS green sturgeon designated CH was NLAA. The supporting rationale was that the effects to southern DPS green sturgeon CH from stranding on the floodplain, loss of forage opportunities on the floodplain, flushing to the sea, and improved stream habitat will be discountable because they will not be exposed. Southern DPS green sturgeon CH does not overlap in space with these effects. In addition, NMFS concluded that effects from loss of forage opportunities in the ocean will be insignificant on Southern DPS green sturgeon CH because: (1) Benthic organisms in the affected area of the ocean are adapted to a disturbance-based ecosystem, such that not all of them will perish; (2) recolonization of benthic organisms will be rapid; and, (3) the action area is small compared to the available surrounding habitat for these forage species in the Pacific Ocean.

h. Recreation and Visitors Services

Table 217 displays the PCE for Southern DPS Green Sturgeon that apply to the ESA action area, and summarizes the effects of the Recreation and Visitors Services program. This effect

analysis is for the use of the concrete BLM boat ramp at the North Spit of Coos Bay. The greatest level of effect to any PCE is insignificant negative (migratory corridors and water quality in estuarine areas) Consequently, the overall effect determination for Southern DPS green sturgeon designated CH is "May Affect, Not Likely to Aversely Affect."

Table 217. PCE of critical habitat for Southern DPS green sturgeon applicable to the ESA action area and summary of the effects of the Recreation and Visitors Services program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Freshwater riverine system	Food resources	No effect
	Migratory corridor	No effect
	Sediment quality	No effect
	Substrate type or size	No effect
	Water depth	No effect
	Water flow	No effect
	Water quality	No effect
Estuarine areas	Food resources	No effect
	Migratory corridor	Insignificant negative. Noise from boat motors would result in insignificant effects to the migratory corridor/estuary areas PCE.
	Sediment quality	No effect
	Water depth	No effect
	Water flow	No effect
	Water quality	Insignificant negative effect from petroleum products: boat motor fuel leakage and lubricants

i. Special Forest Products

Table 218 displays the PCE for Southern DPS Green Sturgeon that apply to the ESA action area, and summarizes the effects of the Special Forest Products program.

Table 218. PCE of critical habitat for Southern DPS green sturgeon applicable to the ESA action area and summary of the effects of the Special Forest Products program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Freshwater riverine system	Food resources	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable effect to the production of macroinvertebrates, and other food sources higher on the food chain for sturgeon that are dependent upon macroinvertebrates.
	Migratory corridor	No effect. There is no causal mechanism to affect fish passage.
	Sediment quality	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable effect to sediment quality.
	Substrate type or size	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from special forest product activities would not result in a measurable effect to sediment quality.
	Water depth	No effect. There is no causal mechanism to affect water depth.
	Water flow	No effect. The activity would not add or remove roads, create other flow-concentrating paths to stream channels, or remove vegetation or forest cover at a scale that would affect peak or base flows.
	Water quality	Insignificant negative. The very small amount of sediment delivery to stream channels, if any, from special forest products activities would not result in a measurable increase in turbidity. Any accidental fuel spills would be in a very small amount; likely a fraction of a gallon. The likelihood that it would reach the stream channel and cause a meaningfully measurable effect to water quality is extremely low (discountable). There is no causal mechanism to introduce nutrients to stream flows (no effect).
Estuarine areas	Food resources	No effect
	Migratory corridor	No effect.
	Sediment quality	No effect.
	Water depth	No effect.
	Water flow	No effect.
	Water quality	No effect.

j. Sustainable Energy

Table 219 displays the PCE for Southern DPS Green Sturgeon that apply to the ESA action area, and summarizes the effects of the Sustainable Energy program. Note that the effect analysis is based upon the gathering and transportation of slash from Forest Management activities that provides fuel for biomass energy plants. Adverse effects are attributed to winter haul.

Table 219. PCE of critical habitat for Southern DPS green sturgeon applicable to the ESA action area and summary of the effects of the Sustainable Energy program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Freshwater riverine system	Food resources	Adverse. Short-term, localized increases in fine sediments in substrate will result in a measurable effect to the production of macroinvertebrates, and other food sources for sturgeon higher on the food chain that are dependent upon macroinvertebrates.
	Migratory corridor	No effect. There is no causal mechanism to affect fish passage.
	Sediment quality	Adverse. Short-term, localized effects to sediment quality would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Substrate type or size	Adverse. Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water depth	No effect. There is no causal mechanism to affect water depth.
	Water flow	No effect. There is no causal mechanism to affect the PCE.
	Water quality	Adverse. It is a result of short-term, localized increases in turbidity.
Estuarine areas	Food resources	No effect
	Migratory corridor	No effect.
	Sediment quality	No effect.
	Water depth	No effect.
	Water flow	No effect.
	Water quality	No effect.

k.

Trails and Travel Management

Table 220 displays the PCE for Southern DPS Green Sturgeon that apply to the ESA action area, and summarizes the effects of the Trails and Travel Management program. This analysis is informed by the analysis for the effects to habitat indicators presented above in V.A of this chapter. It is also informed by the PCE effects analysis of the NMFS programmatic biological opinion that addressed the category "*Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use.*" It addressed the effects of the maintenance and use of hiking and public motorized travel trails. The PCE analysis for effects of new road construction, maintenance and decommissioning is included in the overall effects of the Forest Management Program, located above in section V.B.5.d.

Table 220. PCE of critical habitat for Southern DPS green sturgeon applicable to the ESA action area and summary of the effects of the Trails and Travel Management program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Freshwater riverine system	Food resources	Adverse. Short-term, localized increases in fine sediments in substrate will result in a measurable effect to the production of macroinvertebrates, and other food sources for sturgeon higher on the food chain that are dependent upon macroinvertebrates.
	Migratory corridor	No effect. There is no causal mechanism to affect fish passage.
	Sediment quality	Adverse. Short-term, localized effects to sediment quality would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Substrate type or size	Adverse. Short-term, localized effects to substrate would occur as a result of fine sediment in interstitial spaces between substrate particles.
	Water depth	No effect. There is no causal mechanism to affect water depth.
	Water flow	Insignificant negative. Trails may concentrate flows for short distances that deliver to stream channels, but it is unlikely to result in meaningfully measured increases in peak flows in areas where there is designated CH. Base flows are not affected by the action.
	Water quality	Adverse. There would be short-term, localized increases in turbidity. Chemical contamination may occur at small stream segments where treated wood Is used at trail crossings. There may be localized increases in water temperature at a few stream crossings where shade vegetation has been removed by extensive use.
Estuarine areas	Food resources	No effect
	Migratory corridor	No effect.
	Sediment quality	No effect.
	Water depth	No effect.
	Water flow	No effect.

	Water quality	No effect.

6. Southern DPS Pacific eulachon

There is very limited BLM land adjacent to Southern DPS Pacific eulachon designated CH. There are only 0.12 miles of designated CH adjacent to BLM land. There are three locations and each is adjacent to a BLM recreation area: 1) Dean Creek day use and elk viewing site is located on the south bank of the lower Umpqua River and is located approximately 400 feet from designated CH; 2) The Spruce Reach Island has a garden for public viewing and is located on the north bank of the Lower Umpqua River. The remainder of BLM land on that site is occupied marbled murrelet habitat; and, 3) BLM land is part of the Oxbow Park recreation site on the Sandy River, at the extreme upper limit of designated CH. The next nearest BLM land ownership is more than one mile upstream from that site on the Sandy River.

a. New River Breaching Project

The BLM received a BO/LOC from NMFS on November 16, 2011 on the New River Breaching Project (NMFS 2011, consultation number 2009/05787). The project is located in Curry County in southern Oregon. The BLM allows breaching New River across the foredune to the ocean on BLM land between the New Lake outlet and the Croft Lake outlet. The breach could occur annually depending on storm events and flooding.

The NMFS concluded that the effects determination for Southern DPS Pacific eulachon designated CH was NLAA. The New River estuary is not designated CH for the species. The supporting rationale was that the effects to Southern DPS Pacific eulachon designated CH from stranding on the floodplain, loss of forage opportunities on the floodplain, and improved stream habitat will be insignificant because: (1) Most of the effects occur prior to February (before the peak migration and spawning period); (2) eulachon upstream migration peaks between February and March; (3) southern eulachon do not use the floodplain for forage; and (4) southern eulachon only migrate through the area flooded, they do not reside there.

The effects from loss of forage opportunities in the ocean will be insignificant because eulachon feed on phytoplankton and zooplankton that will not be affected by the breach.

b. Minerals

Table 221 displays the PCE for Southern DPS eulachon that apply to the ESA action area, and summarizes the effects of the proposed action. The only effect to Southern DPS Pacific eulachon designated CH from the Minerals program would be from methymercury in zooplankton and phytoplankton that are food items in estuary environments. It would be a result of legacy mercury mobilized from deep streambed sediment by suction gold dredge mining.

This is a very conservative effect determination because the following is unknown:

- How much elemental mercury reaches estuary areas as a result of suction dredge mining on BLM land
- How much of that becomes methylmercury
- The degree to which it enters the food chain
- There is no information on methylmercury levels in the tissues of Southern DPS Pacific eulachon taken from individuals of the species in the potentially affected estuaries in Oregon

Table 221. PCE of critical habitat for Southern DPS Pacific eulachon applicable to the ESA action area and summary of the effects of the proposed action.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	**Site Attribute**	
Freshwater spawning and incubation	Flow	No effect.
	Water quality	No effect.
	Water temperature	No effect.
	Substrate	No effect.
Freshwater migration	Flow	No effect.
	Water quality	No effect.
	Water temperature	No effect.
	Food	Measurable negative (adverse). Methymercury bioaccumulation in zooplankton and phytoplankton in the estuary negatively affects the PCE.

c. Recreation and Visitors Services

Table 222 displays the PCE for Southern DPS Pacific eulachon that apply to the ESA action area, and summarizes the effects of the Recreation and Visitors Services program. Note that the effects described below are for BLM land managed for recreation at the upstream limit of Pacific eulachon designated CH in the Sandy River.

Table 222. PCE of critical habitat for Southern DPS eulachon applicable to the ESA action area and summary of the effects of the Recreation and Visitors Services program.

Primary Constituent Elements		Effect of the Proposed Action (most impacting)
Site Type	Site Attribute	
Freshwater spawning and incubation	Flow	No effect.
	Water quality	Insignificant negative. There may be a very small amount of erosion at the recreation sites that would result in suspended sediment, but it would not measurably affect water quality during the winter when eulachon are present.
	Water temperature	No effect.
	Substrate	Insignificant negative. There may be a very small amount of erosion at the recreation sites that would result in fine sediment on the streambed, but it would not measurably affect the PCE during the winter when eulachon are present.
Freshwater migration	Flow	No effect.
	Water quality	Insignificant negative. There may be a very small amount of erosion at the recreation sites that would result in suspended sediment, but it would not measurably affect water quality during the winter when eulachon are present.
	Water temperature	No effect.
	Food	Insignificant negative. There may be a very small amount of erosion at the recreation sites that would result in fine sediment on the streambed, but it would not measurably affect the PCE during the winter when eulachon are present.

7. Summary of the analyses of PCEs of designated CH by PRMP program

The potential effects to each PCE of designated CH for species (or groups of species with similar PCEs) by an action of a PRMP program are summarized in Table 223 to Table 228. Please read the effects analyses immediately preceding this summary for details regarding the effects by PCE for each program. Note that the effects shown in the table reflect the most impacting effect. Different elements of an action may have a range of effects to a PCE, ranging from no effect, a discountable or insignificant effect, or an adverse affect.

The adverse effects displayed in Table 223 to Table 228 reflect a sub-set of actions under each program. Depending upon the site-specific proximity to designated CH, and the exposure of that designated CH to the potential effects of an action, the effects for an entire action may be less than adverse. The footnotes to each table provide details on exactly what aspects of the program were evaluated for the effects that are represented in each table.

Note that effects to bull trout spawning PCEs were not analyzed. The USFWS has typed bull trout critical habitat associated with BLM lands in the McKenzie River basin as “Foraging,

Migration and Overwintering" or FMO habitat. There is no spawning and rearing habitat. A conversation with Paul Bridges, USFWS biologist (Bridges pers. comm. 2015) suggests evaluating the rearing and migratory PCEs in the context of FMO use. That is the approach taken in the table below. That is the approach taken in Table 225.

Table 223. Summary of effects to PCEs of designated CH by PRMP program for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead and OC Coho Salmon.

PRMP Program	Effects to PCEs **A** = adverse, D = discountable, I = insignificant, NE = no effect.											
	Freshwater Spawning			Freshwater Rearing					Freshwater Migration			
	Substrate	Water Quality	Water Quantity	Floodplain Connectivity	Forage	Natural Cover	Water Quality	Water Quantity	Free of Artificial Obstruction	Natural Cover	Water Quality	Water Quantity
1. Cultural Resources	I	I	D	N	C	I	I	D	N	I	I	D
2. Fire and Fuels	I	I	D	N	**A**	**A**	**A**	**A**	N	I	I	**A**
3. Fisheries[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
4. Forest Management	I	I	I	N	**A**	**A**	**A**	**A**	I	I	I	I
5. Hydrology[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**	**A**
6. Invasive species[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**	**A**
7. Lands and Realty[2]	I	I	I	**A**	**A**	**A**	**A**	I	N	I	I	I
8. Livestock grazing[3]	I	I	I	N	I	N	I	I	N	N	I	I
9. Minerals[4]	**A**	I	N	N	**A**	**A**	**A**	N	I	I	**A**	N
10. Paleontological Resources	I	I	D	N	I	I	I	D	N	I	I	D
11. Recreation & Visitors Services	I	**A**	I	I	**A**	**A**	**A**	I	N	**A**	**A**	I
12. Soil Resources[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**	**A**
13. Special Forest Products	I	I	N	N	I	I	I	N	N	I	I	N
14. Sustainable Energy[5]	I	I	N	N	**A**	**A**	**A**	N	N	I	I	N
15. Trails & Travel Management[6]	I	I	I	N	**A**	**A**	**A**	I	N	I	I	I
16. Wildlife[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**N**	**A**	**A**	**A**
17. Wild Horses[7]	-	-	-	-	-	-	-	-	-	-	-	-

[1]These programs only have restoration actions. Effects are interpreted from the PCE analysis of the programmatic BO known as ARBO II (NMFS 2013). Effects are short-term, and there are long-term benefits to many of the same PCEs.

[2]The PCE analysis summary is specifically for the case of a discretionary road right-of-way within a Riparian Reserve adjacent to a stream with designated CH. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (Lightcap, pers. comm. 2015).

[3]The only livestock grazing under the PRMP in the OC coho salmon ESU takes place under a Cooperative Management Agreement. It has undergone ESA consultation with NMFS concurrence on a NLAA effect determination. There were no adverse effects to any indicators in that consultation.

[4]The effects depicted for the Minerals program are for use of rock quarries (salable mineral) and for suction dredge gold mining (locatable mineral). Use of rock quarries was addressed in a programmatic consultation (USDA FS et al. 2010, NMFS 2011). The effects of approving NOI for suction gold dredge mining on the Rogue-Siskiyou NF was addressed in a BA (USDA FS 2015). The effects depicted in the table are a synthesis of the effects analyses for both types of minerals mining. The effects of the leasable minerals aspect of the Minerals program, or any other mining activity, was not evaluated because the range of possible actions is so large that it would be a speculative analysis and there are no proposals before the BLM at this time. Future minerals actions would require, when appropriate, NEPA analysis and Section 7 consultation.

[5]The effects of the Sustainable Energy program displayed in the table are for gathering and transporting residual slash from timber harvest to biomass energy plants. Other aspects of the Sustainable Energy program in the FEIS are: 1) how energy transmission Right-of-Way (ROW) avoidance and exclusion areas affect the potential siting of wind energy developments and sustainable energy corridor designations; and, 2) how leasable stipulations such as no surface occupancy would negatively affect, though not entirely preclude, the potential for geothermal development on BLM-administered lands. Neither of the last two aspects of the PRMP Sustainable Energy program have any causal mechanisms to affect any fish habitat characteristics or PCE of designated CH, nor are there any mechanisms to directly impact individual fish.

[6] This program includes three components: The road system; public motorized travel designations; and, the trail system. The construction of new roads, the maintenance of existing roads, and the closure of roads under the PRMP are largely connected to the Forest Management program. Because of that nexus, the effects of those activities are addressed in the Forest Management program PCE analysis of this BA.

[7]The Wild Horses program is located outside any of the Pacific salmon ESUs and DPSs in the Klamath River basin on lands administered by the BLM Klamath Falls Field Office. The affected designated CH is for shortnose sucker and Lost River sucker.

Table 224. Summary of effects to PCEs of designated CH by PRMP program for Southern Oregon / Northern California Coasts coho salmon.

PRMP Program	Effects to PCEs **A** = adverse, D = discountable, I = insignificant, NE = no effect.																	
	Spawning and juvenile rearing areas								Adult and juvenile migration corridors									
	Cover/shelter	Food (juvenile)	Riparian vegetation	Space	Spawning gravel	Water Quality	Water Quantity	Water temperature	Cover/shelter	Food (juvenile)	Riparian vegetation	Safe passage	Space	Substrate	Water Quality	Water Quantity	Water temperature	Water velocity
1. Cultural Resources	I	I	I	I	I	I	D	I	I	I	I	N	I	I	I	D	I	N
2. Fire and Fuels	**A**	**A**	I	**A**	I	**A**	**A**	I	I	**A**	I	N	I	I	I	**A**	I	D
3. Fisheries[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
4. Forest Management	**A**	**A**	I	**A**	I	**A**	**A**	D	I	**A**	I	I	I	I	I	**A**	D	D
5. Hydrology[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	N	**A**	**A**	**A**	**A**	**A**	**A**
6. Invasive species[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	N	**A**	**A**	**A**	**A**	**A**	**A**
7. Lands and Realty[2]	**A**	**A**	**A**	**A**	I	**A**	I	I	I	**A**	**A**	N	I	I	I	I	I	N
8. Livestock grazing	**A**	**A**	**A**	**A**	I	**A**	**A**	**A**	I	**A**	**A**	N	I	I	I	**A**	I	N
9. Minerals[3]	**A**	**A**	D	**A**	**A**	**A**	N	**A**	I	**A**	**A**	N	I	I	I	**A**	I	N
10. Paleontological Resources	I	I	I	I	I	I	D	I	I	I	I	N	I	I	I	D	I	N
11. Recreation & Visitors Services	**A**	**A**	**A**	**A**	I	**A**	I	**A**	**A**	**A**	**A**	N	I	I	**A**	I	**A**	N
12. Soil Resources[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	N	**A**	**A**	**A**	**A**	**A**	**A**
13. Special Forest Products	I	I	I	I	I	I	N	I	I	I	I	N	I	I	I	N	I	N
14. Sustainable Energy[4]	**A**	**A**	N	**A**	I	**A**	N	N	I	**A**	N	N	I	I	I	N	N	N
15. Trails & Travel Management[5]	**A**	**A**	I	**A**	I	**A**	I	**A**	I	**A**	I	N	I	I	I	I	I	N
16. Wildlife[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	N	**A**	**A**	**A**	**A**	**A**	**A**
17. Wild Horses[6]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[1]These programs only have restoration actions. Effects are interpreted from the PCE analysis of the programmatic BO known as ARBO II (NMFS 2013). Effects are short-term, and there are long-term benefits to many of the same PCEs.

[2]The PCE analysis summary is specifically for the case of a discretionary road right-of-way within a Riparian Reserve adjacent to a stream with designated CH. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (Lightcap, pers. comm. 2015).

[3]The effects depicted for the Minerals program is for use of rock quarries (salable mineral) and for suction dredge gold mining (locatable mineral). Use of rock quarries was addressed in a programmatic consultation (USDA FS et al. 2010, NMFS 2011). The effects of approving NOI for suction gold dredge mining on the Rogue-Siskiyou NF was addressed in a BA (USDA FS 2015). The effects depicted in the table are a synthesis of the effects analyses for both types of minerals mining. The effects of the leasable minerals aspect of the Minerals program, or any other mining activity, was not evaluated because the range of possible actions is so large that it would be a speculative analysis and there are no proposals before the BLM at this time. Future minerals actions would require, when appropriate, NEPA analysis and Section 7 consultation.

[4]The effects of the Sustainable Energy program displayed in the table are for gathering and transporting residual slash from timber harvest to biomass energy plants. Other aspects of the Sustainable Energy program in the FEIS are: 1) how energy transmission Right-of-Way (ROW) avoidance and exclusion areas affect the potential siting of wind energy developments and sustainable energy corridor designations; and, 2) how leasable stipulations such as no surface occupancy would negatively affect, though not entirely preclude, the potential for geothermal development on BLM-administered lands. Neither of the last two aspects of the PRMP Sustainable Energy program have any causal mechanisms to affect any fish habitat characteristics or PCE of designated CH, nor are there any mechanisms to directly impact individual fish.

[5]This program includes three components: The road system; public motorized travel designations; and, the trail system. The construction of new roads, the maintenance of existing roads, and the closure of roads under the PRMP are largely connected to the Forest Management program. Because of that nexus, the effects of those activities are addressed in the Forest Management program PCE analysis of this BA.

[6]The Wild Horses program is located outside of any of the Pacific salmon ESUs and DPSs in the Klamath River basin on lands administered by the BLM Klamath Falls Field Office. The affected designated CH is for shortnose sucker and Lost River sucker.

Table 225. Summary of effects to PCEs of designated CH by PRMP program for McKenzie River basin bull trout.

PRMP Program	Effects to PCEs **A** = adverse, D = discountable, I = insignificant, NE = no effect.							
	Rearing						Migration	Occurrence of non-native predatory fish species or competing fish species
	Complex aquatic environments and processes	Food base	Substrate	Water quality	Water Quantity	Natural hydrograph	Minimal physical, biological or water quality impediments	Low levels that if present, are adequately temporally and spatially isolated from bull trout
1. Cultural Resources	I	I	I	I	D	D	I	N
2. Fire and Fuels	I	**A**	**A**	**A**	I	D	I	N
3. Fisheries[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	N
4. Forest Management	I	**A**	**A**	**A**	I	I	I	N
5. Hydrology[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	N
6. Invasive species[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	N
7. Lands and Realty[2]	**A**	**A**	**A**	**A**	I	I	I	N
8. Livestock grazing[3]	-	-	-	-	-	-	-	N
9. Minerals[4]	I	I	I	I	I	I	I	N
10. Paleontological Resources	I	I	I	I	D	D	I	N
11. Recreation & Visitors Services	**A**	**A**	**A**	I	I	I	I	N
12. Soil Resources[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	N
13. Special Forest Products	I	I	I	I	N	N	I	N
14. Sustainable Energy[5]	N	**A**	**A**	**A**	N	N	I	N
15. Trails & Travel Management[6]	**A**	**A**	**A**	**A**	I	I	I	N
16. Wildlife[1]	**A**	**A**	**A**	**A**	**A**	**A**	**A**	N
17. Wild Horses[7]	-	-	-	-	-	-	-	N

[1]These programs only have restoration actions. Effects are interpreted from the PCE analysis of the programmatic BO known as ARBO II (USFWS 2013). Effects are short-term, and there are long-term benefits to many of the same PCEs.

[2]The PCE analysis summary is specifically for the case of a discretionary road right-of-way within a Riparian Reserve adjacent to a stream with designated CH. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (Lightcap, pers. comm. 2015).

[3]No livestock grazing occurs on BLM land in the McKenzie River basin. There will be no effect to bull trout PCEs in the McKenzie River basin by the Livestock Grazing program.

[3]The effects depicted for the Minerals program are for use of rock quarries (salable mineral). There are no mining claims on BLM land in the McKenzie River basin according to a search of a BLM GIS layer. Eugene BLM District Fish biologist Brett Blundon states that he has not seen any suction dredges in the mainstem McKenzie River that has the only bull trout designated CH in the basin (Blundon, pers. comm. 2015). Consequently, there are no effects to the PCEs of bull trout designated CH from suction dredge gold mining in the McKenzie River basin. The effects of the leasable minerals aspect of the Minerals program, or any other mining activity, was not evaluated because the range of possible actions is so large that it would be a speculative analysis and there are no proposals before the BLM at this time. Future minerals actions would require, when appropriate, NEPA analysis and Section 7 consultation.

[4]The USFWS issued an amendment to their 2008 programmatic BO in 2011 to address effects to bull trout designated CH (USFWS 2011, tracking number 11-307). The effect determination was NLAA for the category of *Road Maintenance and Storm Proofing* that included the use of rock quarries. The analysis in the original BO did not split out effects to the habitat indicators for the use of rock quarries nested within the effects of the rest of the Road Maintenance and Storm Proofing category. Consequently, the BLM cannot identify which PCEs may be affected. However, because the effect determination was NLAA, it follows that there are no effects to PCEs that exceed an insignificant level.

[5]The effects of the Sustainable Energy program displayed in the table are for gathering and transporting residual slash from timber harvest to biomass energy plants. Other aspects of the Sustainable Energy program in the FEIS are: 1) how energy transmission Right-of-Way (ROW) avoidance and exclusion areas affect the potential siting of wind energy developments and sustainable energy corridor designations; and, 2) how leasable stipulations such as no surface occupancy would negatively affect, though not entirely preclude, the potential for geothermal development on BLM-administered lands. Neither of the last two aspects of the PRMP Sustainable Energy program have any causal mechanisms to affect any fish habitat characteristics or PCE of designated CH, nor are there any mechanisms to directly impact individual fish.

[6]The Trails and Travel Management program includes three components: The road system; public motorized travel designations; and, the trail system. The construction of new roads, the maintenance of existing roads, and the closure of roads under the PRMP are largely connected to the Forest Management program. Because of that nexus, the effects of those activities are addressed in the Forest Management program PCE analysis of this BA.

[7] The Wild Horses program is located in the Klamath River basin on lands administered by the BLM Klamath Falls Field Office. The affected designated CH is for shortnose sucker and Lost River sucker.

Table 226. Summary of effects to PCEs of designated CH by PRMP program for Lost River and shortnose sucker.

PRMP Program		Effects to PCEs **A** = adverse, D = discountable, I = insignificant, NE = no effect.									
		Spawning			**Rearing**						**Connectivity**
		Substrate	**Water quality and depth**	**Stream velocity**	**Emergent vegetation adjacent to open water areas**	**Forage base**	**Substrate**	**Water quality**	**Water quantity and depth**	**Natural flow regimes**	**Minimal physical, biological or water quality impediments**
1. Cultural Resources		I	I	N	N	I	I	I	D	D	N
2. Fire and Fuels		D	I	D	I	**A**	I	I	**A**	D	I
3. Fisheries[1]		**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
4. Forest Management		D	I	N	N	**A**	I	I	**A**	I	I
5. Hydrology[1]		**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
6. Invasive species[1]		**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
7. Lands and Realty[2]		D	I	N	N	**A**	I	I	I	I	I
8. Livestock grazing	Lost River sucker	I	I	N	D	N	I	I	D	I	I
	shortnose sucker	**A**	I	N	**A**	I	I	I	**A**	**A**	I
9. Minerals[3]		-	-	-	-	-	-	-	-	-	-
10. Paleontological Resources		I	I	N	N	I	I	I	D	D	N
11. Recreation & Visitors Services		D	**A**	N	I	**A**	I	I	I	I	I
12. Soil Resources[1]		**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
13. Special Forest Products		I	I	N	I	I	I	I	I	N	N
14. Sustainable Energy[5]		I	**A**	N	N	**A**	**A**	**A**	D	D	I
15. Trails & Travel Management[6]		D	I	N	N	**A**	I	**A**	I	I	**A**
16. Wildlife[1]		**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
17. Wild Horses		I	I	N	I	I	I	I	I	D	I

[1]These programs only have restoration actions. Effects are interpreted from the PCE analysis of the programmatic BO known as ARBO II (USFWS 2013). Effects are short-term, and there are long-term benefits to many of the same PCEs.

[2]The PCE analysis summary is specifically for the case of a discretionary road right-of-way within a Riparian Reserve adjacent to a stream with designated CH. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (Lightcap, pers. comm. 2015).

[3]There are no mining claims on BLM land in waters with Lost River sucker of shortnose sucker designated CH within the planning area according to a search of a BLM GIS layer. The BLM Klamath Falls Resource Area Fish Biologist Rob Roninger states that he has not seen any suction dredge mining in any Lost River sucker or shortnose sucker designated CH (Roninger, pers. comm. 2015). There are no BLM rock quarries that drain to critical habitat for either sucker species. The BLM concludes that there is no effect to the PCE of designated CH for either sucker species from use of rock quarries or from suction dredge gold mining. The effects of the leasable minerals aspect of the Minerals program, or any other mining activity, was not evaluated because the range of possible actions is so large that it would be a speculative analysis and there are no proposals before the BLM at this time. Future minerals actions would require, when appropriate, NEPA analysis and Section 7 consultation.

[4]The USFWS issued an amendment to their 2008 programmatic BO in 2011 to address effects to bull trout designated CH (USFWS 2011, tracking number 11-307). The effect determination was NLAA for the category of *Road Maintenance and Storm Proofing* that included the use of rock quarries. The analysis in the original BO did not split out effects to the habitat indicators for the use of rock quarries nested within the effects of the rest of the Road Maintenance and Storm Proofing category. Consequently, the BLM cannot identify which PCEs may be affected. However, because the effect determination was NLAA, it follows that there are no effects to PCEs that exceed an insignificant level.

[5]The effects of the Sustainable Energy program displayed in the table are for gathering and transporting residual slash from timber harvest to biomass energy plants. Other aspects of the Sustainable Energy program in the FEIS are: 1) how energy transmission Right-of-Way (ROW) avoidance and exclusion areas affect the potential siting of wind energy developments and sustainable energy corridor designations; and, 2) how leasable stipulations such as no surface occupancy would negatively affect, though not entirely preclude, the potential for geothermal development on BLM-administered lands. Neither of the last two aspects of the PRMP Sustainable Energy program have any causal mechanisms to affect any fish habitat characteristics or PCE of designated CH, nor are there any mechanisms to directly impact individual fish.

[6]The Trails and Travel Management program includes three components: The road system; public motorized travel designations; and, the trail system. The construction of new roads, the maintenance of existing roads, and the closure of roads under the PRMP are largely connected to the Forest Management program. Because of that nexus, the effects of those activities are addressed in the Forest Management program PCE analysis of this BA.

BLM land ownership is extremely limited in proximity to designated CH for Southern DPS green sturgeon within the planning area. Implementing the set of PRMP programs displayed in **Table 227** below "may affect" the designated CH.

Table 227. Summary of effects to PCEs of designated CH by PRMP program for Southern DPS green sturgeon.

PRMP Program	Effects to PCEs **A** = adverse, D = discountable, I = insignificant, NE = no effect.												
	Freshwater Riverine System							Estuarine Areas					
	Food Resources	**Migratory corridor**	**Sediment quality**	**Substrate type or size**	**Water depth**	**Water flow**	**Water quality**	**Food Resources**	**Migratory corridor**	**Sediment quality**	**Water depth**	**Water flow**	**Water quality**
1. Cultural Resources	I	N	I	I	N	D	I	N	N	N	N	N	N
2. Fire and Fuels	**A**	N	**A**	**A**	N	**A**	**A**	N	N	N	N	N	N
3. Fisheries[1]	I	N	I	I	N	N	I	I	N	I	N	N	I
4. Forest Management[2]	**A**	N	**A**	**A**	N	**A**	**A**	N	N	N	N	N	N
5. Hydrology[1]	I	N	I	I	N	N	I	I	N	I	N	N	I
6. Invasive species[1]	I	N	I	I	N	N	I	I	N	I	N	N	I
7. Lands and Realty[3]	**A**	N	**A**	**A**	N	I	**A**	N	N	N	N	N	N
8. Livestock grazing[4]	N	N	N	N	N	N	N	N	N	N	N	N	N
9. Minerals[5]	N	N	N	N	N	N	N	**A**	N	**A**	N	N	N
10. Paleontological Resources	I	N	I	I	N	D	I	N	N	N	N	N	N
11. Recreation & Visitors Services[6]	N	N	N	N	N	N	N	N	I	N	N	N	I
12. Soil Resources[1]	I	N	I	I	N	N	I	I	N	I	N	N	I
13. Special Forest Products	I	N	I	I	N	N	I	N	N	N	N	N	N
14. Sustainable Energy[7]	**A**	N	**A**	**A**	N	D	**A**	N	N	N	N	N	N
15. Trails & Travel Management[8]	**A**	N	**A**	**A**	N	I	**A**	N	N	N	N	N	N
16. Wildlife[1]	I	N	I	I	N	N	I	I	N	I	N	N	I
17. Wild Horses[9]	N	N	N	N	N	N	N	N	N	N	N	N	N

[1]These programs only have restoration actions. Effects are interpreted from the PCE analysis of the programmatic BO known as ARBO II (NMFS 2013). The NMFS ARBO II (NMFS 2013) concluded that the effect determination for restoration activities was NLAA for Southern DPS green sturgeon designated CH. The effects to individual PCE from those programs are based upon the NLAA effect determination in ARBO II.

[2] There are two BLM parcels with Harvest Land Base acres that may affect green sturgeon CH. See analysis above for effects to PCE of designated CH from the Forest Management program to Southern DPS green sturgeon for details.

[3]The PCE analysis summary is specifically for the case of a discretionary road right-of-way within a Riparian Reserve adjacent to a stream with designated CH. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (Lightcap, pers. comm. 2015).

[4]No livestock grazing occurs on BLM within miles of Southern DPS green sturgeon designated CH.

[5]The effects depicted for the Minerals program is for use of rock quarries (salable mineral) and for suction dredge gold mining (locatable mineral). Use of rock quarries was addressed in a programmatic consultation (USDA FS et al. 2010, NMFS 2011). The effects of approving NOI for suction gold dredge mining on the Rogue-Siskiyou NF was addressed in a BA (USDA FS 2015). The effects depicted in the table are a synthesis of the effects analyses for both types of minerals mining. The effects of the leasable minerals aspect of the Minerals program, or any other mining activity, was not evaluated because the range of possible actions is so large that it would be a speculative analysis and there are no proposals before the BLM at this time. Future minerals actions would require, when appropriate, NEPA analysis and Section 7 consultation.

[6]The summary for the Recreation and Visitors Services Program is based upon use of the North Spit boat ramp at the entrance to Coos Bay.

[7]The effects of the Sustainable Energy program displayed in the table are for gathering and transporting residual slash from timber harvest to biomass energy plants. Adverse effects are for winter haul only. Other aspects of the Sustainable Energy program in the FEIS are: 1) how energy transmission Right-of-Way (ROW) avoidance and exclusion areas affect the potential siting of wind energy developments and sustainable energy corridor designations; and, 2) how leasable stipulations such as no surface occupancy would negatively affect, though not entirely preclude, the potential for geothermal development on BLM-administered lands. Neither of the last two aspects of the PRMP Sustainable Energy program have any causal mechanisms to affect any fish habitat characteristics or PCE of designated CH, nor are there any mechanisms to directly impact individual fish.

[8]The Trails and Travel Management program includes three components: The road system; public motorized travel designations; and, the trail system. The construction of new roads, the maintenance of existing roads, and the closure of roads under the PRMP are largely connected to the Forest Management program. Because of that nexus, the effects of those activities are addressed in the Forest Management program PCE analysis of this BA.

[9]The Wild Horses program is located in the Klamath River basin on lands administered by the BLM Klamath Falls Field Office. The affected designated CH is for shortnose sucker and Lost River sucker.

BLM land ownership is extremely limited in proximity to designated CH for Southern DPS Pacific eulachon within the planning area. Implementing the set of PRMP programs displayed in **Table 228** below "may affect" the designated CH. One aspect of eulachon life history that limits exposure of the PCEs to the effects of BLM activities is their residence time in rivers. The timing of their spawning run in the Sandy River is typically late winter for a period of days to a few weeks. After hatching, larvae are carried downstream into the Columbia River and widely dispersed by estuarine and ocean currents. The adverse effect for the Minerals program is attributed to exposure of methylmercury in river estuaries downstream from suction dredge gold mining in southern Oregon. The effects of the Recreation program are attributed to activities on BLM land at the Oxbow Park recreation facility on the Sandy River.

Table 228. Summary of effects to PCEs of designated CH by PRMP program for Southern DPS Pacific Eulachon.

PRMP Program	**Effects to PCEs** **A** = adverse, D = discountable, I = insignificant, NE = no effect.							
	Freshwater Spawning and Incubation				Freshwater Migration			
	Flow	Water Quality	Water Temperature	Substrate	Flow	Water Quality	Water Temperature	Substrate
1. Minerals	N	N	N	N	N	N	N	**A**
2. Recreation & Visitors Services	N	I	N	I	N	I	N	I

C. Effects to Limiting Factors

The effects of the action to limiting factors for ESA-listed fish species identified in recovery plans and other documents are assessed. This analysis is based upon the effects to habitat indicators summarized in **Table 171**, and to the PCEs of critical habitat summarized in Table 214 to Table 219.

1. Lower Columbia River Chinook salmon, Lower Columbia River coho salmon and Lower Columbia River steelhead.

The limiting factors (LF) for the three species are displayed in Table 20, located in section 3.A.1 (Status of the Species) and are from NMFS (2013a). The effects of implementing the PRMP to tributary LF are assessed in Table 229. There will be no effect to LF for the Columbia River estuary, hydropower, harvest, hatchery or predation categories by implementing the PRMP.

Table 229. Effects to tributary habitat limiting factors for Lower Columbia River Chinook salmon, coho salmon and steelhead.

Limiting Factor Category	Analysis
Habitat Quantity (Small Dams)	This LF is only for LCR coho salmon. There would be no effect to the limiting factor. The proposed action would not create or remove dams.
Riparian Condition	A sub-set of actions would adversely affect riparian vegetation conditions. Those with short-term adverse effects and long-term beneficial effects include Fire and Fuels, Forest Management (riparian thinning) and Invasive Species (removing invasive plants including treating for sudden oak death). Construction of permanent roads, hiking trails and public motorized travel trails within riparian areas would have long-term adverse effects, but such construction would be minimized by Management Direction. Growth of trees in Riparian Reserves within one site potential tree height of streams over a 100 year period under the PRMP is projected to lead to about 94 percent of the stands being in the Mature & Structurally Complex successional stages (Table 140).
Channel Structure and Form	Instream fish habitat restoration projects may have a short-term adverse effect with long-term beneficial effects to the LF. Tree-tipping associated with Forest Management thinning projects may have a beneficial effect to channel structure and form. Otherwise, channel structure and form would be protected by the Riparian Reserve designation and its management direction.
Side Channel and Wetland Conditions	As above for the Channel Structure and Form LF.
Floodplain Conditions	Activities within Riparian Reserves may occur within floodplains for several programs. However, very limited actions would occur within the

	inner zones. Short-term adverse effects to floodplain connectivity were identified for a sub-set of habitat restoration projects and for possible discretionary right-of-way road construction for the Lands and Realty program. There may be short-term adverse effects to the reducing sedimentation, and filtering nutrients and impurities from runoff floodplain functions as a result of a subset of activities for the Fire and Fuels program. There would be insignificant effects to the following floodplain functions from implementing the PRMP: flood storage and conveyance, reducing flood velocities, reducing flood peaks, processing organic waste and moderating water temperatures.
Sediment Conditions	There would be short-term adverse effects to the LF as a result of fine sediments on stream substrates for a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Minerals, Recreation and Visitors Services, Sustainable energy (for winter haul of biomass only) and the Trails & Travel Management program. There would be long-term benefits from road decommissioning projects.
Water Quality (Temperature)	There may be localized increases in water temperature as a result of implementing a sub-set of actions for the following PRMP programs: Fire and Fuels (short-term from use of pump chances) and Recreation and Visitors Services (from trampling and growth suppression of shade vegetation at recreation sites).
Water Quantity (Flow)	Water quantity may be measurably decreased in the short-term by use of pump chances. Summer base flow may increase for a few years in small catchments after timber harvest. The risk of an increase in measurable peak flow is no greater than insignificant for any PRMP program, including Forest Management.
Toxic Contaminants	This LF is only for LCR steelhead. The following programs would have a sub-set of actions that may have a short-term adverse effect to the LF: Forest Management (petroleum products form heavy equipment replacing culverts), Invasive Plant Control (chemical treatnents) and Recreation & Visitors Services (use of treated wood under certain conditions).

2. Upper Willamette River Chinook salmon and Upper Willamette River steelhead

The limiting factors (LF) for both species are discussed in section 3.A.1 (Status of the Species) and are from ODFW and NMFS (2011). The effects of implementing the PRMP to the LF are assessed in Table 230.

Table 230. Effects to limiting factors for Upper Willamette River Chinook salmon and steelhead.

Limiting Factor Category	Analysis
Degraded freshwater habitat, including floodplain connectivity and function, channel structure and complexity, riparian areas, and large wood recruitment	Floodplain connectivity and function. Activities within Riparian Reserves may occur within floodplains for several programs. However, very limited actions would occur within the inner zones. Short-term adverse effects to floodplain connectivity were identified for a sub-set of habitat restoration projects and for possible discretionary right-of-way road construction for the Lands and Realty program. There may be short-term adverse effects to the reducing sedimentation, and filtering nutrients and impurities from runoff floodplain functions as a result of a subset of activities for the Fire and Fuels program. There would be insignificant effects to the following floodplain functions from implementing the PRMP: flood storage and conveyance, reducing flood velocities, reducing flood peaks, processing organic waste and moderating water temperatures. Channel structure and complexity. Instream fish habitat restoration projects may have a short-term adverse effect with long-term beneficial effects to the LF. Tree-tipping associated with Forest Management thinning projects may have a beneficial effect to channel structure and form. Otherwise, channel structure and complexity would be protected by the Riparian Reserve designation and its management direction. Riparian areas. A sub-set of actions would adversely affect riparian vegetation conditions. Those with short-term adverse effects and long-term beneficial effects include Fire and Fuels, Forest Management (riparian thinning) and Invasive Species (removing invasive plants including treating for sudden oak death). Construction of permanent roads, hiking trails and public motorized travel trails within riparian areas would have long-term adverse effects, but such construction would be minimized by Management Direction. Growth of trees in Riparian Reserves within one site potential tree height of streams over a 100 year period under the PRMP is projected to lead to about 94 percent of the stands being in the Mature & Structurally Complex successional stages (Table 140). Large wood recruitment. There would be a beneficial effect to the LF in the short and long-term under the PRMP within habitat occupied by UWR Chinook and UWR steelhead. This is a result of the tree-tipping requirement, the lack of impact to existing trees in the RR outer zone that would qualify at the time of thinning as LWD, the accelerated growth of trees in the RR outer zone after thinning into the LWD category, natural growth of trees in the RR over the next 100 years into the Mature and Structurally complex successional stages (Table 140), and instream large wood placement for habitat restoration projects. Streambed sediment. There would be short-term adverse effects to the LF as a result of fine sediments on stream substrates for a sub-set of habitat

	restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Minerals, Recreation and Visitors Services, Sustainable energy (for winter haul of biomass only) and the Trails & Travel Management program. There would be long-term benefits from road decommissioning projects.
Degraded water quality including elevated water temperature and toxins	There may be localized increases in water temperature as a result of implementing a sub-set of actions for the following PRMP programs: Fire and Fuels (short-term from use of pump chances) and Recreation and Visitors Services (from trampling and growth suppression of shade vegetation at recreation sites). Short-term increases in turbidity may occur as a result of a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Minerals, Recreation and Visitors Services, Sustainable energy (for winter haul of biomass only) and the Trails & Travel Management program. The following programs would have a sub-set of actions that may have a short-term adverse effect to the LF: Forest Management (petroleum products form heavy equipment replacing culverts), Invasive Plant Control (chemical treatnents) and Recreation & Visitors Services (use of treated wood under certain conditions).
Increased disease incidence	The only causal mechanism of the proposed action that may affect the LF would be caused by stress from increased water temperatures. But this would occur only at a very limited number of localized sites. Fish at those sites may move to seek thermal refuges and avoid the metabolic stress that would reduce disease resistance. At the scale of the ESU and DPS, the effect to the LF is insignificant.
Altered stream flows	Water quantity may be measurably decreased by use of in the short-term by use of pump chances. Summer base flow may increase for a few years in small catchments after timber harvest. The risk of an increase in measurable peak flow is no greater than insignificant for any PRMP program, including Forest Management.
Reduced access to spawning and rearing habitats	There would be a beneficial effect to the LF when culverts that are partial barriers are replaced.
Altered food web due to reduced inputs of microdetritus	Near stream vegetation that would provide microdetritus would be largely unaffected by management activities under the PRMP. There would be a discountable effect to the LF.
Predation by native and non-native species, including hatchery fish	There is no causal mechanism of the proposed action to affect the LF.
Competition related to	Water quantity may be measurably decreased in the short-term by use of

introduced races of salmon and steelhead	pump chances. Summer base flow may increase for a few years in small catchments after timber harvest. The risk of an increase in measurable peak flow is no greater than insignificant for any PRMP program, including Forest Management.
Altered population traits due to fisheries and by-catch	This LF is only for LCR steelhead. The following programs would have sub-set of actions that may have a short-term adverse effect to the LF: Forest Management (petroleum products form heavy equipment replacing culverts), Invasive Plant Control (chemical treatnents) and Recreation & Visitors Services (use of treated wood under certain conditions).

3. Oregon Coast coho salmon

The limiting factors (LF) information for OC coho salmon in section 3.A.1 (Status of the Species) explains that LF at the species scale can be gleaned from the discussion of factors for decline and threats in Stout *et al.* (2012). Also, the state of Oregon provided "population bottlenecks" (*i.e.*, LF at the population scale) in its coastal coho assessment (State of Oregon 2005). The effects of implementing the PRMP to OC coho salmon LF based upon these two sources are evaluated in Table 231.

Table 231. Effects to limiting factors for Oregon Coast coho salmon.

Limiting Factor Category	Analysis
Degraded stream complexity	Instream fish habitat restoration projects may have a short-term adverse effect with long-term beneficial effects to the LF. Tree-tipping associated with Forest Management thinning projects may have a beneficial effect. Otherwise, stream complexity would be protected by the Riparian Reserve designation and its management direction.
Reduced recruitment of wood to streams	There would be a beneficial effect to wood recruitment into streams in the short and long-term under the PRMP within habitat occupied by OC coho salmon. This is a result of the tree-tipping requirement, the lack of impact to existing trees in the RR outer zone that would qualify at the time of thinning as LWD, the accelerated growth of trees in the RR outer zone after thinning into the LWD category, natural growth of trees in the RR over the next 100 years into the Mature and Structurally complex successional stages (Table 140), and instream large wood placement for habitat restoration projects.
Increased fine substrate sediment	There would be short-term adverse effects to the LF as a result of fine sediments on stream substrates for a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Minerals, Recreation and Visitors Services, Sustainable energy (for winter haul of biomass only) and the Trails & Travel Management program. There would be long-term benefits from road decommissioning projects.
Loss of beaver dams	There is no causal mechanism of the proposed action to affect the LF.

Increased water temperature	There may be localized increases in water temperature as a result of implementing a sub-set of actions for the following PRMP programs: Fire and Fuels (short-term from use of pump chances) and Recreation and Visitors Services (from trampling and growth suppression of shade vegetation at recreation sites).
Reduced stream flow	Water quantity may be measurably decreased in the short-term by use of pump chances.
Human disturbance of the landscape	There will be human disturbance of the landscape by implementing the PRMP. Effects to ESA-listed OC coho salmon and its designated CH would be minimized by implementation of Management Direction and BMPs.
Loss of wetlands and estuarine habitat	Implementing the PRMP would not reduce wetlands or estuarine habitat.
Fish passage barriers	There would be a beneficial effect to the LF when culverts that are partial barriers are replaced.
Effects of global climate change	There is no causal mechanism of the proposed action to affect the LF.
Periodic reduction in marine productivity	There is no causal mechanism of the proposed action to affect the LF.
Hatchery effects	There is no causal mechanism of the proposed action to affect the LF.
Effects from exotic fish species	There is no causal mechanism of the proposed action to affect the LF.

4. Southern Oregon / Northern California Coasts coho salmon

The limiting factors (LF) information for Southern Oregon / Northern California Coasts coho salmon in section 3.A.1 (Status of the Species) are from NMFS (2014). The effects of implementing the PRMP to SONCC coho salmon LF are evaluated in

Table 232.

Table 232. Effects to limiting factors for Southern Oregon / Northern California Coasts coho salmon.

Limiting Factor Category	Analysis
Lack of floodplain and channel structure	There would be a beneficial effect to floodplain and channel structure in the short and long-term under the PRMP within habitat occupied by SONCC coho salmon. This is a result of wood recruitment from the tree-tipping requirement of the Forest Management program, the lack of impact to existing trees in the RR outer zone that would qualify at the time of thinning as LWD, the accelerated growth of trees in the RR outer zone after thinning into the LWD category, natural growth of trees in the RR over the next 100 years into the Mature and Structurally complex successional stages (Table 140), and instream large wood placement for habitat restoration projects. Otherwise, floodplain and channel structure would be protected by the Riparian Reserve designation and its management direction.
Impaired water quality	There may be localized increases in water temperature as a result of implementing a sub-set of actions for the following PRMP programs: Fire and Fuels (short-term from use of pump chances), Livestock Grazing (trampling and eating shade vegetation), and Recreation and Visitors Services (from trampling and growth suppression of shade vegetation at recreation sites). Short-term increases in turbidity may occur as a result of a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Livestock Grazing, Minerals, Recreation and Visitors Services, Sustainable energy (for winter haul of biomass only) and the Trails & Travel Management program. The following programs would have a sub-set of actions that may have adverse effects to chemical contamination: Forest Management (petroleum products form heavy equipment replacing culverts), Invasive Plant Control (chemical treatments), Minerals (methymercury from legacy mercury brought up by suction dredging) and Recreation & Visitors Services (use of treated wood under certain conditions).
Altered hydrologic function (timing of volume of water flow)	Water quantity may be measurably decreased in the short-term by use of pump chances and by livestock drinking from small streams at summer base flow and from reservoirs at low pool. Summer base flow may increase for a few years in small catchments after timber harvest. The risk of an increase in measurable peak flow is no greater than insignificant for any PRMP program, including Forest Management.

Impaired estuary/mainstem function	Implementation of the PRMP would not impair estuary or mainstem function.
Degraded riparian forest conditions	A sub-set of actions would adversely affect riparian vegetation conditions. Those with short-term adverse effects and long-term beneficial effects include Fire and Fuels, Forest Management (riparian thinning) and Invasive Species (removing invasive plants including treating for sudden oak death). Livestock grazing would have a short-term (recovered by next season of use) adverse effect. Construction of permanent roads, hiking trails and public motorized travel trails within riparian areas would have long-term adverse effects, but such construction would be minimized by Management Direction. Growth of trees in Riparian Reserves within one site potential tree height of streams over a 100-year period under the PRMP is projected to lead to about 94 percent of the stands being in the Mature & Structurally Complex successional stages (Table 140).
Altered sediment supply	There would be short-term adverse effects to the LF as a result of fine sediments on stream substrates and in the water column resulting in turbidity for a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Livestock Grazing, Minerals, Recreation and Visitors Services, Sustainable energy (for winter haul of biomass only) and the Trails & Travel Management program. There would be long-term benefits from road decommissioning projects.
Increased disease/predation/competition	There is no causal mechanism of the proposed action to affect predation or competition.
Barriers to migration	There would be a beneficial effect to the LF when culverts that are partial barriers are replaced.
Fishery-related effects	There is no causal mechanism of the proposed action to affect the LF.
Hatchery-related effects	There is no causal mechanism of the proposed action to affect the LF.

5. Southern DPS green sturgeon

The limiting factors (LF) information for Southern DPS green sturgeon in section 3.A.1 (Status of the Species) explains that the principal factor for the decline of southern green sturgeon is the reduction of its spawning area to a single known population limited to a small portion of the Sacramento River. This situation is outside the planning area.

It is currently at risk of extinction primarily because of human-induced ‘‘takes’’ involving elimination of freshwater spawning habitat, degradation of freshwater and estuarine habitat quality, water diversions, fishing, and other causes (USDC 2010). Adequate water flow and

temperature are issues of concern. Water diversions pose an unknown but potentially serious threat within the Sacramento and Feather Rivers and the Sacramento River Delta. Poaching also poses an unknown but potentially serious threat because of high demand for sturgeon caviar. The effects of contaminants and nonnative species are also unknown but potentially serious. The effects of implementing the PRMP to Southern DPS green sturgeon LF based upon the above discussion are evaluated in Table 233.

Note that the amount of BLM land in proximity to Southern DPS green sturgeon occupancy and designated CH is extremely limited. The effects to the LF below would occur only at a few locations across the range of the species in Oregon.

Table 233. Effects to limiting factors for Southern DPS green sturgeon.

Limiting Factor Category	Analysis
Elimination of freshwater spawning habitat	There is no causal mechanism of the proposed action to affect the LF. Spawning habitat for Southern DPS green sturgeon is outside the planning area.
Degradation of freshwater and estuarine habitat quality (including water temperature and contaminants)	Note that the effects below are primarily for freshwater habitat. The only adverse effect to estuarine habitat may occur from methymercury contamination resulting from upstream suction dredging, as described below. There may be localized increases in water temperature as a result of implementing a sub-set of actions for the following PRMP programs: Fire and Fuels (short-term from use of pump chances), and Recreation and Visitors Services (from trampling and growth suppression of shade vegetation at recreation sites). Short-term increases in turbidity may occur as a result of a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Minerals, Recreation and Visitors Services, Sustainable energy (for winter haul of biomass only) and the Trails & Travel Management program. The following programs would have a sub-set of actions that may have adverse effects to chemical contamination: Forest Management (petroleum products form heavy equipment replacing culverts), Invasive Plant Control (chemical treatments), Minerals (methymercury from legacy mercury brought up by suction dredging) and Recreation & Visitors Services (use of treated wood under certain conditions). Water quantity may be measurably decreased in the short-term by use of pump chances. Summer base flow may increase for a few years in small catchments after timber harvest. The risk of an increase in measurable peak flow is no greater than insignificant for any PRMP program, including Forest Management. There would be short-term adverse effects as a result of fine sediments

	on stream substrates and in the water column resulting in turbidity for a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Minerals, Recreation and Visitors Services, Sustainable Energy (for winter haul of biomass only) and the Trails & Travel Management program. There would be long-term benefits from road decommissioning projects. A sub-set of actions would adversely affect riparian vegetation conditions. Those with short-term adverse effects and long-term beneficial effects include Fire and Fuels, Forest Management (riparian thinning) and Invasive Species (removing invasive plants including treating for sudden oak death). Construction of permanent roads, hiking trails and public motorized travel trails within riparian areas would have long-term adverse effects, but such construction would be minimized by Management Direction. Growth of trees in Riparian Reserves within one site potential tree height of streams over a 100-year period under the PRMP is projected to lead to about 94 percent of the stands being in the Mature & Structurally Complex successional stages (Table 140).
Water diversions	There is no causal mechanism of the proposed action to affect the LF.
Poaching	Implementation of the PRMP would not impair estuary or mainstem function.
Non-native species	There is no causal mechanism of the proposed action to affect the LF.

6. Southern DPS Pacific eulachon

The NMFS has not identified limiting factors for this species. However, the status review for the species (Gustafson *et al.* 2010) listed threats to the species, displayed in Table 73 insection 3.A.1 (Status of the Species) earlier in this BA. Only one of the 16 threats may be affected by the BLM PRMP. It is effects to water quality, and the greatest level of effect is an insignificant effect as a result of fine sediment from recreation activities on BLM land in the Sandy River.

7. Lost River sucker and shortnose sucker

The revised recovery plan for the two sucker species identifies habitat limiting factors as loss or degradation of spawning, rearing or adult habitat (USFWS 2012). Connectivity of habitats is a concern, as well as reductions in habitat quality, including poor water quality. The effects of implementing the PRMP to Lost River sucker and shortnose sucker LF based upon the information above are evaluated in

Table 234.

Table 234. Effects to limiting factors for Lost River sucker and shortnose sucker.

Limiting Factor Category	Analysis
Loss of spawning, rearing or adult habitat.	There is no causal mechanism of the proposed action to affect the LF. There would be no reduction in habitat for either sucker species by implementing the PRMP.
Degradation of spawning, rearing or adult habitat, including water quality.	There may be localized increases in water temperature as a result of implementing a sub-set of actions for the following PRMP programs: Fire and Fuels (short-term from use of pump chances), Livestock Grazing (trampling and eating shade vegetation), and Recreation and Visitors Services (from trampling and growth suppression of shade vegetation at recreation sites). Short-term increases in turbidity may occur as a result of a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Livestock Grazing, Minerals, Recreation and Visitors Services, Sustainable energy (for winter haul of biomass only) and the Trails & Travel Management program. The following programs would have a sub-set of actions that may have adverse effects to chemical contamination: Forest Management (petroleum products form heavy equipment replacing culverts), Invasive Plant Control (chemical treatments) and Recreation & Visitors Services (use of treated wood under certain conditions). Water quantity may be measurably decreased in the short-term by use of pump chances. Summer base flow may increase for a few years in small catchments after timber harvest. The risk of an increase in measurable peak flow is no greater than insignificant for any PRMP program, including Forest Management. There would be short-term adverse effects as a result of fine sediments on stream substrates and in the water column resulting in turbidity for a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Livestock Grazing, Minerals, Recreation and Visitors Services, Sustainable Energy (for winter haul of biomass only) and the Trails & Travel Management program. There would be long-term benefits from road decommissioning projects. A sub-set of actions would adversely affect riparian vegetation conditions. Those with short-term adverse effects and long-term beneficial effects include Fire and Fuels, Forest Management (riparian thinning) and Invasive Species (removing invasive plants including treating for sudden oak death). Construction of permanent roads, hiking trails and public motorized travel trails within riparian areas would have long-term adverse effects, but such construction would be minimized by Management Direction. Livestock grazing would have a

	short-term (recovery before next grazing season) adverse effect. Growth of trees in Riparian Reserves within one site potential tree height of streams over a 100-year period under the PRMP is projected to lead to about 94 percent of the stands being in the Mature & Structurally Complex successional stages (Table 140).
Habitat connectivity	There is no causal mechanism of the proposed action to affect the LF. There are no opportunities to improve fish passage on BLM land.

8. McKenzie River basin bull trout

The final bull trout recovery plan (USFWS 2015) identifies the following habitat threats in the Upper Willamette River Core Area (including the McKenzie River basin): loss of pool habitat, instream structure, cover, and floodplain connectivity and increases in temperature due to historical wood removal and riparian harvest. All have been cited as limiting ecological function and biological productivity. The recovery plan states that restoration activities should focus on: increasing instream habitat complexity, off-channel habitat, and high flow refugia by adding large wood; managing riparian areas for a future supply of large wood, adequate shade, and diverse allochthonous inputs; and reducing fine sediment and water quality impacts from roads and recreational development. The effects of implementing the PRMP to McKenzie River Basin bull trout LF based upon the information above are evaluated in Table 235.

Table 235. Effects to limiting factors for McKenzie River basin bull trout.

Limiting Factor Category	Analysis
Lack of habitat complexity, instream structure and cover resulting from loss of pools, lack of LWD and its recruitment.	There would be a beneficial effect to habitat complexity, instream structure and cover in the short and long-term under the PRMP within habitat occupied by McKenzie River basin bull trout. This is a result of wood recruitment from the tree-tipping requirement of the Forest Management program, the lack of impact to existing trees in the RR outer zone that would qualify at the time of thinning as LWD, the accelerated growth of trees in the RR outer zone after thinning into the LWD category, natural growth of trees in the RR over the next 100 years into the Mature and Structurally complex successional stages (Table 140), and instream large wood placement for habitat restoration projects. The structure and function of Riparian Reserves that results in instream habitat complexity, structure and cover would be protected by the Riparian Reserve designation and its management direction.
Degradation of water quality (including water temperature) and degradation of instream habitat from sediment.	It is unlikely that water temperature may be measurably affected by implementing the PRMP in the McKenzie River basin. Any use of pump chances would not result in a measurable water temperature increase in waters occupied by bull trout or where there is designated CH (in the mainstem McKenzie River). Recreation developments are located on the mainstem McKenzie River and shade loss from vegetation at these developments would not result in measurable increases in water

	temperature. Short-term increases in turbidity may occur as a result of a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Minerals, Recreation and Visitors Services, Sustainable energy (for winter haul of biomass only) and the Trails & Travel Management program. The following programs would have a sub-set of actions that may have adverse effects to chemical contamination: Invasive Plant Control (chemical treatments) and Recreation & Visitors Services (use of treated wood under certain conditions). Summer base flow may increase for a few years in small catchments after timber harvest. The risk of an increase in measurable peak flow is no greater than insignificant for any PRMP program, including Forest Management. There would be short-term adverse effects as a result of fine sediments on stream substrates and in the water column resulting in turbidity for a sub-set of habitat restoration activities, and a sub-set of activities for the following programs: Forest Management, Lands and Realty, Minerals, Recreation and Visitors Services, Sustainable Energy (for winter haul of biomass only) and the Trails & Travel Management program. There would be long-term benefits from road decommissioning projects. A sub-set of actions would adversely affect riparian vegetation conditions. Those with short-term adverse effects and long-term beneficial effects include Fire and Fuels, Forest Management (riparian thinning) and Invasive Species (removing invasive plants including treating for sudden oak death). Construction of permanent roads, hiking trails and public motorized travel trails within riparian areas would have long-term adverse effects, but such construction would be minimized by Management Direction. Growth of trees in Riparian Reserves within one site potential tree height of streams over a 100-year period under the PRMP is projected to lead to about 94 percent of the stands being in the Mature & Structurally Complex successional stages (Table 140).
Floodplain connectivity	Floodplain connectivity of the mainstem McKenzie River (where there is the only designated CH adjacent to BLM land) would not be affected by PRMP activities. Elsewhere on tributary streams, there is very little occupied bull trout habitat near BLM land. Activities within Riparian Reserves may occur within floodplains for several programs. However, very limited actions would occur within the inner zones. Short-term adverse effects to floodplain connectivity were identified for a sub-set of habitat restoration projects and for possible discretionary right-of-way road construction for the Lands and Realty program.
Diverse allochthonous inputs	PRMP activities under the PRMP are very limited within RR inner zones. There would not be measurable negative effects to allochthonous

	inputs.

VI. ESA Effect Determinations

Table 236 displays the ESA effect determination for each PRMP program by species and designated CH. The effect determinations are based upon the effects by program to the habitat indicators, direct effects to the species, and effects to the PCEs of designated CH that were evaluated in section V of the BA. If there was an adverse effect to any indicator or PCE, or if there were direct effects to the species resulting in harm or harassment, the effect determination is “May Affect, Likely to Adversely Affect” (LAA). If a program was determined to be “May Affect” to the species and designated CH, and all effects were no greater than discountable or insignificant, the effect determination is “May Affect, Not Likely to Adversely Affect” (NLAA). If there was no causal mechanism for a program to affect the species or its designated CH, the effect is “No Effect” (NE).

Table 237 displays ESA effect determinations by species and associated designated CH for the implementation of the PRMP. It was determined that effects were LAA for one or more PRMP programs to each species and associated designated CH. Consequently, the overall ESA effect determination for implementation of the PRMP is LAA to each species and its associated designated CH.

Table 236. ESA effect determination by fish species and its associated designated CH for the effects of implementing each PRMP program.

PRMP Program	LCR Chinook salmon	LCR coho salmon	LCR steelhead	UWR Chinook salmon	UWR steelhead	OC coho salmon	SONCC coho Salmon	S. DPS green sturgeon	S. DPS Pacific eulachon	Lost River sucker	Shortnose sucker	Bull trout
1. Air Quality	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2. Areas of Critical Environmental Concern	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3. Cultural Resources	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE	NE	NLAA	NLAA	NLAA
4. Fire and Fuels	LAA	LAA	LAA	LAA	LAA	LAA	LAA	NE	NE	LAA	LAA	LAA
5. Fisheries[1]	LAA	LAA	LAA	LAA	LAA	LAA	LAA	NLAA	NE	LAA	LAA	LAA
6. Forest Management	LAA	LAA	LAA	LAA	LAA	LAA	LAA	LAA	NE	LAA	LAA	LAA
7. Hydrology[1]	LAA	LAA	LAA	LAA	LAA	LAA	LAA	NLAA	NE	LAA	LAA	LAA
8. Invasive species[1]	LAA	LAA	LAA	LAA	LAA	LAA	LAA	NLAA	NE	LAA	LAA	LAA
9. Lands and Realty[2]	LAA	LAA	LAA	LAA	LAA	LAA	LAA	NE	NE	LAA	LAA	LAA
10. Lands w/ Wilderness Characteristics	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
11. Livestock grazing[3]	NE	NE	NE	NE	NE	NLAA	LAA	NE	NE	NLAA	LAA	NE
12. Minerals[4]	LAA	LAA	LAA	LAA	LAA	LAA	LAA	LAA	LAA	LAA	LAA	NLAA[5]
13. National Trails System	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

14. Paleontological Resources	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE	NE	NLAA	NLAA	NLAA
15. National Trails System	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
17. Recreation & Visitors Services	LAA	LAA	LAA	LAA	LAA	LAA	LAA	NLAA	NLAA	LAA	LAA	LAA
18. Soil Resources[1]	LAA	LAA	LAA	LAA	LAA	LAA	LAA	NLAA	NE	LAA	LAA	LAA
19. Special Forest Products	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NE	NE	NLAA	NLAA	NLAA
20. Sustainable Energy[6]	LAA	LAA	LAA	LAA	LAA	LAA	LAA	NE	NE	LAA	LAA	LAA
21. Trails & Travel Management[7]	LAA	LAA	LAA	LAA	LAA	LAA	LAA	NE	NE	LAA	LAA	LAA
22. Tribal Interests	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
23. Wild and Scenic Rivers	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
24. Wildlife[1]	LAA	LAA	LAA	LAA	LAA	LAA	LAA	NLAA	NE	LAA	LAA	LAA
25. Wild Horses[8]	NE	NE	NE	NE	NE	NE	NE	NE	NE	NLAA	NLAA	NE

[1]These programs only have restoration actions. Effects are interpreted from the PCE analysis of the programmatic BOs known as ARBO II (NMFS 2013, USFWS 2013). Effects are short-term, and there are long-term benefits to many of the same PCEs.

[2]The PCE analysis summary is specifically for the case of a discretionary road right-of-way within a Riparian Reserve adjacent to a stream with designated CH. While possible, this would be an extremely rare event. Based upon a query of west-side Oregon BLM fish biologists, there have been no BLM discretionary road right-of-ways with these circumstances in 10 years (Lightcap, pers. comm. 2015).

[3]Livestock grazing only occurs on BLM land in the OC coho salmon ESU, the SONCC coho salmon, and the Upper Klamath RU for shortnose sucker and Lost River sucker.

[4]The effects depicted for the Minerals program is for use of rock quarries (salable mineral) and for suction dredge gold mining (locatable mineral). Use of rock quarries was addressed in a programmatic consultation (USDA FS et al. 2010, NMFS 2011). The effects of approving NOI for suction gold dredge mining on the Rogue-Siskiyou NF was addressed in a BA (USDA FS 2015). The effects depicted in the table are a synthesis of the effects analyses for both types of minerals mining. The effects of the leasable minerals aspect of the Minerals program, or any other mining activity, was not evaluated because the range of possible actions is so large that it would be a speculative analysis and there are no proposals before the BLM at this time. Future minerals actions would require, when appropriate, NEPA analysis and Section 7 consultation.

[5]The USFWS issued an amendment to their 2008 programmatic BO in 2011 to address effects to bull trout designated CH (USFWS 2011, tracking number 11-307). The effect determination was NLAA for the category of *Road Maintenance and Storm Proofing* that included the use of rock quarries. The analysis in the

original BO did not split out effects to the habitat indicators for the use of rock quarries nested within the effects of the rest of the Road Maintenance and Storm Proofing category. Consequently, the BLM cannot identify which PCEs may be affected. There are no mining claims on BLM land in the McKenzie River basin according to a search of a BLM GIS layer. Eugene BLM District Fish biologist Brett Blundon states that he has not seen any suction dredges in the mainstem McKenzie River that has the only bull trout designated CH in the basin (Blundon, pers. comm. 2015). Consequently, there are no effects to the PCEs of bull trout designated CH from suction dredge gold mining in the McKenzie River basin. Because the effect determination was NLAA, it follows that there are no effects to PCEs that exceed an insignificant level. However, the BLM acknowledges that other forms of mining may occur at a future date that "may affect" McKenzie River basin bull trout. The effects of the leasable minerals aspect of the Minerals program, or any other mining activity, was not evaluated because the range of possible actions is so large that it would be a speculative analysis and there are no proposals before the BLM at this time. Future minerals actions would require, when appropriate, NEPA analysis and Section 7 consultation.

[6]The effects of the Sustainable Energy program displayed in the table are for gathering and transporting residual slash from timber harvest to biomass energy plants. Other aspects of the Sustainable Energy program in the FEIS are: 1) how energy transmission Right-of-Way (ROW) avoidance and exclusion areas affect the potential siting of wind energy developments and sustainable energy corridor designations; and, 2) how leasable stipulations such as no surface occupancy would negatively affect, though not entirely preclude, the potential for geothermal development on BLM-administered lands. Neither of the last two aspects of the PRMP Sustainable Energy program have any causal mechanisms to affect any fish habitat characteristics or PCE of designated CH, nor are there any mechanisms to directly impact individual fish.

[7]The Trails and Travel Management program includes three components: The road system; public motorized travel designations; and, the trail system. The construction of new roads, the maintenance of existing roads, and the closure of roads under the PRMP are largely connected to the Forest Management program. Because of that nexus, the effects of those activities are addressed in the Forest Management program PCE analysis of this BA.

[8]The Wild Horses program is located in the Klamath River basin on lands administered by the BLM Klamath Falls Field Office. The program "May Affect" hortnose sucker and Lost River sucker, and their designated CH .

Table 237. ESA effect determinations for implementation of the PRMP to ESA-listed fish species and designated critical habitat.

Species	ESA Listing Status	Determination of Effects	
		Individuals	Critical Habitat
Lower Columbia River Chinook salmon	Threatened	LAA	LAA
Lower Columbia River coho salmon	Threatened	LAA	LAA
Lower Columbia River steelhead	Threatened	LAA	LAA
Upper Willamette River Chinook salmon	Threatened	LAA	LAA
Upper Willamette River steelhead	Threatened	LAA	LAA
Oregon Coast coho salmon	Threatened	LAA	LAA
Southern Oregon/Northern California Coasts coho Salmon	Threatened	LAA	LAA
Southern DPS green sturgeon	Threatened	LAA	LAA
Southern DPS Pacific eulachon	Threatened	LAA	LAA
Lost River sucker	Endangered	LAA	LAA
Shortnose sucker	Endangered	LAA	LAA
Bull trout	Threatened	LAA	LAA

VII. ESA Cumulative Effects

Endangered Species Act cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the ESA action area considered in this BA [50 CFR §402.02]. This definition applies only to Section 7 analyses and should not be confused with the broader use of this term in the National Environmental Policy Act or other environmental laws. Future federal actions that are unrelated to the proposed action, and have not already undergone consultation under the ESA, are not considered here because they require separate consultation pursuant to Section 7 of the ESA.

Cumulative effects, in the context of Section 7 consultation, are generic to the area of consideration and not related to the Federal action. The cumulative effects analysis that follows is therefore independent of the effects of the proposed action addressed in this BA, and addresses impacts in the context of general trends in population and land-use.

Oregon's estimated 2009 population was 3,823,460. Oregon's population increased by 2.5 times since 1950, and is expected to reach 4.4 million by the year 2020 (State of Oregon Department of Administrative Services 2010). Much of Oregon's population is concentrated in the land area west of the Cascade mountain range, which includes the area of the proposed action for this BA.

Intuitively, population growth results in increasing residential and commercial development. Improvements and upgrades to infrastructure (including highways, other transportation facilities, pipelines, power lines, and power plants) will likely track closely with increased residential and commercial development. Primary pathways of potential effects of land development include the following: direct habitat loss, decreased water quality, contamination of waterways and uplands, changes to runoff patterns, habitat fragmentation, isolation of populations, and loss of habitat diversity. In general, as development increases the quantity and quality of habitat suitable for threatened and endangered species typically decreases. Based on past trends and types of development, future residential, commercial, and infrastructure development will likely lead to further habitat degradation. Actions taken to mitigate for the potential impacts of development may help slow the rate of habitat degradation.

In many areas within the WORMP planning area, certain ongoing agricultural practices (such as irrigation, stream cleaning, diking and tide gates, chemical application, and riparian plant removal in agricultural areas) are likely to prevent habitat from attaining optimal condition for ESA-listed fish species.

Timber harvest and associated impacts on State and private lands occur within the WORMP planning area. Timber harvest also occurs within the Tillamook, Clatsop and Elliot State Forests within the planning area. There have been improvements in practices to protect water quality and riparian areas since the Oregon Forest Practices Act was first instituted in 1972. However, the collective impacts of past and reasonably foreseeable future forestry activities are likely to result in additional future degradation of habitat for ESA-listed fish species.

Air and water pollution can degrade habitat and have lethal and sub-lethal effects to ESA-listed fish species. Increased human population typically causes increased air and water pollution. Developed

areas also generate effluent, and runoff is often polluted with a variety of substances. Each of the sub-basins within the PRMP planning area contain 303(d)-listed streams with water temperature being the most frequent parameter exceeding state standards. Other notable parameters include bacteria, dissolved oxygen, flow modification, habitat modification, nutrients, pH, sedimentation, total dissolved gas, toxics and turbidity.

As population increases, the number of people pursuing recreational activities in and near streams and other water bodies will increase. Recreational activities such as fishing, camping and off-road vehicle use will also result in adverse effects to ESA-listed fish and to designated CH.

There are also non-federal actions that benefit ESA-listed fish species and designated CH. The State of Oregon developed a comprehensive aquatic conservation strategy known as "The Oregon Plan." In 1997 the Oregon Coastal Salmon Restoration Initiative was renamed the Oregon Plan for Salmon and Watersheds and was broadened to steelhead populations of the Oregon coast and Lower Columbia including Willamette River. On January 14, 1999, Governor Kitzhaber expanded the Oregon Plan for Salmon and Watersheds (Oregon 1997) to include all at-risk wild salmonids throughout the State. This Executive Order provides the framework and direction for state agencies to implement, to the extent of their authorities, the Oregon Plan in a timely and effective manner.

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. This process included chartering 84 locally-formed and represented "watershed councils" across the State. Membership on the watershed councils includes: landowners, businesses interests, agricultural interests, sport fishers, irrigation/water districts, individuals, State, Federal, and Tribal agencies, and local government officials. Participation in the Oregon Plan is voluntary.

Oregon Plan efforts led to the following watershed outcomes in 2010-2011 (http://www.oregon.gov/OWEB/Docs/OPBR11-13_ExecSum.pdf) and are an indicator of potential future restoration actions.

- 810 riparian stream miles treated
- 201 miles of stream habitat treated with instream restoration projects
- 356 miles of streams made accessible to fish migration

Ongoing activities in Oregon will help mitigate and/or reverse pollutant sinks and sources. The Oregon Department of Environmental Quality (ODEQ), for instance, has completed 31 TMDLs for major basins across the state through 2015 (http://www.deq.state.or.us/wq/tmdls/tmdls.htm). Even still, pollutant discharges will likely continue in the future and are very likely to degrade habitat for listed species.

A moratorium on instream (suction dredge) and upland motorized placer mining in Oregon will begin on January 2, 2016 and continue until 2021 (ODEQ 2015). According to an ODEQ news release dated July 16, 2015, the prohibition will be:

- In all streams above the lowest extent of spawning habitat in rivers and tributaries

containing Essential Salmonid Habitat or naturally reproducing populations of bull trout.
- In upland areas within 100 yards of these streams if the mining results in the removal or disturbance of vegetation in a manner that may affect water quality.

In summary, the BLM anticipates that these uses and associated negative and beneficial impacts will continue in the future. Some uses and associated negative impacts will increase with human population growth in the PRMP planning area. It is also expected that activities on these lands will comply with county, state, and federal laws and regulations. Implementation of the Oregon Plan will continue to result in beneficial effects to habitat for ESA-listed fish species.

VIII. EFH Effect Analysis and Determination

The final rule for Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (16 USC. 1855(b) in accordance with the Sustainable Fisheries Act of 1996 (Public Law 104-267), was published in the Federal Register on January 17, 2002 (67 FR 2343). Provisions of the Magnuson-Stevens Act require heightened consideration of habitat for commercial species in resource management decisions, including EFH for coho salmon, Chinook salmon, Pacific Coast groundfish and coastal pelagic species.

EFH is defined in section 3 of the Magnuson-Stevens Act as “those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity” and includes all waters historically used by anadromous salmonids of commercial value. NMFS interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem.

The Pacific Fishery Management Council (PFMC) described and identified EFH for groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Chinook salmon, coho salmon, and Puget Sound pink salmon (PFMC 1999). The ESA action area includes areas designated as EFH for coho salmon and Chinook salmon. It also includes EFH for various life-history stages of Pacific Coast groundfish and coastal pelagic fish species within estuaries (Table 238).

Table 238. Groundfish species and pelagic ocean species that have Essential Fish Habitat within estuaries of the action area.

Pacific Coast Groundfish Species	
Leopard shark (*Triakis semifasciata*)	Quillback rockfish (*S. maliger*)
Soupfin shark (*Galeorhinus zyopterus*)	Redbanded rockfish (*S. babcocki*)
Spiny dogfish (*Squalus acanthias*)	Redstripe rockfish (*S. proriger*)
Big skate (*Raja binoculata*)	Rosethorn rockfish (*S . helvomaculatus*)
California skate (*R. inornata*)	Rosy rockfish (*S. rosaceus*)
Longnose skate (*R. rhina*)	Rougheye rockfish (*S. aleutianus*)
Ratfish (*Hydrolagus colliei*)	Sharpchin rockfish (*S. zacentrus*)
Pacific rattail (*Coryphaenoides acrolepsis*)	Shortbelly rockfish (*S. jordani*)
Lingcod (*Ophiodon elongatus*)	Shortraker rockfish (*S. borealis*)
Cabezon (*Scorpaenichthys marmoratus*)	Silvergray rockfish (*S. brevispinus*)
Kelp greenling (*Hexagrammos decagrammus*)	Speckled rockfish (*S. ovalis*)

Pacific cod (*Gadus macrocephalus*)	Splitnose rockfish (*S. diploproa*)
Pacific whiting (Hake) (*Merluccius productus*)	Stripetail rockfish (*S. saxicola*)
Sablefish (*Anoplopoma fimbria*)	Tiger rockfish (*S. nigrocinctus*)
Aurora rockfish (*Sebastes aurora*)	Vermillion rockfish (*S. miniatus*)
Bank Rockfish (*S. rufus*)	Widow Rockfish (*S. entomelas*)
Black rockfish (*S. melanops*)	Yelloweye rockfish (*S. ruberrimus*)
Blackgill rockfish (*S. melanostomus*)	Yellowmouth rockfish (*S. reedi*)
Blue rockfish (*S. mystinus*)	Yellowtail rockfish (*S. flavidus*)
Bocaccio (*S. paucispinis*)	Arrowtooth flounder (*Atheresthes stomias*)
Brown rockfish (*S. auriculatus*)	Butter sole (*Isopsetta isolepsis*)
Canary rockfish (*S. pinniger*)	Curlfin sole (*Pleuronichthys decurrens*)
Chilipepper (*S. goodei*)	Dover sole (*Microstomus pacificus*)
China rockfish (*S. nebulosus*)	English sole (*Parophrys vetulus*)
Copper rockfish (*S. caurinus*)	Flathead sole (*Hippoglossoides elassodon*)
Darkblotched rockfish (*S. crameri*)	Pacific sanddab (*Citharichthys sordidus*)
Grass rockfish (*S. rastrelliger*)	Petrale sole (*Eopsetta jordani*)
Greenspotted rockfish (*S. chlorostictus*)	Rex sole (*Glyptocephalus zachirus*)
Greenstriped rockfish (*S. elongatus*)	Rock sole (*Lepidopsetta bilineata*)
Longspine thornyhead (*Sebastolobus altivelis*)	Sand sole (*Psettichthys melanostictus*)
Shortspine thornyhead (*Sebastolobus alascanus*)	Starry flounder (*Platyichthys stellatus*)
Pacific Ocean perch (*S. alutus*)	
Coastal Pelagic Species	
Northern anchovy (*Engraulis mordax*)	Jack mackerel (*Trachurus symmetricus*)
Pacific sardine (*Sardinops sagax*)	Market squid (*Loligo opalescens*)
Pacific mackerel (*Scomber japonicus*)	

Coho salmon and Chinook salmon

This BA evaluated effects to ESA-listed coho salmon and Chinook salmon, as well as to their designated CH, within the planning area where there is designated CH. It also evaluated effects where the ESA-listed salmon species occupy habitat that is upstream from designated CH. The habitat indicators and PCEs of designated CH utilized in this BA for the ESA effects analysis also represent aquatic habitat health for EFH for coho salmon and Chinook salmon. The BLM considers the ESA effect analysis as a surrogate for an effect analysis for salmon EFH.

There are geographic areas within the planning area that are occupied by coho salmon and Chinook salmon that are not listed under the ESA and do not have CH designated. All of the areas occupied by non-ESA listed Chinook salmon are also occupied by ESA-listed coho salmon. Typically, coho salmon occupy habitat farther upstream than Chinook salmon. Therefore, the ESA effects analyses for coho salmon in the planning area serve as surrogate EFH analyses for Chinook salmon in those areas where Chinook salmon is not listed under the ESA.

There is one geographic location within the planning area where coho salmon not listed under the ESA are present. This is in the Willamette River and its tributaries upstream from Willamette Falls. Part of their distribution overlaps that of ESA-listed UWR Chinook salmon and UWR steelhead. In those overlap areas, the ESA effect analysis in the BA serves as a surrogate for an EFH analysis for coho salmon.

The BLM used GIS to evaluate if there were any subwatersheds in the upper Willamette River area that were occupied by coho salmon but not UWR Chinook salmon or UWR steelhead. There is one subwatershed that meets that criterion: Headwaters Mary's River (HUC 170900030201). Coho salmon occupy about 1.7 miles of stream in the lower subbasin. There is a small amount of BLM ownership just below the ridge in the headwaters, containing a few acres that include two intermittent, non-fish bearing streams. The BLM land is located about 9.4 miles upstream from the upper extent of coho salmon distribution according to Streamnet information. The BLM believes that any BLM activities occurring under the PRMP in that subbasin would have no effect to coho salmon EFH because it is over 9 miles upstream from coho distribution.

This BA conducted a thorough analysis of the effects of implementing the proposed action to habitat indicators and to the PCE of designated CH of multiple coho and Chinook salmon ESUs and steelhead DPSs that encompass the planning area. Based upon that analysis, the ESA effect determination was "May Affect, Likely to Adversely Affect." Because the habitat indicators and the PCE of designated CH address the characteristics of EFH, it is concluded that implementation of the proposed action "**May Adversely Affect**" (MAA) EFH for coho and Chinook salmon.

Pacific Coast groundfish and coastal pelagic species

The ESA action area includes river estuaries in Oregon. There is very limited BLM land ownership in the estuary areas. Some of the Pacific Coast groundfish and coastal pelagic species may utilize estuarine tidal influence areas during part of their life history. Consequently an analysis of effects to EFH for these species is required.

The proposed action includes recreation activities associated with a BLM boat ramp on the North Spit of Coos Bay. The BLM determined that there was an insignificant negative effect to the water quality PCE for Southern DPS green sturgeon as a result of possible boat motor fuel leakage or spills, and lubricants. The BLM believes the use of the North Spit boat ramp will not adversely affect EFH for coho salmon, Chinook salmon, Pacific Coast groundfish or coastal pelagic fish species.

The BLM also administers land in the tidal zone of New River. The effects of breaching the New River across a fore dune to the Pacific ocean were analyzed in a BLM BA dated 10/15/2009, resulting in a NMFS BO issued on 11/11/2011 (NMFS Consultation Number 2009/05787). The breaching could occur on an annual basis. The BO also included an EFH response that addressed effects to Pacific Coast groundfish and coastal pelagic fish species. The EFH analysis in the NMFS document concluded that the action "May Adversely Affect" EFH for Pacific Coast groundfish or coastal pelagic fish species. For further information, please refer to the EFH analysis contained in the NMFS BO, which is incorporated by reference.

The BLM consulted on the effects of removing invasive non-native European beachgrass for restoration and maintenance of western snowy plover habitat on the foredune of the New River. The scope of the project is to remove European beach grass on 20 acres per year for 5 years, for a total of 100 acres of restored, improved, and maintained plover habitat, along 4.25 miles of a narrow sand strip bounded by the Pacific Ocean to the west and the New River to the east. Removal will occur using bulldozers, burning, and hand pulling. Follow-up maintenance

treatment is also proposed to remove re-sprouts with a brush blade during years three, four, and five. That would result in an additional 40 to 60 acres of maintenance treatments in addition to 20 acres per year receiving removal treatments.

The effects were analyzed in a BLM BA dated 10/7/2008, resulting in a NMFS Letter of Concurrence (LOC) issued on 3/13/2009 (NMFS Consultation Number 2008/07031). The BO also included an EFH response that addressed effects to Pacific Coast groundfish and coastal pelagic fish species. The EFH analysis in the NMFS document concluded that the action "Would Not Adversely Affect" (WNAA) EFH for Pacific Coast groundfish or coastal pelagic fish species. For further information, please refer to the EFH analysis contained in the NMFS LOC, which is incorporated by reference.

Suction gold dredge mining was determined to adversely affect EFH for Pacific Coast groundfish and coastal pelagic fish species in estuary areas of southern Oregon in a BA prepared by the Rogue-Siskiyou National Forest (USDA FS 2015). The BA EFH analysis is incorporated by reference. The EFH effect analysis concluded that suction dredge gold mining would bring up legacy metallic mercury (from historic gold mining) from deep streambed sediments into the water column. Mercury attached to fine sediment particles in the clay-silt size class is likely to be transported to estuary areas where conditions in associated wetlands are conducive to microbial production of methylmercury. This would negatively impact the chemical properties of EFH for some Pacific groundfish and coastal pelagic species. The Rogue-Siskiyou National Forest BA made a determination that this "May Adversely Affect" EFH for Pacific Coast groundfish and coastal pelagic species. The BLM concurs that this may occur, but the conditions conducive to methlymercury production are more likely to be present in the Rogue River estuary than in the Umpqua River estuary.

In summary, the potential for effects to EFH for Pacific Coast groundfish or coastal pelagic fish species from BLM activities is limited. Considering the past determinations of effect to EFH for the species for the New River Breaching project (MAA), for the New River Snowy Plover Habitat Restoration Project (WNAA), the current EFH effect determination for the use of the Coos Bay North Spit boat ramp (WNAA), and the recent determination of effect for suction dredge gold mining in Southern Oregon on the Rogue-Siskiyou National Forest (MAA), the BLM concludes that implementation of the PRMP **"May Adversely Affect"** EFH for Pacific Coast groundfish and coastal pelagic fish species.

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X. Appendices

Appendix A. Management Objectives and Direction

Management Objectives and Direction

This section identifies the management objectives and direction that would apply under the Proposed RMP. Appendix B of the Draft RMP/EIS includes management objectives and direction for action alternatives analyzed in the Draft RMP/EIS, which is incorporated here by reference.

Under the Proposed RMP, the BLM would take actions that are specifically provided for in the management direction. In addition, the BLM may take actions that are not specifically mentioned in the management direction if they do not conflict with management direction and are consistent with the management objectives.

Proposed RMP

The Proposed RMP includes management objectives and management direction for land use allocations and for resource programs. The management objectives and management direction described for land use allocations apply only within that land use allocation. The management objectives and management direction described for resource programs apply across land use allocations, unless otherwise noted.

In the Proposed RMP, the Harvest Land Base and Late-Successional Reserve have specific, mapped sub-allocations, some of which have differing management objectives or management direction. For these sub-allocations, the management objectives and management direction of the broader allocation apply, as well as the management objectives or management direction specific to that sub-allocation. For example, the Harvest Land Base includes three sub-allocations: Low Intensity Timber Area, Moderate Intensity Timber Area, and Uneven-Aged Timber Area. In each of these three sub-allocations, both the management objectives and management direction described below for the Harvest Land Base and the individual sub-allocation applies.

In addition, the Riparian Reserve has differing management objectives and management direction for Riparian Reserve west of Highway 97 (i.e., in the Coos Bay, Eugene, Medford, Roseburg, and Salem Districts, and the portion of the Klamath Falls Field Office west of Highway 97) and Riparian Reserve east of Highway 97 (i.e., within the Eastside Management Area in the Klamath Falls Field Office). Although the management objectives are the same for all of the Riparian Reserve west of Highway 97, the management direction varies among three classes of subwatersheds. In addition, for the Riparian Reserve west of Highway 97, some management direction varies for the sub-allocations of the Riparian Reserve – Moist and Riparian Reserve – Dry.

The Proposed RMP requires the future allocation of marbled murrelet occupied stands[19] to the Late-Successional Reserve for occupied sites identified[20] after March 26, 2015 as a result of BLM marbled murrelet surveys in (1) all land use allocations within 35 miles of the Pacific Coast, and (2) Late-Successional Reserve and Riparian Reserve between 35–50 miles from the Pacific Coast and outside of exclusion Areas C and D (shown in **Figure 3-166**). In addition, the Proposed RMP requires the future

[19] Marbled murrelet occupied stand refers to all forest stands, regardless of age or structure, within ¼ mile (1,320 feet) of the location of marbled murrelet behavior indicating occupancy and not separated from the location of marbled murrelet behavior indicating occupancy by more than 328 feet of non-forest.

[20] In this context, "identified after March 26, 2015" means that survey data for occupied marbled murrelet sites was entered into the BLM corporate database after March 26, 2015.

allocation of red tree vole "habitat areas"[21] to the Late-Successional Reserve for occupied sites identified as a result of BLM red tree vole surveys within the range of the North Oregon Coast Distinct Population Segment of the red tree vole north of Highway 20.

{create Table of Contents}

[21] Red tree vole "habitat areas" are described in the management direction below.

Land Use Allocations

Congressionally Reserved Lands and the National Landscape Conservation System

- **Management Objectives**
- Conserve, protect, and restore the identified outstanding cultural, ecological, and scientific values of the National Landscape Conservation System and other congressionally designated lands.
- Preserve the wilderness character of designated Wilderness Areas.
- Preserve wilderness characteristics in Wilderness Study Areas in accordance with non-impairment standards as defined under the management policy for Wilderness Study Areas (BLM Manual 6330 – Management of BLM Wilderness Study Areas; USDI BLM 2012), until Congress either designates these lands as Wilderness or releases them for other purposes.
- Protect and enhance the free-flowing condition, water quality, and outstandingly remarkable values of eligible, suitable, and designated Wild and Scenic River corridors.[22]
- Provide protection to Wild and Scenic River corridors[1] that are suitable for inclusion as components of the National Wild and Scenic Rivers system until Congress makes a decision on designation.
- Provide protection to Wild and Scenic River corridors[1] that are eligible but have not yet been studied for suitability as components of the National Wild and Scenic Rivers system pending suitability evaluations.

- **Management Direction**
- In designated Wilderness Areas, exclude all prohibited uses of Wilderness (as defined in the Wilderness Act of 1964 and BLM Manual 6340 – Management of Designated Wilderness (USDI BLM 2012)), unless they have been demonstrated to be the minimum necessary (using the minimum requirements decision guide) to administer the area for the purposes of the Wilderness Act.
- Provide for the enjoyment and appreciation of the resources, qualities, values, and associated settings and primary uses within National Trail rights-of-way (including those classified as Scenic, Historical, and Recreational) and for which National Trails are designated.
- Enhance, promote, and protect the scenic, natural, and cultural resource values associated with current and future designated National Scenic and Historic Trails.
- Conduct silvicultural treatments in National Trail management corridors (including those classified as Scenic, Historical, and Recreational) only as needed to protect or maintain recreation setting characteristics or to achieve recreation objectives.
- Conduct management actions, including but not limited to fuels treatments, invasive species management, riparian or wildlife habitat improvements, forest management, and trail construction, in Wild and Scenic River corridors only if consistent with designated or tentative classifications and if any reductions in outstandingly remarkable values would be temporary and outstandingly remarkable values would be protected or enhanced over the long term.
- Do not use ground-disturbing equipment or aerial application of non-fugitive retardant in areas visible from the river within Wild and Scenic River corridors during wildfire management operations, except where the wildfire is deemed a threat to human safety or private property, or where use is essential for wildfire control.

[22] These corridors include all of the river classifications – Wild, Scenic, and Recreational.

- Conserve and develop the scenic, natural, and historic values of the Yaquina Head Outstanding Natural Area, and allow the continued use of the area for the purposes for which it was designated.

District-Designated Reserves

- **Management Objectives**
- Maintain the values and resources for which the BLM has reserved these areas from sustained-yield timber production.

- **Management Direction**
- Manage constructed facilities and infrastructure, such as seed orchards, roads, buildings, quarries, communication sites, pump chances, heliponds, and maintenance yards, as needed for the purposes for which the BLM constructed them.
- Maintain access to roads and facilities by removing hazard trees and blowdown. Logs may be retained as down woody debris, moved for placement in streams for fish habitat restoration, or removed through a commercial harvest.
- Manage seed orchards consistent with the Seed Orchard Records of Decision for Integrated Pest Management (Salem, Eugene, Medford Districts; USDI BLM 2005c, 2005d, 2006).

District-Designated Reserve – Timber Production Capability Classification

- **Management Objectives**
- *See District-Designated Reserves management objectives.*

- **Management Direction**
- Manage areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system, for other uses if those uses are compatible with the reason for which the BLM has reserved these lands (as identified by the Timber Production Capability Classification codes).
- Apply silvicultural or fuels treatments, including prescribed fire, that restore or maintain community-level structural characteristics, promote desired species composition, and emulate ecological conditions produced by historic fire regimes, in areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system,
- Designate additional lands as District-Designated Reserve – Timber Production Capability Classification through updates to the Timber Production Capability Classification system and remove those lands from the Harvest Land Base when examinations indicate that those lands meet the criteria for reservation.
- Un-designate lands as District-Designated Reserve – Timber Production Capability Classification and return those lands to the Harvest Land Base through updates to the Timber Production Capability Classification system when examinations indicate that those lands do not meet the criteria for reservation.

District-Designated Reserve – Lands Managed for their Wilderness Characteristics[23]

- **Management Objectives**
- Protect wilderness characteristics (i.e., roadlessness, naturalness, opportunities for solitude and primitive unconfined recreation, and identified supplemental values), while allowing competing resource demands that do not conflict with preserving long-term wilderness characteristics.

- **Management Direction**
- Allow mechanical vegetation treatment consistent with Visual Resource Management Class II for the purpose of improving ecological condition, contributing to threatened or endangered species recovery, or enhancing long-term wilderness characteristics.
- Do not construct new buildings or new temporary or permanent roads.
- Allow fuels treatments, invasive species management, riparian or wildlife habitat improvements, forest management, and other vegetation management only if any reductions in wilderness characteristics are temporary and wilderness characteristics are protected over the long term.
- Do not use ground-disturbing equipment or aerial application of non-fugitive retardant during wildfire management operations, except where the wildfire is deemed a threat to human safety or private property or where use is essential for wildfire control.
- For lands identified for protection of wilderness characteristics where the BLM-administered lands rely on adjoining Federal lands being managed to protect the same values to meet the size criteria (BLM Manual 6310 – Conducting Wilderness Characteristics Inventory on BLM Lands; USDI BLM 2012) and the agency managing the adjoining lands revises its land use plan to no longer protect wilderness characteristics, the BLM-administered lands will no longer meet the minimum size criteria and thus will no longer possess wilderness characteristics.
    - Wilderness characteristics will no longer be protected on these lands and the accompanying land use plan allocations (e.g., right-of-way exclusion, Visual Resource Management Class II) applied specifically to protect the wilderness characteristics will automatically be dropped as part of plan maintenance.
    - These lands will then be managed consistent with the land use allocations, management objectives, and management direction of comparable or adjacent BLM-administered lands.

Eastside Management Area

Eastside Management Area – Forested Lands

- **Management Objectives**
- Manage forested lands on a sustainable basis for multiple uses including wildlife and riparian habitats, recreational needs, cultural resources, community stability, and commodity production, including commercial timber and other forest products.
- Promote development of fire-resilient forests.

[23] These objectives and direction apply to lands outside of designated Wilderness Areas and Wilderness Study Areas that the BLM has identified as having wilderness characteristics and for which the BLM is proposing to manage for the protection of those wilderness characteristics.

- Offer for sale the probable sale quantity of 350 Mbf of timber per year.

- **Management Direction**
- Utilize uneven-aged management when managing forest stands. This will include use of a combination of harvesting methods including thinning, single tree selection harvest, and group selection harvest.
- Conduct uneven-aged management harvests for the removal and sale of timber or biomass. Harvests will be applied to stands of any age, and throughout all diameters, for any of the following purposes:
  - Maintain growth and vigor of the stand.
  - Adjust stand composition or structure.
  - Recover anticipated mortality.
  - Reduce stand susceptibility to natural disturbance such as fire, windstorm, disease, or insect infestation.
  - Improve merchantability and value.
  - Promote multi-structural conditions in forest stands.
- Retain an overstory component of trees in uneven-aged management harvest units to provide shade, reduce wind speed, and promote overall fire resiliency in the stand. Maintain relative density between 15 and 55, but allow relative density to vary outside of this range based on vegetative type, site productivity, and fire risk factors such as slope, aspect, and elevation.
- Incorporate group selection harvest of up to 5 acres in size individually, and an aggregate level of up to 25 percent of the area of the treated stand within uneven-aged management harvest units when needed to maintain or develop desired species composition, achieve desired diameter distribution, or address natural disturbances.
- Implement timber salvage harvest after disturbances as needed to recover economic value and to minimize commercial loss or deterioration of damaged trees. Retain overstory trees as needed within regeneration harvest areas to provide for shade, frost protection, seeding, or other silvicultural needs.
- Convert lands historically supporting conifer species (other than juniper) that are currently growing primarily brush or hardwoods to conifer species suitable to the site.
- Conduct prescribed burns, and mechanical or hand fuels treatments to reduce the potential for uncharacteristic wildfires. Apply maintenance treatments at appropriate intervals to retain or improve fire resilient conditions.
- Apply pre-commercial thinning to forest stands to achieve long-term management objectives.
- Apply pruning to enhance timber value and for fuels and disease management.
  - During silvicultural treatment of stands, retain existing—
  - snags ≥ 6” dbh
  - down woody material ≥ 6” in diameter at the large end and > 20’ in length

  except for safety, operational, or fuels reduction reasons. Retain snags ≥ 6” dbh felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.
- Create new snags when the existing level of snags > 16” DBH is less than 2 snags per acre on the average over the treatment stand, to meet this level. When the existing level of down woody debris over 12” in diameter and 12 feet in length is less than a total of 40 feet per acre over the treatment stand, create new down woody debris to meet this level. Also:
  - Snag and down woody material levels described above will be met by any combination of the creation of new snags and down woody material from live conifer trees and the retention of existing levels of snags (Class I and Class II) and down woody material (Class I and Class II). If existing levels of snags and down woody material are insufficient to meet these levels in a thinning project, the desired levels can be satisfied by including in the project decision the

creation of snags and down woody material within 5 years to meet these levels after completion of the harvest or associated fuels treatment.
  - Snag and down woody material retention or creation levels will be met at the scale of the harvest unit and are not intended to be attained on every acre. Snag and down woody material retention will be variable per acre throughout the treatment area.
  - If the pre-harvest quadratic mean diameter of the stand is less than 16", then the snags to be created or retained will be 2 snags per acre with a diameter larger than the quadratic mean diameter of the stand.

Eastside Management Area – Non-forested Lands

- **Management Objectives**
- Manage non-forested lands with the intent of maintaining or improving wildlife habitat and rangeland conditions based on ecological site parameters. Where conditions are currently late seral or potential natural community, maintain these conditions. Where conditions are early or mid seral, improve conditions towards late seral or potential natural community.
- Manage non-forested lands for multiple uses in addition to those listed above including recreational needs, community stability, and commodity production. Commodities include firewood, logs, biomass, chips, and other products and byproducts from juniper woodlands and rangelands.
- Promote development of fire-resilient woodlands and rangelands.
- Provide for the conservation of Bureau Special Status Species.

- **Management Direction**
- Treat vegetation communities encroached by invasive juniper using prescribed fire, mechanical, chemical, and manual juniper removal treatments.
- Manage and retain juniper woodlands on sites they occupied historically (pre-European settlement), as identified by ecological site inventories or other methods.
- Cut encroaching juniper that hinders attainment of desired forage conditions to maintain and restore forage for big game and to restore unoccupied or historic greater sage-grouse habitat. Remove, utilize, or pile and burn cut juniper.
- Plant or seed native species to improve unoccupied or historic greater sage-grouse habitat.
- Retain old-growth 'legacy' juniper when it meets the following definition: Individual trees that likely originated in the pre-settlement period, before 1870. These trees are commonly found in rocky areas where vegetation is sparse and fire frequency is naturally low. Characteristics of old-growth juniper include some or all of the following:
  - Flat, rounded, broad at top, or irregular crown (as opposed to the more pointed tops of younger trees) or dead "spike" top
  - Numerous dead branches
  - Coarse, bright yellow-green lichen (*Letharia* or wolf lichen) covered branches
  - Large diameter lower branches
  - Large diameter trunk relative to height
  - Spirally twisted bark and deep furrows on the trunk
  - Hollow trunk
- Apply prescribed burns, mechanical or hand fuels treatments to reduce the potential for uncharacteristic wildfires. Apply maintenance treatments at appropriate intervals to retain or improve fire-resilient conditions.
- Manage unoccupied or historic greater sage-grouse habitat consistent with the Greater Sage-Grouse Conservation Assessment and Strategy for Oregon and with the Oregon Sage-Grouse Action Plan.

- Maintain or enhance wildlife habitat on rangelands.
- Continue the existing road closures to motorized vehicles, except for administrative purposes, between November 1 and April 15 in the designated closure areas within the Interstate and Klamath Deer Winter Ranges. These seasonal road closures include South Gerber, Willow Valley, Harpold Ridge, Bryant Mountain, North Bryant, Windy Ridge, Stukel Mountain, and Lorella.
- Plant or seed native forage species for deer and elk along roadsides, skid trails, and on disturbed areas, or create forage plots when forage quality is determined to be a limiting factor in achieving the management goals of the Oregon Department of Fish and Wildlife. Include forage retention requirements for wildlife when implementing silvicultural treatments or habitat management activities.

Eastside Management Area – Riparian Reserve

- **Management Objectives**
- Provide for conservation of Bureau Special Status fish and other Bureau Special Status riparian-associated species.
- Provide for the riparian and aquatic conditions that supply stream channels with shade, sediment filtering, leaf litter and large wood sources, and stream bank stability.
- Maintain and restore water quality and hydrologic functions.
- Maintain and restore access to stream channels for all life stages of aquatic species.
- Maintain and restore the proper functioning condition and ecological site potential of riparian and wetland areas.

- **Management Direction**

Table B-239. Eastside Management Area - Riparian Reserve distances by water feature.

Feature	Riparian Reserve Distance*
Fish-bearing streams and/or perennial streams	150 feet on each side of a stream channel from the ordinary high water line or from the outer edge of the channel migration zone for low-gradient alluvial shifting channels.
Non-fish-bearing intermittent streams, all lakes, all natural ponds, constructed water impoundments > 1 acre, constructed ponds > 1 acre, and wetlands > 1 acre	100 feet on each side of the water feature from the ordinary high water line.
Wetlands < 1 acre, constructed water impoundments < 1 acre, and constructed ponds < 1 acre.	25 feet on each side of the water feature from the ordinary high water line.

* Reported distances are measured as slope distance.

All Water Features

- Implement instream and riparian restoration activities, such as gravel augmentation, aspen restoration, or placement of boulders and large wood in streams, including tree lining from adjacent riparian areas for all streams. Use manual or ground-based methods. Place an emphasis on streams that have high intrinsic potential for fish, high priority fish populations (such as those defined in recovery plans), or high levels of chronic sediment inputs.

- Remove or modify human-caused fish passage barriers to restore access to stream channels for all life stages of aquatic species.
- Fall and move trees as needed for safety or operational reasons, including, but not limited to, hazard tree removal, creation of yarding corridors, and road construction, improvement, or maintenance.
- Retain existing snags and down woody material during silvicultural treatment of stands, except for safety, operational, or fuels reduction reasons. Retain snags felled for safety or operational reasons as down woody material.
- Apply vegetation treatments and prescribed burns as needed to reduce the potential for uncharacteristic wildfires.
    - Do not conduct timber salvage, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.
- Manage livestock grazing at a level that meets Rangeland Health Standards (USDI BLM 1997) and allows for maintenance or development of an upward trend toward the proper functioning condition of riparian and wetland plant communities. Implement practices such as installing and maintaining livestock exclosures, managing season of use and intensity, developing off-stream watering facilities, and other techniques to attain this condition.
- Remove conifer encroachment where conifers are interfering with the natural vegetation community type, or where excessive erosion may occur.
- Apply Best Management Practices (BMPs) for roads, stream and riparian restoration work, and vegetation management as needed to maintain or restore water quality and hydrologic function (**Appendix J**).

Fish-bearing Streams and Perennial Streams

- Conduct thinning and other vegetation treatments to accelerate the development of potential natural forest stand conditions including late-successional stand characteristics and native riparian shrub communities.
- Do not conduct thinning and other vegetation treatments using ground-based machinery within 75 feet (slope distance) on either side of the edge of the stream channel, as measured from the ordinary high water line.
- Do not conduct thinning and other vegetation treatments using ground-based machinery on slopes > 35 percent, soils sensitive to displacement, rutting, or compaction, or in slide-prone areas.
- Retain and promote long-term site-potential shade conditions.

Non-fish-bearing Intermittent Streams

- Conduct thinning and other vegetation treatments to speed the development of large trees to provide an eventual source of large woody material to stream channels.
- Do not conduct thinning and other vegetation treatments using ground-based machinery on slopes > 35 percent, soils sensitive to displacement, rutting, or compaction, or in slide-prone areas.

Lakes, Natural Ponds, and Wetlands

- Conduct thinning and other vegetation treatments within the Riparian Reserve to speed the development of potential natural vegetation communities.
- Do not conduct thinning and other vegetation treatments using ground-based machinery within 50 feet (slope distance) on each side of the ordinary high water line of the water feature, or seasonally saturated soils (whichever is greatest).

Constructed Water Impoundments and Constructed Ponds

- Follow inspection guidelines for BLM infrastructure (e.g., dams and spillway structures), and implement maintenance and repair as needed.
- Dredge constructed water impoundments as necessary to maintain capacity.
- Maintain vegetation, access, and plumbing associated with fire water sources for all types of firefighting equipment (e.g., engines, aircraft, and tenders).

Harvest Land Base

- **Management Objectives**
- Manage forest stands to achieve continual timber production that can be sustained through a balance of growth and harvest.
- Offer for sale the declared Allowable Sale Quantity of timber.
- Recover economic value from timber following disturbances, such as fires, windstorms, disease, or insect infestations.
- In harvested or disturbed areas, ensure the establishment and survival of desirable trees appropriate to the site and enhance their growth.
- Enhance the economic value of timber in forest stands.

- **Management Direction**
- Conduct silvicultural treatments to contribute timber volume to the Allowable Sale Quantity.
- Conduct silvicultural treatments to enhance timber values and to reduce fire risks and insect and disease outbreaks.
- Implement timber salvage harvest after disturbances to recover economic value and to minimize commercial loss or deterioration of damaged trees.
- Employ site preparation methods such as mechanical treatments (e.g., machine piling), manual treatments (e.g., brushing), and prescribed burns to prepare newly harvested and inadequately stocked areas for the regeneration of desirable tree species.
- Manually apply supplemental nutrients where necessary to enhance vigor and growth of desired vegetation. Do not use aerial application methods.
- During commercial thinning, selection harvest,[24] or regeneration harvest treatments of stands, retain existing—
  - Snags > 20” DBH
  - Snags 6-20” DBH in decay classes III, IV, and V (BLM Manual H-5250-1 Forest Survey Handbook)
  - Down woody material > 20” in diameter at the large end and > 20’ in length
  - Down woody material 6-20” in diameter at the large end and > 20’ in length in decay classes III, IV, and V (BLM Manual H-5250-1 Forest Survey Handbook)

  except for safety, operational, or fuels reduction reasons. Retain snags ≥ 6” DBH felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.

[24] **Selection harvest** is a type of commercial harvesting. Selection harvesting generally involves removing individual trees or groups of trees up to four acres in size and is used as part of an uneven-aged management regime, or to create uneven-aged stands.

- If not suitable for commercial removal, make felled hazard trees available for habitat restoration purposes in any land use allocation.
- When implementing commercial harvest,[25] except timber salvage, create new snags in the amounts and sizes specified in **Table B-240** within 1 year of completion of yarding the timber in the timber sale. If insufficient trees are available in the size class specified, use trees from the largest size class available. Meet snag creation levels as an average at the scale of the harvest unit; snag creation levels are not required to be attained on every acre. When creating the required number of snags, locate them according to the following criteria:
  - Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.
  - Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
  - Concentrate the creation of snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Meet snag creation levels with trees from any species.

Table B-240. Snag creation levels within the Harvest Land Base.

District/ Field Office	Province	Number of Snags/Acre Created Within 1 Year of Yarding the Timber in the Timber Sale		
		> 20” DBH	> 10” DBH	Total Snags
Coos Bay	All	1	-	1
Eugene	OR Coast Range	1	-	1
	Western Cascades	1	-	1
Klamath Falls	All	1	-	1
Medford	All	-	-	-
Roseburg	OR Coast Range	3	-	3
	Western Cascades	3	3	6
	Klamath	-	-	-
Salem	OR Coast Range	1	-	1
	Western Cascades	1	-	1

[25] In the context of management direction for the Harvest Land Base, **commercial harvest** means stand harvesting in which some or all of the cut trees are removed from the stand for timber volume and a monetary value assessed. Commercial harvest in this context does not include the following:
  - Individual tree falling
  - Stand thinning in which all of the cut trees are left in the stand for restoration purposes or the cut trees are removed for firewood or other non-commercial harvest
  - Fuels reduction treatments in which cut trees are burned, chipped, or otherwise disposed of without removal from the stand for timber

Commercial harvest may be implemented through a variety of mechanisms, including timber sale contracts, stewardship agreements, or other types of contracts.

Harvest Land Base – Low Intensity Timber Area (LITA)

- **Management Objectives**
- *See Harvest Land Base management objectives.*
- Provide complex early successional ecosystems.
- Develop diverse late-successional ecosystems for a portion of the rotation.
- Provide a variety of forest structural stages distributed both spatially and temporally.

- **Management Direction**
- *See Harvest Land Base management direction.*
- Apply regeneration harvest for any of the following reasons:
  - Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.
  - Adjust the age class distribution in the LITA in each sustained-yield unit.
  - Manage insect and disease infestations.
  - Convert stands capable of supporting conifer species that are currently growing primarily hardwoods or shrubs to a mix of conifer and hardwood species suitable to the site.
  - Increase or maintain vegetative species diversity.
  - Restore and maintain habitat for Bureau Special Status Species.
  - Create growing space for hardwood and pine species persistence and regeneration.
  - Produce complex early successional ecosystems.
  - Reset stand development in overly dense stands that would not respond well to commercial thinning.
- In each regeneration harvest unit, retain 15–30 percent of pre-harvest stand basal area in live trees. Retain trees in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. Include among retained trees all trees that are both ≥ 40" DBH and that the BLM identifies were established prior to 1850, except where removal is necessary for safety or operational reasons. The BLM identification of trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.
- After regeneration harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 130 trees per acre within 5 years of harvest.
- Conduct commercial thinning for any of the following reasons:
  - Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.
  - Recover anticipated mortality.
  - Adjust stand composition or dominance.
  - Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.
  - Improve stand merchantability and value.
  - Increase or maintain vegetative species diversity.
  - Promote or enhance the development of structural complexity.
  - Create growing space for the creation or augmentation of Bureau Special Status plant populations.
  - Create growing space for hardwood and pine persistence and regeneration.
- Maintain stand densities through commercial thinning above densities needed to occupy the site, but below densities that will result in loss of stand vigor and health.
  - Conduct thinning to result in a stand average relative density between 25 percent and 45 percent after harvest.

- Leave untreated areas (skips) and group selection openings[26] to provide increased structural complexity in the post-treatment stand. Do not exceed 10 percent of the thinned portion of the stand in group selection openings after harvest. Leave at least 5 percent of the planned harvest unit in untreated skips.
- Include among retained trees all trees that are both ≥ 40" DBH and that the BLM identifies were established prior to 1850, except where removal is necessary for safety or operational reasons. The BLM identification of trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.

- Implement timber salvage harvest after disturbance events to recover economic value and to minimize commercial loss or deterioration of damaged trees where the BLM determines that removal is economically viable.
  - In timber salvage harvest units, retain at least 15 percent of pre-harvest stand basal area in live trees or snags in individual harvest units. Retain trees and snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.
  - After salvage harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 130 trees per acre within 5 years of harvest.
- For areas without timber salvage harvest after disturbance events, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 130 trees per acre (including surviving green trees) within 10 years of the disturbance event, to the extent possible given safety and operational constraints.

Harvest Land Base – Moderate Intensity Timber Area (MITA)

- **Management Objectives**
- *See Harvest Land Base management objectives.*
- Provide complex early successional ecosystems.
- Develop diverse late-successional ecosystems for a portion of the rotation.
- Provide a variety of forest structural stages distributed both temporally and spatially.

- **Management Direction**
- *See Harvest Land Base management direction.*
- Conduct regeneration harvest for any of the following reasons:
  - Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.
  - Adjust the age class distribution in the MITA in each sustained-yield unit.
  - Manage insect and disease infestations.
  - Convert stands capable of supporting conifer species that are currently growing primarily hardwoods or shrubs to a mix of conifer and hardwood species suitable to the site.
  - Increase or maintain vegetative species diversity.
  - Restore and maintain habitat for Bureau Special Status Species.
  - Create growing space for hardwood and pine species persistence and regeneration.
  - Produce complex early successional ecosystems.

[26] **Group selection openings** are defined as areas with ≤ 2 live trees ≥ 7" DBH per acre. Roads, landings, yarding corridors, and skid trails do not count as group selection openings.

    - Reset stand development in overly dense stands that would not respond well to commercial thinning.
- In each regeneration harvest unit, retain 5–15 percent of pre-harvest stand basal area in live trees. Retain trees in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. Include among retained trees all trees that are both ≥ 40" DBH and that the BLM identifies were established prior to 1850, except where removal is necessary for safety or operational reasons. The BLM identification of trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.
- After regeneration harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 150 trees per acre within 5 years of harvest.
- Conduct commercial thinning for any of the following reasons:
    - Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.
    - Recover anticipated mortality.
    - Adjust stand composition or dominance.
    - Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.
    - Improve stand merchantability and value.
    - Increase or maintain vegetative species diversity.
    - Promote or enhance the development of structural complexity.
    - Create growing space for the creation or augmentation of Bureau Special Status plant populations.
    - Create growing space for hardwood and pine persistence and regeneration.
- Maintain stand densities through commercial thinning above densities needed to occupy the site, but below densities that will result in loss of stand vigor and health.
    - Conduct thinning to result in stand average relative density between 25 percent and 45 percent after harvest.
    - Leave untreated areas (skips) and group selection openings to provide increased structural complexity in the post-treatment stand. Do not exceed 10 percent of the thinned portion of the stand in group selection openings after harvest. Leave at least 5 percent of the planned harvest unit in untreated skips.
    - Include among retained trees all trees that are both ≥ 40" DBH and that the BLM identifies were established prior to 1850, except where removal is necessary for safety or operational reasons. The BLM identification of trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.
- Implement timber salvage harvest after disturbance events to recover economic value and to minimize commercial loss or deterioration of damaged trees where the BLM determines that removal is economically viable.
    - In timber salvage harvest units, retain at least 5 percent of pre-harvest stand basal area in live trees or snags in individual harvest units. Retain trees and snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.
    - After salvage harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 150 trees per acre within 5 years of harvest.
- For areas without timber salvage harvest after disturbance events, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 150 trees per acre (including surviving green trees) within 10 years of the disturbance event, to the extent possible given safety and operational constraints.

Harvest Land Base – Uneven-aged Timber Area (UTA)

- **Management Objectives**
- *See Harvest Land Base management objectives.*
- Increase diversity of stocking levels and size classes within and among the stands.

- **Management Direction**
- *See Harvest Land Base management direction.*
- Utilize integrated vegetation management[27] in designing and implementing treatments. Conduct integrated vegetation management for any of the following:
  - Produce timber to contribute to the attainment of the declared Allowable Sale Quantity.
  - Promote the development and retention of large, open grown trees and multi-cohort stands.
  - Develop diverse understory plant communities.
  - Increase or maintain vegetative species diversity.
  - Restore and maintain habitat for Bureau Special Status Species.
  - Promote or enhance the development of structural complexity and heterogeneity.
  - Create growing space for hardwood and pine persistence and regeneration.
  - Create and maintain areas for hardwood and shrub dominance.
  - Adjust stand composition or dominance.
  - Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.
- In forest stands ≥ 10 acres treated with selection harvest or commercial thinning, harvest to result in stand average relative density between 20 percent and 45 percent after harvest.
  - Do not create group selection openings more than 4 acres in size.
  - Do not create group selection openings on more than 30 percent of the stand area.
  - Leave untreated areas (skips) on at least 10 percent of the stand area.
- When regenerating group selection openings created from selection harvest or commercial thinning, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to an average density across the opening of at least 150 trees per acre within 5 years of harvest.
- When treating stands with integrated vegetation management, retain dominant Douglas-fir (*Pseudotsuga menziesii*) and pine (*Pinus* spp.) trees that are both ≥ 36" DBH and that the BLM identifies were established prior to 1850 and madrone (*Arbutus menziesii*), bigleaf maple (*Acer macrophyllum*), and oak (*Quercus* spp.) trees > 24" DBH, except where removal is necessary for safety or operational reasons.
  - The BLM identification of Douglas-fir and pine trees established prior to 1850 may be based on any of a variety of methods, such as evaluation of bark, limb, trunk, or crown characteristics or increment coring, at the discretion of the BLM.
  - Protect and develop these retained trees by reducing competition to improve vigor and resistance to fire, drought, disease, and other disturbances and removing adjacent fuels to reduce risk of fire-related mortality.

[27] **Integrated vegetation management** includes the use of a combination of silvicultural or other vegetation treatments, fire and fuels management activities, harvest methods, and restoration activities. Activities include, but are not limited to, vegetation control, planting, snag creation, prescribed fire, biomass removal, thinning, single tree selection harvest, and group selection harvest.

- Apply prescribed fire for any of the following:
  - Promote the development and retention of large, open-grown trees and multi-cohort stands.
  - Develop diverse understory plant communities.
  - Increase or maintain vegetative species diversity.
  - Restore and maintain habitat for Bureau Special Status Species.
  - Promote or enhance the development of stand structural complexity and heterogeneity.
  - Create growing space for hardwood and pine persistence and regeneration.
  - Create and maintain areas for hardwood and shrub dominance.
  - Adjust stand composition or dominance.
  - Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.
- Treat fuels to improve, enhance, or maintain landscape and ecosystem resilience. Identify sites for fuels treatments based on risk of large-scale, high-intensity fire, operationally strategic locations, and near highly valued resources and assets.
- Modify fuel loading to produce fire behavior and fire effects representative of the natural fire regime. Implement interim fuels treatments (e.g., hand pile and burn) in areas that are highly departed from natural conditions in order to facilitate prescribed fire in the future.
- Implement prescribed fire in low/mixed severity or high-frequency fire regimes to emulate historic fire function and processes. Apply prescribed fire across the landscape to create a mosaic of spatial and temporal stand conditions and patterning (appropriate to the fire regime).
- Implement timber salvage harvest after disturbance events to recover economic value and to minimize commercial loss or deterioration of damaged trees where the BLM determines that removal is economically viable.
  - In timber salvage harvest units, retain at least 5 percent of pre-harvest stand basal area in live trees or snags in individual harvest units. Retain trees and snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.
  - After salvage harvest, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to a stand-level average of at least 150 trees per acre within 5 years of harvest.

Late-Successional Reserve

- **Management Objectives**
  - Maintain[28] nesting-roosting habitat for the northern spotted owl and nesting habitat for the marbled murrelet.

[28] **Maintain northern spotted owl nesting-roosting habitat** refers to a silvicultural activity that changes a conifer forest stand but maintains structural characteristics such that the stand continues to support the same northern spotted owl life history requirements: nesting-roosting habitat continues to support northern spotted owl nesting-roosting. Scientific findings support the idea that conifer forest stands can be altered in a manner that does not necessarily change their use by northern spotted owls (see the summary in the Revised Recovery Plan for the Northern Spotted Owl, USDI FWS 2011, p. III-15). Although structural characteristics vary across the northern spotted owl's range, northern spotted owl nesting-roosting habitat generally is characterized by conifer stands with a multi-layered, multispecies canopy dominated by large (> 30" DBH) conifer overstory trees, and an understory of shade-tolerant conifers or hardwoods, ≥ 60 percent canopy cover, substantial decadence in the form of large, live conifer trees with deformities (such as cavities, broken tops, and dwarf mistletoe infections; numerous large snags), ground cover characterized by large accumulations of logs and other woody debris, and a canopy that is open enough to allow northern spotted owls to fly within and beneath it. Activities needed to protect the overall health of

- Promote the development of nesting-roosting habitat for the northern spotted owl in stands that do not currently support northern spotted owl nesting and roosting.
- Promote the development of nesting habitat for the marbled murrelet in stands that do not currently meet nesting habitat criteria.
- Promote the development and maintenance of foraging habitat for the northern spotted owl, including creating and maintaining habitat to increase diversity and abundance of prey for the northern spotted owl.

- **Management Direction**
- Manage for large blocks of northern spotted owl nesting-roosting habitat that support clusters of reproducing spotted owls, are distributed across the variety of ecological conditions, and are spaced to facilitate the movement and survival of spotted owls dispersing between and through the blocks.
- In stands that are currently northern spotted owl nesting-roosting habitat, maintain nesting-roosting habitat function, regardless of northern spotted owl occupancy.
- Protect[29] stands of older, structurally-complex conifer forest. Such stands are a subset of, and represent the highest value, northern spotted owl nesting-roosting habitat.
  - Undertake activities such as individual tree removal, including the felling of hazard trees and stream logs, and the construction of linear and non-linear rights-of-way or other facilities, including communication sites, as long as northern spotted owl nesting-roosting habitat continues to support northern spotted owl nesting and roosting at the stand level, and northern spotted owl dispersal habitat continues to support northern spotted owl movement and survival at the landscape level.
- Protect marbled murrelet occupied stands. In this context, **protect marbled murrelet occupied stands** means to prohibit activities in the occupied stand except for the following: felling of live or dead hazard trees, felling trees for habitat restoration, and the construction or maintenance of linear and nonlinear rights-of-way, spur roads, yarding corridors or other facilities, as long as the occupied stand continues to support marbled murrelet nesting. Implement wildfire management actions and activities needed to protect the overall health of the stand or adjacent stands, such as fuels reduction

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the stand or adjacent stands, such as fuels reduction and insect and disease control, and wildfire management actions/activities may occur even if they downgrade or remove northern spotted owl habitat.

Maintain marbled murrelet habitat refers to a silvicultural activity that changes a conifer forest stand but maintains structural characteristics such that the stand continues to support marbled murrelet nesting opportunities. Activities needed to protect the overall health of the stand or adjacent stands, such as fuels reduction and insect and disease control, and wildfire management actions/activities may occur even if they remove marbled murrelet habitat.

[29] **Protect older, structurally-complex conifer forest** means to prohibit harvesting activities in a conifer forest stand except as provided in this definition. Harvesting activities are limited to the following: felling of live or dead hazard trees and logs for streams, the construction, modification, maintenance and removal of linear and nonlinear rights-of-way, spur roads, yarding corridors or other facilities, as long as the forest stand continues to support the same northern spotted owl and marbled murrelet life history requirements: nesting-roosting habitat continues to support northern spotted owl nesting-roosting; dispersal habitat continues to support northern spotted owl movement and survival; and marbled murrelet nesting habitat continues to support marbled murrelet nesting. Activities needed to protect the overall health of the stand or adjacent stands, such as fuels reduction and insect and disease control, and wildfire management actions/activities may occur even if they downgrade or remove northern spotted owl habitat or remove marbled murrelet habitat.

and insect and disease control, as long as the occupied stand continues to support marbled murrelet nesting.

- During silvicultural treatment of stands, retain existing—
  - snags ≥ 6" dbh
  - down woody material ≥ 6" in diameter at the large end and > 20' in length

except for safety, operational, or fuels reduction reasons. Retain snags ≥ 6" dbh felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.

- Cut individual green trees in the Late-Successional Reserve and move for placement in streams for fish habitat restoration.
- Maintain access to roads and facilities by removing hazard trees and blowdown. Logs may be retained as down woody debris, moved for placement in streams for fish habitat restoration, or removed through a commercial harvest.
- In stands that are not northern spotted owl nesting-roosting habitat, apply silvicultural treatments to speed the development of northern spotted owl nesting-roosting habitat or improve the quality of northern spotted owl nesting-roosting habitat in the stand or in the adjacent stand in the long term. Limit such silvicultural treatments (other than forest pathogen treatments) to those that do not preclude or delay by 20 years or more the development of northern spotted owl nesting-roosting habitat in the stand and in adjacent stands, as compared to development without treatment. Allow silvicultural treatments that do not meet the above criteria if needed to treat infestations or reduce the spread of forest pathogens.

- Utilize integrated vegetation management[30] in designing and implementing treatments. Conduct integrated vegetation management for any of the following:
  - Promote the development and retention of large, open grown trees and multi-cohort stands.
  - Develop diverse understory plant communities.
  - Increase or maintain vegetative species diversity.
  - Restore and maintain habitat for Bureau Special Status species.
  - Promote or enhance the development of structural complexity and heterogeneity.
  - Create growing space for hardwood and pine persistence and regeneration.
  - Create and maintain areas for hardwood and shrub dominance.
  - Adjust stand composition or dominance.
  - Reduce stand susceptibility to disturbances such as a fire, windstorm, disease, or insect infestation.
- In stands ≥ 10 acres treated with selection harvest or commercial thinning,
  - Conduct harvest to result in stand average relative density percent between 20 percent and 45 percent after harvest.
  - Do not create group selection openings[31] more than 4 acres in size.
  - Do not create group selection openings on more than 25 percent of the stand area.
  - Leave untreated skips on at least 10 percent of the stand area.
- In stands < 10 acres treated with selection harvest or commercial thinning, do not create group selection openings more than 2.5 acres in size.

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[30] **Integrated vegetation management** includes the use of a combination of silvicultural or other vegetation treatments, fire and fuels management activities, harvest methods, and restoration activities. Activities include but are not limited to vegetation control, planting, snag creation, prescribed fire, thinning, single tree selection harvest, and group selection harvest.

[31] **Group selection openings** are defined as areas with ≤ 2 live trees ≥ 7" DBH per acre. Roads, landings, yarding corridors, and skid trails do not count as group selection openings.

- When regenerating group selection openings created from selection harvest or commercial thinning, use natural or artificial regeneration to reforest a mixture of species appropriate to the site to an average density across the group selection openings of at least 75 trees per acre within 5 years of harvest.
- When conducting commercial harvest, create new snags in the amounts and sizes specified in **Table B-241** within one year of completion of yarding the timber in the timber sale. If insufficient trees are available in the size class specified, use trees from the largest size class available. Meet snag creation levels as an average at the scale of the harvest unit; snag creation levels need not be attained on every acre. When creating the required number of snags, locate them according to the following criteria:
  - Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.
  - Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
  - Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years.

Table B-241. Snag creation levels within the Late-Successional Reserve and Riparian Reserve.

District/ Field Office	Province	Snags/Acre		
		> 20” DBH	> 10” DBH	Total Snags
Coos Bay	All	5	5	10
Eugene	OR Coast Range	5	5	10
	Western Cascades	5	20	25
Klamath Falls	All	2	5	7
Medford	All	1	1	2
Roseburg	OR Coast Range	6	7	13
	Western Cascades	6	25	31
	Klamath	1	1	2
Salem	OR Coast Range	5	5	10
	Western Cascades	5	20	25

- When conducting fuels reduction or prescribed fire treatments, retain down woody material at levels specified in **Table B-242** post-treatment. Meet down wood levels as an average at the scale of the treatment area following the treatment; down wood levels need not be attained on every acre.

Table B-242. Down woody material retention levels when implementing fuels reduction or prescribed fire treatments within the Late-Successional Reserve and Riparian Reserve.

District/ Field Office	Province	Down Wood Percent Cover*
Coos Bay	All	6%
Eugene	OR Coast Range	6%
	Western Cascades	10%
Klamath Falls	All	3%
Medford	All	2%
Roseburg	OR Coast Range	6%
	Western Cascades	10%
	Klamath	2%
Salem	OR Coast Range	6%
	Western Cascades	10%

* Percent cover of down wood > 4" diameter.

- Do not conduct timber salvage, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.

Late-Successional Reserve – Dry

- **Management Objectives**
  - *See Late-Successional Reserve management objectives.*
- Enable forests to: (1) recover from past management measures, (2) respond positively to climate-driven stresses, wildfire and other disturbance with resilience, (3) ensure positive or neutral ecological impacts from wildfire, and (4) contribute to northern spotted owl recovery.
- Reduce the risk of loss of key late-successional structure through the development of vertical and horizontal heterogeneity.
- Increase diversity of stocking levels and size classes within the stand and the landscape.

- **Management Direction**
- *See Late-Successional Reserve management direction.*
- Apply selection harvest or commercial thinning treatments in Late-Successional Reserve – Dry in the South River Field Office of Roseburg District to at least 4,500 acres per decade.
- Apply selection harvest or commercial thinning treatments in Late-Successional Reserve – Dry in the Medford District to at least 17,000 acres per decade.
- When treating stands with integrated vegetation management, retain dominant Douglas-fir (*Pseudotsuga menziesii*) and pine (*Pinus* spp.) trees that are ≥ 36" DBH and were established prior to 1850 and madrone (*Arbutus menziesii*), bigleaf maple (*Acer macrophyllum*), and oak (*Quercus* spp.) trees > 24" DBH, except where removal is necessary for safety or operational reasons.
  - Identify Douglas-fir and pine trees established prior to 1850 for retention based on a BLM evaluation of bark, limb, trunk, and crown characteristics.
  - Protect and develop these retained trees by reducing competition to improve vigor and resistance to fire, drought, disease, and other disturbances and removing adjacent fuels to reduce risk of fire related mortality.

- Treat fuels to improve, enhance, or maintain landscape and ecosystem resilience. Identify sites for fuels treatments based on risk of large-scale crown fire, operationally strategic locations, and potential for hazard reduction near highly valued resources.
- Modify fuel beds to produce characteristic fire behavior and fire effects representative of the fire regime. Implement interim fuels treatments (e.g., hand pile and burn) in areas that are highly departed from natural conditions in order to facilitate prescribed fire in the future.
- Apply prescribed fire in low/mixed severity or high-frequency fire regimes to emulate historic fire function and processes. Apply prescribed fire across the landscape to create a mosaic of spatial and temporal stand conditions and patterning (appropriate to the fire regime). Based on site-specific considerations, take measures to prevent and control fire regime altering species.
- Apply prescribed fire and mechanical or hand fuels treatments to reduce the potential for uncharacteristic wildfires. Apply maintenance treatments at appropriate intervals to retain or improve fire-resilient conditions.
  - Maintain access to roads and facilities by removing hazard trees and blowdown. Logs may be retained as down woody debris, moved for placement in streams for fish habitat restoration, removed through a commercial timber sale, or treated as necessary for fuels reduction.

Riparian Reserve (West of Highway 97)

Riparian Reserve – Moist

- **Management Objectives**
- Contribute to the conservation and recovery of ESA-listed fish species and their habitats and provide for conservation of Bureau Special Status fish and other Bureau Special Status riparian-associated species.
- Maintain and restore natural channel dynamics, processes, and the proper functioning condition of riparian areas, stream channels, and wetlands by providing forest shade, sediment filtering, wood recruitment, stream bank and channel stability, water storage and release, vegetation diversity, nutrient cycling, and cool and moist microclimates.
- Maintain water quality and streamflows within the range of natural variability, to protect aquatic biodiversity, provide quality water for contact recreation and drinking water sources.
- Meet ODEQ water quality criteria.
- Maintain high quality water and contribute to the restoration of degraded water quality for 303(d) listed streams.
- Maintain high quality waters within ODEQ designated Source Water Protection watersheds.

- **Management Direction**
  - Maintain access to roads and facilities by removing hazard trees and blowdown. Retain logs as down woody material or move for placement in streams for fish habitat restoration, unless removal of logs, including through commercial harvest, is necessary to accomplish removal of hazard trees or blowdown to maintain access to roads and facilities.
  - Allow yarding corridors, skid trails, road construction, stream crossings, and road maintenance and improvement where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives.
  - Use site-specific BMPs (**Appendix J**) to maintain water quality during land management actions, including discretionary actions of others crossing BLM-administered lands.
  - In new recreational developments, install sanitation systems that maintain water quality (e.g., sealed vault or similar).

- Do not operate ground-based machinery for timber harvest within 50 feet of streams (slope distance), except where machinery is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.
- Do not operate ground-based machinery on slopes > 35 percent. Mechanical equipment with tracks (e.g., excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet (slope distance)).
- During silvicultural treatment of stands, retain existing—
  - snags ≥ 6" dbh
  - down woody material ≥ 6" in diameter at the large end and > 20' in length

  except for safety, operational, or fuels reduction reasons. Retain snags ≥ 6" dbh felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.
- Prohibit timber salvage, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.
- Implement Sudden Oak Death (SOD) eradication activities that do not exceed (at the watershed scale (HUC 10))—
  - The removal of > 30 percent canopy cover over a contiguous 0.5 mile stream length or removal of > 50 percent canopy cover over a contiguous 0.25 mile stream length for small perennial streams (active channel width < 27 feet) where a 4,600-foot separation of non-treatment between sequential contiguous treatments would be maintained;
  - The removal of > 50 percent canopy cover over a contiguous 0.5 mile stream length for medium-large perennial streams (active channel width > 27 feet) where a 4,600-foot separation of non-treatment between sequential contiguous treatments would be maintained; and
  - A limit of 3 miles of treatment for any 5-year period and 3 percent of the total Federal perennial stream miles.

  Implement SOD eradication activities that exceed these limitations only consistent with existing ESA consultation documents that address SOD eradication activities in the decision area.
- Cut or tip individual green trees and move for fish habitat restoration.
- Cut or tip individual trees directly into the stream channel for fish habitat restoration.
- Tree-tipping: When conducting commercial thinning[32] in any portion of the Outer Zone in a stand in all watershed classes, fall or tip up to 15 square feet of basal area per acre of live trees, averaged across the Riparian Reserve portion of the treated stand. Leave felled or tipped trees on site or yard, deck, and make felled or tipped trees available for fish habitat restoration. The felled or tipped trees can be of any size and come from any zone.
- Promote beaver habitat restoration where the presence of beaver and their associated dams would improve fish and aquatic habitat.

[32] In the context of management direction for the Riparian Reserve, **commercial thinning** means stand thinning in which any of the cut trees are removed from the stand for timber volume. Commercial thinning in this context does not include individual tree falling or tipping or stand thinning in which all of the cut trees are left in the stand for restoration purposes, or fuels reduction treatments in which cut trees are burned, chipped, or otherwise disposed of without removal from the stand for timber. Commercial thinning may be implemented through a variety of mechanisms, including timber sale contracts, stewardship agreements, or other types of contracts.

- Along ponds and wetlands < 1 acre and constructed water impoundments of any size, treat vegetation as needed for habitat restoration, access, or safety.
- For constructed water impoundments and constructed ponds:
  - Follow inspection guidelines for BLM infrastructure (e.g., dams and spillway structures), and implement maintenance and repair as needed.
  - Dredge constructed water impoundments as necessary to maintain capacity.
  - Maintain vegetation, access, and plumbing associated with fire water sources for all types of firefighting equipment (e.g., engines, aircraft, and tenders).
- Mining operators with an accepted Notice or approved Plan of Operations will comply with performance standards (43 CFR 3809.420), including all applicable State and Federal water quality standards.

Table B-243. Riparian Reserve distance by water feature.

Feature	Riparian Reserve Distance*
Fish-bearing streams and perennial streams	One site-potential tree height distance from the ordinary high water line or from the outer edge of the channel migration zone for low-gradient alluvial shifting channels, whichever is greatest, on each side of a stream
Intermittent, non-fish-bearing streams	Class I and II subwatersheds: One site-potential tree height distance from the ordinary high water line on each side of a stream
	Class III subwatersheds: 50’ from the ordinary high water line on each side of a stream
Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails	The extent of the unstable area. Where there is a stable area between such an unstable area and a stream, and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area.
Lakes, natural ponds > 1 acre, and wetlands > 1 acre	100’ extending from the ordinary high water line
Natural ponds < 1 acre and wetlands < 1 acre (including seeps and springs), and constructed water impoundments of any size	25’ extending from the ordinary high water line

* Reported distances are measured as slope distance.

Table B-244. Zone-specific management direction for streams in Class I subwatersheds.

Fish-bearing streams and perennial streams
Inner Zone (0–120 feet)
Do not thin stands, except for— • SOD treatments and • Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the

scale of the portion of the harvest unit within the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-241** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
Intermittent, non-fish-bearing streams
Inner Zone (0–50 feet)
Do not thin stands, except for— • SOD treatments; and • Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Middle Zone (50–120 feet)
Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Remove cut trees only as needed for safety or operational reasons, or to meet the tree-tipping management direction described above.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the harvest unit within the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-241** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

Table B-245. Zone-specific management direction for streams in Class II subwatersheds.

Fish-bearing streams and perennial streams
Inner Zone (0–120 feet)
Do not thin stands, except for— • SOD treatments; and • Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally-complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-241** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
Intermittent, non-fish-bearing streams
Inner Zone (0–50 feet)
Do not thin stands, except for— • SOD treatments • Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (50 feet to one site-potential tree height)
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally-complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-241** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.

• Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

Table B-246. Zone-specific management direction for streams in Class III subwatersheds.

Fish-bearing streams and perennial streams
Inner Zone (0–120 feet)
Do not thin stands, except for— • SOD treatments; and • Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally-complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-241** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
Intermittent, non-fish-bearing streams (0-50 feet)
Do not thin stands, except for— • SOD treatments; and • Individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.

Riparian Reserve – Dry

- **Management Objectives**
- Contribute to the conservation and recovery of ESA-listed fish species and their habitats and provide for conservation of Bureau Special Status fish and other Bureau Special Status riparian-associated species.

- Maintain and restore natural channel dynamics and processes and the proper functioning condition of riparian areas, stream channels and wetlands by providing forest shade, sediment filtering, wood recruitment, stability of stream banks and channels, water storage and release, vegetation diversity, nutrient cycling and cool and moist microclimate.
- Maintain water quality and streamflows within the range of natural variability, to protect aquatic biodiversity, provide quality water for contact recreation and drinking water sources.
- Meet ODEQ water quality criteria.
- Maintain high quality water and contribute to the restoration of degraded water quality for 303(d) listed streams.
- Maintain high quality waters within ODEQ designated Source Water Protection watersheds.

- **Management Direction**
  - Maintain access to roads and facilities by removing hazard trees and blowdown. Retain logs as down woody material, move for placement in streams for fish habitat restoration, or treat as necessary for fuels reduction, unless removal of logs, including through commercial harvest, is necessary to accomplish removal of hazard trees or blowdown to maintain access to roads and facilities.
  - Allow yarding corridors, skid trails, road construction, stream crossings, and road maintenance and improvement where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives.
  - Use site-specific BMPs (**Appendix J**) to maintain water quality during land management actions, including discretionary actions of others crossing BLM-administered lands.
  - In new recreational developments, install sanitation systems that maintain water quality (e.g., sealed vault or similar).
  - Do not operate ground-based machinery for timber harvest within 50 feet of streams (slope distance), except where machinery is on improved roads, designated stream crossings, or where equipment entry into the 50-foot zone would not increase the potential for sediment delivery into the stream.
  - Do not operate ground-based machinery on slopes > 35 percent. Mechanical equipment with tracks (e.g., excavators, loaders, forwarders, and harvesters) may be used on short pitch slopes of greater than 35 percent but less than 45 percent when necessary to access benches of lower gradient (length determined on a site-specific basis, generally less than 50 feet (slope distance)).
  - During silvicultural treatment of stands, retain existing—
    - snags ≥ 6” dbh
    - down woody material ≥ 6” in diameter at the large end and > 20’ in length

    except for safety, operational, or fuels reduction reasons. Retain snags ≥ 6” dbh felled for safety or operational reasons as down woody material, unless they would also pose a safety hazard as down woody material.
  - In all subwatershed classes:
    - Apply low or moderate-severity prescribed burns where needed to invigorate native deciduous tree species. Moderate severity prescribed burns will be limited to no more than 20 percent of area of Riparian Reserve subwatershed (HUC 12) each year.
    - Apply non-commercial tree thinning to adjust fuel loads as necessary to achieve desired fire effects prior to prescribed burning.
  - When conducting fuels or prescribed fire treatments, retain down woody material at levels specified in **Table B-242**. Down woody material retention standards would be met as an average at the scale of the treatment area, and is not intended to be attained on every acre.
  - Do not conduct timber salvage, except when necessary to protect public safety, or to keep roads and other infrastructure clear of debris.

- Cut or tip individual green trees and move as necessary for fish habitat restoration.
- Cut or tip individual green trees directly into the stream channel for fish habitat restoration.
- Tree-tipping: When conducting commercial thinning[33] in any portion of the Outer Zone in a stand in all subwatershed classes, fall or tip up to 15 square feet of basal area per acre of live trees, averaged across the Riparian Reserve portion of the treated stand. Leave felled or tipped trees on site or yard, deck, and make felled or tipped trees available for fish habitat restoration. The felled or tipped trees can be of any size and come from any zone within the Riparian Reserve.
- Promote beaver habitat restoration where the presence of beaver and their associated dams would improve fish and aquatic habitat.
- Along ponds and wetlands < 1 acre and constructed water impoundments of any size, treat vegetation as needed for habitat restoration, access, or safety.
- For constructed water impoundments and constructed ponds:
  - Follow inspection guidelines for BLM infrastructure (e.g., dams and spillway structures), implement maintenance, and repair as needed.
  - Dredge constructed water impoundments as necessary to maintain capacity.
  - Maintain vegetation, access, and plumbing associated with fire water sources for all types of firefighting equipment (e.g., engines, aircraft, and tenders).
- Mining operators with an accepted Notice or approved Plan of Operations will comply with performance standards (43 CFR 3809.420), including all applicable State and Federal water quality standards.

[33] In the context of management direction for the Riparian Reserve, '**commercial thinning'** means stand thinning in which some or all of the cut trees are removed from the stand for timber. Commercial thinning in this context does not include individual tree falling or tipping or stand thinning in which all of the cut trees are left in the stand for restoration purposes, or fuels reduction treatments in which cut trees are burned, chipped, or otherwise disposed of without removal from the stand for timber. Commercial thinning may be implemented through a variety of mechanisms, including timber sale contracts, stewardship agreements, or other types of contracts.

Table B-247. Riparian Reserve distance by water feature.

Feature	Riparian Reserve Distance*
Fish-bearing streams and perennial streams	One site-potential tree height distance from the ordinary high water line or from the outer edge of the channel migration zone for low-gradient alluvial shifting channels, whichever is greatest, on each side of a stream
Intermittent, non-fish-bearing streams	Class I and II subwatersheds: One site-potential tree height distance from the ordinary high water line on each side of a stream
	Class III subwatersheds: 50’ from the ordinary high water line on each side of a stream
Unstable areas that are above or adjacent to stream channels and are likely to deliver material such as sediment and logs to the stream if the unstable area fails	The extent of the unstable area. Where there is a stable area between such an unstable area and a stream, and the unstable area has the potential to deliver material such as sediment and logs to the stream, extend the Riparian Reserve from the stream to include the intervening stable area as well as the unstable area.
Lakes, natural ponds > 1 acre, and wetlands > 1 acre	100’ extending from the ordinary high water line
Natural ponds < 1 acre and wetlands < 1 acre (including seeps and springs), and constructed water impoundments of any size	25’ extending from the ordinary high water line

* Reported distances are measured as slope distance.

Table B-248. Zone-specific management direction for streams in Class I subwatersheds.

Fish-bearing streams and perennial streams
Inner Zone (0–120 feet)
Do not thin stands, except for— • Fuels treatments as needed to reduce the risk of stand-replacing crown fires. Do not conduct fuels treatments within 60 feet of fish-bearing or perennial streams. Retain at least 50 percent canopy cover per acre. Do not cut trees > 12” DBH; and • as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing crown fires. Retain at least 30 percent canopy cover and 60 trees per acre, expressed as an average across the treated portion of the Riparian Reserve. Make available for sale the merchantable timber from thinning and other silvicultural treatments. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-241** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size

class specified, use trees from the largest size class available. Meet the snag creation amounts as an average at the scale of the portion of the harvest unit within the Riparian Reserve, but may not be attained on every acre. For implementation:

- Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.
- Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Use trees from any species to meet snag creation levels.

Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

Intermittent, non-fish-bearing streams

Inner Zone (0–50 feet)

Do not thin stands, except as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.

Middle Zone (50–120 feet)

Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve.

Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve.

Remove cut trees as needed for safety or operational reasons, to reduce the risk of stand-replacing, crown fires, or to meet the tree-tipping management direction described above. Merchantable timber from thinning, fuels reduction, and other silvicultural treatments that must be removed for safety or operational reasons, to reduce the risk of stand-replacing, crown fires, or to meet the tree-tipping management direction described above may be made available for sale.

Outer Zone (120 feet to one site-potential tree height)

Thin stands as needed to ensure that stands are able to provide trees that would function as stable wood in the stream. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve.

Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve.

Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-241** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation:

- Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees.
- Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species.

Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

Table B-249. Zone-specific management direction for streams in Class II subwatersheds.

Fish-bearing streams and perennial streams
Inner Zone (0–120 feet)
Do not thin stands, except for— • Fuels treatments as needed to reduce the risk of stand-replacing crown fires. Do not conduct fuels treatments within 60 feet of fish-bearing or perennial streams. Retain at least 50 percent canopy cover per acre. Do not cut trees > 12” DBH; and • as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-241** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.
Intermittent, non-fish-bearing streams
Inner Zone (0–50 feet)
Do not thin stands, except for— • Fuels treatments as needed to reduce the risk of stand-replacing crown fires. Do not conduct fuels treatments within 60 feet of fish-bearing or perennial streams. Retain at least 50 percent canopy cover per acre. Do not cut trees > 12” DBH; and • as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (50 feet to one site-potential tree height)
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as

an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-241** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

Table B-250. Zone-specific management direction for streams in Class III subwatersheds.

Fish-bearing streams and perennial streams
Inner Zone (0–120 feet)
Do not thin stands, except as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.
Outer Zone (120 feet to one site-potential tree height)
Thin stands as needed to promote the development of large, open grown trees, develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Apply silvicultural treatments to increase diversity of riparian species and develop structurally complex stands. Maintain at least 30 percent canopy cover and 60 trees per acre expressed as an average at the scale of the portion of the harvest unit within the Riparian Reserve. Apply fuels reduction treatments, including prescribed fire, as needed to reduce the risk of stand-replacing, crown fires. Retain at least 30 percent canopy cover and 60 trees per acre expressed as an average across the treated portion of the Riparian Reserve. Merchantable timber from thinning and other silvicultural treatments may be made available for sale. When conducting commercial thinning, create new snags in the amounts and sizes specified in **Table B-241** within one year of completion of yarding the timber in the timber sale. If trees are not available in the size class specified, use trees from the largest size class available. Snag creation amounts would be met as an average at the scale of the portion of the harvest unit within the Riparian Reserve, and need not be attained on every acre. For implementation: • Create snags in a variety of spatial patterns, including aggregated groups, stringers, and individual trees. • Concentrate created snags in areas of the stand where the BLM does not anticipate skidding or yarding will occur within 20 years. Snag creation levels can be met with trees from any species. Do not create snags within falling distance of power lines, structures, or roads that will remain open after harvesting activities are complete.

Intermittent, non-fish-bearing streams (0-50 feet)
Do not thin stands, except as described above in management direction for prescribed burns, individual tree falling/tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning.

Administrative Actions

- **Management Objective**
- Provide for the orderly and efficient management of resources.

- **Management Direction**
- Implement administrative actions in any land use allocation to the extent consistent with land use allocation management direction. Administrative actions include but are not limited to the following actions:
  - Competitive and commercial recreation activities
  - Special forest product collection permit issuance
  - Lands and realty actions (e.g., the issuance of grants, leases, and permits)
  - Trespass resolution
  - Facility maintenance
  - Facility improvements
  - Road maintenance
  - Hauling permit issuance
  - Recreation site maintenance
  - Recreation site improvement
  - Hazardous materials removal
  - Abandoned Mine Land physical closure or removal and environmental remedial actions
  - Law enforcement
  - Legal land or mineral estate ownership surveys
  - Cadastral and engineering surveys
  - Field visits for the design of projects (including clearance inventories) and contract administration
  - Tree sampling (including using the 3P fall, buck, and scale sampling method)
  - Project implementation monitoring and plan effectiveness monitoring
  - Incidental live or dead tree removal for safety or operational reasons
  - Wildlife, fisheries, or plant community and population survey or monitoring

Resource Programs

Air Quality

- **Management Objectives**
- Protect air quality related values in Federal mandatory Class I areas.
- Prevent exceedances of national, State, or local ambient air quality standards.

- **Management Direction**
- Comply with the Oregon Smoke Management Plan when implementing prescribed burning activities.
- Use BMPs (**Appendix J**) to reduce dust from unpaved road surfaces during extended management operations, such as timber sales and wildfire management actions/activities. Example practices include applying dust suppressants.
- Follow State Implementation Plan requirements for activities that could negatively affect the status of air quality non-attainment or maintenance areas.

Areas of Critical Environmental Concern

- **Management Objective**
- Maintain or restore relevant and important values in Areas of Critical Environmental Concern, including Research Natural Areas and Outstanding Natural Areas.

- **Management Direction**
- Implement activities as necessary to maintain, enhance, or restore relevant and important values (**Appendix F**).
- Do not use ground-disturbing equipment or aerial application of non-fugitive retardant that would compromise important and relevant values during wildfire management operations, except where the wildfire is deemed a threat to human safety or private property, or where use is essential for wildfire control.

Cultural Resources

- **Management Objectives**
- Preserve and protect significant cultural resources and ensure that they are available for appropriate uses by present and future generations.
- Reduce imminent threats and resolve potential conflicts from natural or human-caused deterioration or potential conflict with other resources by ensuring that all authorizations for land and resource use will comply with Section 106 of the National Historic Preservation Act.

- **Management Direction**
- Evaluate all documented cultural resources for National Register of Historic Places eligibility. For all sites that are listed or eligible for listing on the National Register of Historic Places, protect sites through avoidance or other protection measures.
- Conduct public education and outreach activities, and develop materials in order to educate and interpret for the public the cultural and historic resources within the decision area.
- Assign all cultural resources into one of the use allocations in **Table B-251**.

Table B-251. Cultural use allocations with desired outcomes and management actions.

Use Allocation	Desired Outcome	Management Action
Scientific use	Preserved until research potential is realized	Permit appropriate research including data recovery
Conservation for future use	Preserved until conditions for use are met	Propose protection measures/designations
Traditional use	Long-term preservation	Consult with Tribes; determine limitations
Public use	Long-term preservation, on-site interpretation	Determine limitations, permitted uses
Experimental use	Protected until used	Determine nature of experiments
Discharged from management	No use after recordation, not preserved	Remove protective measures

Fire, Fuels, and Wildfire Response

- **Management Objectives**
- Respond to wildfires in a manner that provides for public and firefighter safety while meeting land management objectives by utilizing the full range of fire management options.
- Fire management strategies would be risk-based decisions that consider firefighter and public safety, values at risk, management objectives, and costs that are commensurate with the identified risk.
- Actively manage the land to restore and maintain resilience of ecosystems to wildfire and decrease the risk of uncharacteristic, large, high-intensity/high-severity wildfires.
- Manage fuels to reduce wildfire hazard, risk, and negative impacts to communities and infrastructure, landscapes, ecosystems, and highly valued resources.
- Manage fire, fuels, and wildfire response consistent with the National Cohesive Wildland Fire Management Strategy.
- Participate with communities bordering Federal lands in partnership with local, State, and Federal stakeholders to reduce the risks and threats from wildland fire.

- **Management Direction**
- Take immediate action to suppress all human-caused ignitions at the lowest cost commensurate with the protection of firefighter and public safety and welfare, and resulting in the fewest negative consequences to natural and cultural resources.
- Apply the full range of fire management options in responding to natural ignitions or escaped prescribed fires. These fires may be used to achieve management objectives when expected fire behavior and potential effects of a fire, or a part of a fire, are aligned with the management objectives and direction of the underlying land use allocation and affected resources.

- Conduct wildfire rehabilitation and restoration efforts to protect and sustain ecosystems, ecosystem services, public health and safety, and infrastructure adversely affected by fire management operations or direct fire effects.
- Treat both management activity fuels and natural hazardous fuels for any of the following reasons:
  - Modify the fuel profile (e.g., raise canopy base heights or reduce surface and ladder fuels and crown bulk density)
  - Reduce potential fire behavior (e.g., crown fire activity, wildfire spread, or intensity)
  - Reduce potential fire severity
  - Improve effective fire management opportunities within the Wildland Urban Interface[34] or in close proximity to other highly valued resources
- Treat fuels in a way that increase intervals between future maintenance treatments.
- Create fuel beds or fuel breaks that reduce the potential for high-intensity fire spread within the wildland urban interface and in close proximity to other highly valued resources.
- Prior to applying prescribed fire, take necessary mitigation actions to reduce impacts to Bureau Special Status Species wildlife and plants and their habitats.
- Conduct necessary vegetation maintenance treatments to ensure that fire management operations are able to access existing natural and human-made strategic infrastructure (e.g., communication sites, pump chances and other wildfire management actions/activities water sources, key road systems, containment lines, fuel breaks, and helispots).

Fisheries

- **Management Objectives**
- Improve the distribution and quantity of high-quality fish habitat across the landscape for all life stages of ESA-listed, BLM Special Status Species, and other fish species.
- Maintain and restore access to stream channels for all life stages of aquatic species.

- **Management Direction**
- Restore degraded spawning, rearing, and holding habitat for fish using a combination of accepted techniques including but not limited to log and boulder placement in stream channels, tree tipping, and gravel enhancement.
- Remove or modify human-caused fish passage barrier to restore access to stream channels for all life stages for aquatic species.

Forest Management

- **Management Objectives**
- Enhance the health, stability, growth, and vigor of forest stands.
- In harvested or disturbed areas, ensure the establishment and survival of desirable vegetation appropriate to the site.
- Facilitate safe and efficient forestry operations for the BLM, reciprocal right-of-way agreement holders, and permittees.

[34] The Wildland Urban Interface includes wildland developed areas.

- **Management Direction**
- Promote the establishment and survival of desirable vegetation through stand maintenance treatments.
- Apply thinning or prescribed fire to forest stands to achieve appropriate stocking and density levels.
- Use genetically improved native trees for reforestation when available.
- Fall and move live or dead trees as needed for safety or operational reasons, including, but not limited to, the creation of yarding corridors or skid trails adjacent to nearby harvest units, hazard tree removal, and road construction, improvement, or maintenance.
- Allow road construction, maintenance, improvement, and decommissioning as well as construction of skid trails and yarding corridors based on operational needs and consistent with valid existing rights.
- Allow management activities in density management study sites (Cissel *et al.* 2006) that are compatible with study objectives.

Hydrology

- **Management Objective**
- Maintain water quality within the range of natural variability that meets ODEQ water quality standards for drinking water, contact recreation, and aquatic biodiversity.

- **Management Direction**
- Select and implement site-level BMPs to maintain water quality for BLM actions (including, but not limited to, road construction, road maintenance, silvicultural treatments, recreation management, prescribed burning, and wildfire management actions/activities) and discretionary actions of others crossing BLM-administered lands.
  - Design culverts, bridges, and other stream crossings for the 100-year flood event, including allowance for bed load and anticipated floatable debris. Culverts will be of adequate width to preclude ponding of water higher than the top of the culvert. Design stream crossings with ESA-listed fish to meet design standards consistent with existing ESA consultation documents that address stream crossings in the decision area.
- Implement road improvements, storm proofing, maintenance, or decommissioning to reduce or eliminate chronic sediment inputs to stream channels and water bodies. This could include maintaining vegetated ditch lines, improving road surfaces, and installing cross drains at appropriate spacing.
- Suspend commercial road use where the road surface is deteriorating due to vehicular rutting or standing water, or where turbid runoff is likely to reach stream channels.
- Decommission roads no longer needed for resource management and are at risk of failure or are contributing sediment to streams, consistent with valid existing rights.

Invasive Species

- **Management Objectives**
- Prevent the introduction of invasive species and the spread of existing invasive species infestations.
- Prevent the introduction and spread of sudden oak death (*Phytophthora ramorum*) infections.

- **Management Direction**
- Implement measures to prevent, detect, and rapidly control new invasive species infestations.
- Use manual, mechanical, cultural, chemical, and biological treatments to manage invasive species infestations.
- Treat invasive plants and host species for invasive forest pathogens in accordance with the Records of Decision (RODs) for the Northwest Area Noxious Weed Control Program Environmental Impact Statement and the Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in Oregon Environmental Impact Statement (USDI BLM 2010).
- Apply state-of-the art, integrated pest management prescriptions for the treatment of all identified sudden oak death (*Phytophthora ramorum*) infection sites.

Lands, Realty, and Roads

- **Management Objectives**
- Make land tenure adjustments to facilitate the management of resources and enhance public resource values.
- Provide legal access to BLM-administered lands and facilities to support resource management programs.
- Provide needed rights-of-way, permits, leases, and easements over BLM-administered lands in a manner that is consistent with Federal and State laws.
- Protect lands that have important resource values or substantial levels of investment by withdrawing them, where necessary, from the implementation of nondiscretionary public land and mineral laws.
- Provide a road transportation system that serves resource management needs (administrative/commercial) and casual use needs (recreational/domestic) for both BLM-administered lands and adjacent privately owned lands.

- **Management Direction**
- Retain lands in Land Tenure Zone 1 (Zone 1) under BLM administration. Lands in Zone 1 include existing and future:
  - Designated and suitable Wild and Scenic River corridors
  - Wilderness Areas
  - Wilderness Study Areas
  - National Trail management corridors
  - District-Designated Reserve – Lands managed for their Wilderness Characteristics
  - Areas of Critical Environmental Concern (including Research Natural Areas and Outstanding Natural Areas)
  - Congressionally designated Outstanding Natural Areas
  - Lands acquired with Land and Water Conservation Funds
- Make lands in Land Tenure Zone 2 (Zone 2) available for exchange to enhance public resource values, improve management capabilities, or reduce the potential for land use conflict. Zone 2 lands consist of all lands not listed in the descriptions of the other two Land Tenure Zones.
- Make lands in Land Tenure Zone 3 (Zone 3) available for disposal (identified in **Appendix K**) using appropriate disposal mechanisms. These lands include:
  - Lands that are either not practical to manage, or are uneconomical to manage (because of their intermingled location and non-suitability for management by another Federal agency)
  - Survey hiatuses
  - Unintentional encroachments

- Assign to Zone 3 survey hiatuses and unintentional encroachments discovered in the future.
- Assign to Zone 3 patented lands with reversionary interests reserved by the United States that are relinquished back to Federal ownership.
- Assign to Zone 3 land boundary adjustments due to river movement discovered in the future, which meets the disposal criteria defined in **Appendix K**.
- The BLM may dispose of lands designated in Zones 2 and 3 that provide habitat for ESA-listed species, including critical habitat, only following consultation with the U.S. Fish and Wildlife Service or National Marine Fisheries Service and upon a determination that such action is consistent with relevant law and maximizes public resource values.
- As required by the Oregon Public Lands Transfer and Protection Act (Public Law 105-321), do not reduce through disposal, exchange, or sale the acres of O&C lands of all classifications, and the acres of O&C and public domain lands that are available for harvesting.
- Acquire or dispose of lands to facilitate resource management objectives as opportunities occur. See the Land Tenure Adjustment Criteria section in **Appendix K**.
- Make available for disposal the public domain lands in Zones 2 and 3 that have been classified under Section 7 of the Taylor Grazing Act.
- Manage newly acquired lands for the purpose for which they were acquired or in a manner that is consistent with management objectives for adjacent BLM-administered lands or other BLM-administered lands having similar resource values. See Acquisition Criteria section in **Appendix K**.
- Where the BLM has administrative responsibility on lands managed by other agencies, the BLM will administer those lands in accordance with interagency agreements.
- Issue permits, as identified under the FLPMA (Section 302), for a variety of uses, such as, but not limited to, stockpile and storage sites and as tools to authorize unintentional trespass situations pending final resolution.
- Do not issue land use authorizations for landfills or other waste disposal facilities.
- Use land-use authorizations to resolve agricultural or occupancy trespasses, where appropriate.
- Recognize existing rights-of-way, permits, leases, and easements as valid uses.
- Limit withdrawals to the area needed and restrict only those activities needed to accomplish the purposes of the withdrawal.
- Process formal land withdrawals being relinquished by the BLM or other Federal agency according to the procedures stated under 43 CFR 2372. If the lands are found suitable for return to the public domain, the revocation order will recommend the management prescriptions developed in the environmental review. Manage the lands according to management prescriptions for those lands having the same or similar resource values in the same general area of the land withdrawal.
- Designate Right-Of-Way Exclusion Areas in—
  - Lands designated as Wilderness;
  - District-Designated Reserve – Lands Managed for their Wilderness Characteristics;
  - Wilderness Study Areas;
  - Designated and suitable Wild and Scenic Rivers classified as Wild; and
  - Visual Resource Management Class I areas.

  In right-of-way exclusion areas, do not grant rights-of-way, except when mandated by law.
- Designate right-of-way avoidance areas in—
  - Areas of Critical Environmental Concern (including Research Natural Areas and Outstanding Natural Areas);
  - Recreation Management Areas (Special and Extensive);
  - Designated and suitable Wild and Scenic Rivers classified as Scenic and Recreational; and
  - Visual Resource Management Class II areas not included in right-of-way exclusion areas.

  In right-of-way avoidance areas, grant rights-of-way if the BLM determines that the right-of-way proposals are compatible with the protection of the values for which the land use was designated, or

when no feasible alternative route or designated right-of-way corridor is available as applicable with BLM laws and policy.

- Grant rights-of-way in utility corridors as the preferred location for energy transmission or distribution facilities. Corridors would generally be 1,000 feet on each side of the centerline. Grant the rights-of-way as the minimum necessary to accommodate a specific request. Do not permit development or management activities that would conflict with the construction, operation, or maintenance of facilities corresponding to the purpose of the utility corridor.
- Construct communication facilities on existing developed communication sites where they do not conflict with other management objectives. Require a site plan for applications for communication facilities on undeveloped communication sites (**Appendix K**, **Table K-14** through **Table K-19**).
- Expand existing communication sites and develop new sites. Prioritize the use of existing sites and facilities for accommodating the need for additional capacity.
- Construct new permanent or temporary roads, which may include major culverts and bridges, where needed to meet resource management objectives, to established BLM engineering design standards. Apply road location, design, and construction BMPs as needed (**Appendix J**).
- Maintain existing roads, including major culverts and bridges, to provide access for both resource management and casual use activities while protecting water quality and facility investments, and providing user safety, to established BLM maintenance standards. Apply road maintenance and wet weather road use BMPs as needed (**Appendix J**).
- Remove hazard and downed trees along roads for safety or operational reasons.
- Fully decommission or obliterate (permanent closure) roads with no future resource management need. Decommission (long-term closure) roads not currently needed for resource management but that will be used and maintained again in the future. Apply road closure BMPs as needed (**Appendix J**). Close roads only with the approval of affected permittees consistent with valid existing rights.

Livestock Grazing

- **Management Objectives**
- Provide for livestock grazing consistent with other resource objectives while maintaining or improving the health of public rangelands.
- Prevent livestock from causing trampling disturbance to fish spawning beds where ESA-listed or Bureau Sensitive species occur.

- **Management Direction (All Districts)**
- Authorize livestock grazing through management agreements, non-renewable grazing permits or leases, or special use permits on lands not available for livestock grazing through the issuance of a grazing lease or permit to control invasive plants, reduce fire danger, or accomplish other management objectives.
    - Restrict livestock from streams with ESA-listed or Bureau Sensitive fish species during spawning, incubation, and until 30 days following the emergence of juveniles from spawning areas.

- **Management Direction (Coos Bay District)**
- Lands within the grazing allotments identified on **Table B-252** will not be available for livestock grazing through the issuance of a grazing lease. The BLM will not authorize grazing under Section 15

of the Taylor Grazing Act (see Appendix A). The BLM may authorize grazing through management agreements, nonrenewable grazing permits or leases, or special use permits consistent with the grazing regulations.

Table B-252. Allotments unavailable for livestock grazing, Coos Bay District.

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Bullock	20006	6	12
Kellogg	20007	2	6
Middle Creek	20001	5	5
New River	30001	530	97
	Totals	**543**	**120**

- **Management Direction (Klamath Falls Field Office)**
- Manage livestock grazing in accordance with the Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington (USDI BLM 1997). **Figure 3-108** shows lands available for livestock grazing. **Appendix L** lists allotments available for livestock grazing.
- Maintain current livestock grazing levels and management practices for the allotments shown in **Appendix L**. Make adjustments when rangeland health assessments and evaluations of monitoring data identify that livestock grazing is a contributing factor toward not meeting one or more of the Standards for Rangeland Health and Guidelines for Grazing Management for Public Lands in Oregon and Washington.
- Develop range improvements when needed to achieve the Standards for Rangeland Health and Guidelines for Grazing Management for Public Lands in Oregon and Washington, RMP objectives, or other allotment-specific objectives.
- Implement range improvement projects in adherence with the following:
  - Conduct inventories and surveys for cultural resources, ESA-listed species, and Bureau Special Status Species prior to authorization of any project construction. Implement appropriate mitigations to reduce or eliminate potential effects to these resources.
  - Design projects to minimize surface disturbance at all project sites.
  - Rehabilitate disturbed soil to blend into the surrounding soil surface. Re-vegetate using seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable, to replace ground cover, reduce soil loss from wind and water erosion, and discourage the potential establishment of any invasive plant species.
  - Use existing roads and trails to access areas for range improvement construction to the extent practicable. If needed, create unimproved trails and tracks to reach construction sites and provide access for future maintenance of the improvements. Locate unimproved trails or tracks outside riparian management areas where workable.
  - Limit brushing and tree limb removal to only that necessary for surveying, placement, and construction of improvements.
- Design livestock fencing to prevent the passage of livestock without stopping the movement of wildlife. Wire and post spacing would follow these specifications where practicable:
  - Construct 4-wire fences, with the bottom wire 16-18” off the ground with the sequence of the remaining 3-wires above this being 6”, 6”, and 12”. Do not exceed 42” total height (ground to top wire).
  - Install 2-strand smooth wire, not barbed, for the bottom wire to facilitate antelope crossings.

  - Install steel ‘t-posts’ no less than 16’ and no more than 24’ apart, depending on local conditions.
  - Construct a brace post, tree scab, or rock jack (rock crib) at least every 0.25 mile to enhance fence integrity.
- Do not construct woven wire ‘sheep’ livestock fences on public lands.
- Install gates or cattle guards where livestock fences cross existing roads.
- Construct livestock fences outside of perennially or seasonally saturated soils, such as occur in wet meadows and alongside stream banks, to provide fence longevity and stability, where practicable.
- Fence spring sources to prevent livestock grazing and trampling, when necessary.
- Install escape ramps in all livestock water troughs to allow wildlife to escape.
- Install piping to divert overflow from livestock troughs away from the developed source area.
- Construct pit or dam livestock reservoirs to impound water for livestock and wildlife use in adherence with the following:
  - Do not exceed water storage capacity of 3.0 acre-feet.
  - Construct pits in dry lakebeds or other natural depressions. Pile excavated material from pits adjacent to the pit in a manner that eliminates potential for erosion of the excavated material into the pit. Stockpile topsoil to use to rehabilitate the borrow areas.
  - Construct dams in drainages or to one side of a drainage, with a diversion ditch constructed into the impoundment area. Locate dams, when possible, to take advantage of natural spillway sites. When a natural spillway is not available, construct a spillway around the dam for the reservoir. Design spillway to withstand the 50-year flood flow without overtopping the dam and to direct the pass flow downstream to prevent erosion of the embankment.
  - Construct dams a minimum ratio of 3:1 on the upstream face and minimum ratio of 2:1 on the downstream face. Minimum width of the top of all dams would be 12’.
  - Clear all brush, stumps, roots, and organic matter from borrow areas and beneath dams.
  - Use material from dam impoundment areas or borrow areas as fill material. Use only fill materials consisting of non-organic and cohesive soils adjusted in moisture to optimum water content for dam construction.
  - Place fill material in thin layers parallel with the long axis of the dam. Do not exceed individual layer thickness of 8”. Compact layers with a sheepsfoot roller or similar equipment.
- Obtain necessary water right permits from the Oregon Water Resources Department prior to construction. Coordinate water right applications with applicable agencies, irrigation districts, and interested parties.
- Rest from livestock grazing those areas disturbed by natural and human-induced events (e.g., wildland fire, prescribed burns, timber management treatments, juniper cuts, and rehabilitation projects). Resume livestock grazing after determining that soil and vegetation have recovered from the initial disturbance to support livestock grazing and maintain recovery from the initial disturbance. Exceptions would be for cases where such grazing would not impede site recovery, or where livestock are used as a tool to aid in achieving certain recovery objectives.
- Lands within the grazing allotments identified in **Table B-253** will not be available for livestock grazing through the issuance of a grazing lease or permit. The BLM will not authorize grazing under Section 3 permits or Section 15 leases under the Taylor Grazing Act. The BLM may authorize grazing through management agreements, nonrenewable grazing permits or leases, or special use permits consistent with the grazing regulations.

Table B-253. Allotments unavailable for livestock grazing, Klamath Falls Field Office.

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Edge Creek*	00102	42	-
Plum Hills	00813	163	20
	Totals	205	**20**

* This portion of the Upper Klamath Wild and Scenic River corridor within the Edge Creek Allotment will be made unavailable to livestock grazing. This portion of the allotment is not allocated any AUMs. The remainder of the allotment will be available for livestock grazing.

- Close exclosures and other areas identified on **Table B-254** to livestock grazing.

Table B-254. Exclosures or other areas previously closed to livestock grazing, Klamath Falls Field Office.

Allotment Name	Allotment Number	Area Closed
Edge Creek	00102	Hayden Creek Exclosures (2) Fox Lake Exclosure
Buck Lake	00104	Tunnel Creek Exclosure Surveyor Campground Exclosure
Dixie	00107	Dixie (Long Prairie Creek) Exclosure
Jeld-Wen	00822	Aspen Exclosure
Rodgers	00852	Van Meter Flat Reservoir Exclosure
Yainax	00861	Bull Spring Exclosure Timothy Spring Exclosure
Bear Valley	00876	Holbrook Spring Exclosure
Bumpheads	00877	Bumpheads Reservoir Outlet Exclosure Antelope Creek Exclosure
Horsefly	00882	Long Branch Exclosure Caseview Spring Exclosure Norcross Spring Exclosure Boundary Spring Exclosure
Pankey Basin	00884	Pankey Creek Riparian Exclosure
Horse Camp Rim	00886	21 Reservoir Exclosure
Pitchlog	00887	Pitchlog Creek Exclosure Willow Spring Exclosure CCC Spring Exclosure
Willow Valley	00890	Duncan Spring Exclosure Antelope Creek Exclosure East Fork Lost River Exclosure

- **Management Direction (Medford)**
- Manage livestock grazing in accordance with the Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington (USDI BLM 1997). **Figure 3-108** shows lands available for livestock grazing. **Appendix L** lists allotments available for livestock grazing.
- Maintain current livestock grazing levels and management practices for the allotments shown in **Appendix L**. Make adjustments when rangeland health assessments and evaluations of monitoring data identify that livestock grazing is a contributing factor toward not meeting one or more of the Standards for Rangeland Health and Guidelines for Grazing Management for Public Lands in Oregon and Washington.
- Develop range improvements when needed to achieve the Standards for Rangeland Health and Guidelines for Grazing Management for Public Lands in Oregon and Washington, RMP objectives, or other allotment-specific objectives.
- Implement range improvement projects in adherence with the following:
  - Conduct inventories and surveys for cultural resources, ESA-listed species, and Bureau Special Status Species prior to authorization of any project construction. Implement appropriate mitigations to reduce or eliminate potential effects to these resources.
  - Design projects to minimize surface disturbance at all project sites.
  - Rehabilitate disturbed soil to blend into the surrounding soil surface. Re-vegetate using seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable, to replace ground cover, reduce soil loss from wind and water erosion, and discourage the potential establishment of any invasive plant species.
  - Use existing roads and trails to access areas for range improvement construction to the extent practicable. If needed, create unimproved trails and tracks to reach construction sites and provide access for future maintenance of the improvements. Locate unimproved trails or tracks outside riparian management areas where workable.
  - Limit brushing and tree limb removal to only that necessary for surveying, placement, and construction of improvements.
- Design livestock fencing to prevent the passage of livestock without stopping the movement of wildlife. Wire and post spacing would follow these specifications where practicable:
  - Construct 4-wire fences, with the bottom wire 16-18” off the ground with the sequence of the remaining 3-wires above this being 6”, 6”, and 12”. Do not exceed 42” total height (ground to top wire).
  - Install 2-strand smooth wire, not barbed, for the bottom wire to facilitate antelope crossings.
  - Install steel ‘t-posts’ no less than 16’ and no more than 24’ apart, depending on local conditions.
  - Construct a brace post, tree scab, or rock jack (rock crib) at least every 0.25 mile to enhance fence integrity.
- Do not construct woven wire ‘sheep’ livestock fences on public lands.
- Install gates or cattle guards where livestock fences cross existing roads.
- Construct livestock fences outside of perennially or seasonally saturated soils, such as occur in wet meadows and alongside stream banks, to provide fence longevity and stability, where practicable.
- Fence spring sources to prevent livestock grazing and trampling, when necessary.
- Install escape ramps in all livestock water troughs to allow wildlife to escape.
- Install piping to divert overflow from livestock troughs away from the developed source area.
- Construct pit or dam livestock reservoirs to impound water for livestock and wildlife use in adherence with the following:
  - Do not exceed water storage capacity of 3.0 acre-feet.
  - Construct pits in dry lakebeds or other natural depressions. Pile excavated material from pits adjacent to the pit in a manner that eliminates potential for erosion of the excavated material into the pit. Stockpile topsoil to use to rehabilitate the borrow areas.

- Construct dams in drainages or to one side of a drainage, with a diversion ditch constructed into the impoundment area. Locate dams, when possible, to take advantage of natural spillway sites. When a natural spillway is not available, construct a spillway around the dam for the reservoir. Design spillway to withstand the 50-year flood flow without overtopping the dam and to direct the pass flow downstream to prevent erosion of the embankment.
- Construct dams a minimum ratio of 3:1 on the upstream face and minimum ratio of 2:1 on the downstream face. Minimum width of the top of all dams would be 12'.
- Clear all brush, stumps, roots, and organic matter from borrow areas and beneath dams.
- Use material from dam impoundment areas or borrow areas as fill material. Use only fill materials consisting of non-organic and cohesive soils adjusted in moisture to optimum water content for dam construction.
- Place fill material in thin layers parallel with the long axis of the dam. Do not exceed individual layer thickness of 8". Compact layers with a sheepsfoot roller or similar equipment.

- Obtain necessary water right permits from the Oregon Water Resources Department prior to construction. Coordinate water right applications with applicable agencies, irrigation districts, and interested parties.
- Rest from livestock grazing those areas disturbed by natural and human-induced events (e.g., wildland fire, prescribed burns, timber management treatments, juniper cuts, and rehabilitation projects). Resume livestock grazing after determining that soil and vegetation have recovered from the initial disturbance to support livestock grazing and maintain recovery from the initial disturbance. Exceptions would be for cases where such grazing would not impede site recovery, or where livestock are used as a tool to aid in achieving certain recovery objectives.
- Lands with grazing allotments identified in **Table B-255** will not be available for livestock grazing through the issuance of a grazing lease. The BLM will not authorize grazing under Section 15 of the Taylor Grazing Act. The BLM may authorize grazing through management agreements, nonrenewable grazing permits or leases, or special use permits consistent with the grazing regulations.

Table B-255. Allotments unavailable for livestock grazing, Medford District.

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Pickett Mountain	00302	802	30
Glade Creek	00315	564	17
Cherry Gulch	00316	40	6
Trail Creek	10003	3,211	113
Longbranch	10004*	11,124	71
Antioch Road	10005	40	4
Roundtop Evans	10006	26,204	110
West Perry Road	10010	40	10
East Perry Road	10011	80	7
Upper Table Rock	10012	714	66
Clear Creek	10013	3,794	45
Obenchain Mountain	10014	121	12
Nichols Gap	10018	283	18
Eagle Point Canal	10020	443	55
Shady Branch	10025	321	32
Stiehl	10026	277	18

Allotment Name	Allotment Number	Public Land (Acres)	Forage Allocation (AUMs)
Fielder Creek	10028	83	5
Derby Station	10030	516	36
West Derby	10034	1,125	89
Emigrant Creek	10111	40	7
Baldy	10120	201	87
Lost Creek	10123	78	6
Cartwright	10127	40	4
Bybee Peak	10144	322	36
Sugarloaf/Greensprings	10158	3,008	210
Sterling Spring	10207	27,179	190
Del Rio	10216	42	5
Jump Off Joe	10303	55	8
Deer Creek	10308	1,172	77
Q Bar X	10310	13	3
Applegate	20201	25,415	294
Tunnel Ridge	20202	2,177	14
Timber Mountain	20204	3,202	70
Sardine and Galls Creek	20205	3,323	158
Spencer Gulch	20208	2,109	150
Quartz Gulch	20209	670	9
Burton Butte	20212	10	2
Chapman Creek	20213	3,758	81
Ecker	20217	40	6
Stage Road	20218	40	4
Lomas Road	20222	643	50
Star	20223	121	24
Ferns Lease	20224	249	28
Reeves Creek	20309	1,665	95
Esterly Creek	20312	3,641	152
	Totals	**128,994**	**2,514**

* These portions of the Longbranch Allotment will be made unavailable to livestock grazing. The remainder of the allotment will be available for livestock grazing (see **Appendix L**).

- All areas that are currently without allotments will remain closed to livestock grazing through the issuance of a grazing lease.

Minerals

- **Management Objectives**
- Manage the development of leasable (including conventional and non-conventional hydrocarbon resources) minerals, locatable mineral entry, and salable mineral material disposal in an orderly and efficient manner.
- Maintain availability of mineral material sites needed for development and maintenance of access roads for forest management, timber harvest, local communities, rights-of-way for energy production and transmission, and other uses.

- **Management Direction**
- Pursuant to 43 CFR 3809.11(c)(6), the BLM is creating two exceptions to the requirement that a Plan of Operations is required for any mining activities that are greater than casual use (such as notice-level operations) when the activities are located within lands or waters known to contain federally proposed or listed threatened or endangered species or their proposed or designated critical habitat. An operator is not required to submit a Plan of Operations for notice-level activities in the following two situations:
    - When pursuant to Section 7 of the ESA, the BLM determines that the notice-level activity will have no effect on federally proposed or listed threatened or endangered species or their proposed or designated critical habitat.
    - When BLM has completed consultation to the extent required under section 7(a)(2) of the ESA and the U.S. Fish and Wildlife Service or National Marine Fisheries Service has concurred with the BLM's finding that the notice-level activity is not likely to adversely affect federally proposed or listed threatened or endangered species or their proposed or designated critical habitat.
- A Plan of Operations will be required for mining proposals that the BLM determines would be likely to adversely affect federally proposed or listed threatened or endangered species or their proposed or designated critical habitat.
- Proposals that require a Plan of Operations and are located within lands or waters known to contain federally proposed or listed threatened or endangered species or their proposed or designated critical habitat continue to be governed by the standards in 43 CFR 3809 *et seq*.
- Pursuant to 43 CFR 3809.31(b)(2), the operator must contact the BLM before beginning operations that involve the use of a suction dredge to determine whether the operator needs to submit a notice or a plan to BLM, or whether the activities constitute casual use. It is the operator's burden to determine the location of their activity relative to the location of lands or waters that contain federally proposed or listed threatened or endangered species or their proposed or designated critical habitat, in light of the operator's potential liability under Section 9 of the ESA.
    - Suction dredging activity proposed within lands or waters that contain federally proposed or listed threatened or endangered species or their proposed or designated critical habitat, regardless of the level of disturbance, must not begin until BLM has completed consultation to the extent required under section 7(a)(2) of the ESA.
- Energy and mineral development can occur concurrently with some resource uses.

- **Leasable Minerals: Oil, Gas, or Coalbed Natural Gas Resources**[35]
- Maintain all lands as open to leasable mineral development except where closed by legislation.
- Apply site-specific stipulations, such as no surface occupancy or conditional surface uses, based on resource protection needs in—
  - Designated and suitable Wild and Scenic River segments (where not already closed by legislation);
  - National Trail management corridors;
  - District-Designated Reserve – Lands Managed for their Wilderness Characteristics;
  - Areas of Critical Environmental Concern (including Research Natural Areas and Outstanding Natural Areas where not already closed by legislation); and
  - Recreation Management Areas (Special Recreation Management Area/Extensive Recreation Management Area).
- Apply site-specific stipulations as needed to protect ESA-listed species and their critical habitats.

- **Locatable Minerals**
- Recommend for withdrawal from locatable mineral entry—
  - Designated and suitable Wild and Scenic River segments (where not already closed by legislation);
  - National Trail management corridors; and
  - District-Designated Reserve – Lands Managed for their Wilderness Characteristics.
- Recommend for withdrawal from locatable mineral entry Special Recreation Management Areas and Extensive Recreation Management Areas when mineral entry is not compatible with meeting recreation objectives or maintaining recreation setting characteristics.
- Recommend for withdrawal from locatable mineral entry Areas of Critical Environmental Concern with identified special management needs associated with locatable mineral entry (**Appendix F**).
- Retain all other areas not congressionally or secretarially withdrawn as open for locatable mineral entry.

- **Salable Minerals**
- Close to salable mineral material disposal—
  - Designated and suitable Wild and Scenic River segments (where not already closed by legislation);
  - National Trail management corridors; and
  - District-Designated Reserve – Lands Managed for their Wilderness Characteristics.
- Close Special Recreation Management Areas and Extensive Recreation Management Areas to salable mineral material disposal when not compatible with meeting recreation objectives or maintaining recreation setting characteristics.
- Close Areas of Critical Environmental Concern with identified special management needs to salable mineral material disposal (**Appendix F**).
- Maintain all other areas not closed through legislation as open to salable mineral material disposal.
- **Appendix M** provides a trends analysis that will be applied to disposals.

[35] The Sustainable Energy section addresses Geothermal Resources.

Paleontological Resources

- **Management Objectives**
- Protect and preserve significant localities from natural or human-caused deterioration or potential conflict with other resources.
- Provide appropriate scientific, educational, and recreational uses, such as research and interpretive opportunities, for paleontological resources.

- **Management Direction**
- Protect all paleontological resources through avoidance or other protection measures, consistent with BLM Handbook 8270-1 – General Procedural Guidance for Paleontological Resource Management, Chapter III (USDI BLM 1998).
- Conduct public education, outreach activities, and develop materials to educate the public on paleontological resources existing within the decision area.

Rare Plants and Fungi

- **Management Objectives**
- Provide for conservation and contribute toward the recovery of plant species that are ESA-listed or candidates.
- Support the persistence and resilience of natural communities, including those associated with forests, oak woodlands, shrublands, grasslands, cliffs, rock outcrops, talus slopes, meadows, and wetlands. Support ecological processes and disturbance mechanisms to allow for a range of seral conditions.
- Provide for the conservation of Bureau Special Status plant and fungi species.
- Support the persistence and resilience of oak species within oak woodlands and within mixed hardwood/conifer communities.

- **Management Direction**
- Manage ESA-listed species consistent with recovery plans, conservation agreements, species management plans, and designated critical habitat, and species-specific or project-specific conservation measured developed with the U.S. Fish and Wildlife Service, including the protection and restoration of habitat, altering the type, timing, and intensity of actions, and implementing other strategies designed to recover populations of species.
- Manage ESA candidate and Bureau Sensitive species consistent with any conservation agreements or strategies including the protection and restoration of habitat, alteration of the type, timing, and intensity of actions, and other strategies designed to conserve populations of the species.
- Manage habitat to maintain populations of ESA-listed, proposed, and candidate plant species.
- Prior to implementing actions that could result in habitat modification or species disturbance in the suitable habitat of any ESA-listed, proposed, or candidate plant species, or Bureau Sensitive plant species, conduct surveys to determine species presence. In addition to pre-project surveys, conduct additional surveys on BLM-administered lands for ESA-listed, proposed, and candidate plant species within suitable habitat as needed to find new populations.
- Maintain or restore natural processes, native species composition, and vegetation structure in natural communities through actions such as applying prescribed fire, thinning, removing encroaching

vegetation, treating non-native invasive species, retaining legacy components (e.g., large trees, snags, and down logs), maintaining water flow to wetlands, and planting or seeding native species.

- When re-vegetating degraded or disturbed areas, utilize locally adapted seeds and native plant materials appropriate to the location and site-specific conditions, and meeting management objectives for vegetation management and restoration activities. Use seeds and plant materials that are genetically appropriate and native to the plant community or region, to the extent practicable.
- Manage mixed hardwood/conifer communities to maintain and enhance oak (*Quercus* spp.) persistence and structure by removing competing conifers, thinning, and prescribed fire, to the extent consistent with management direction for the land use allocation.
- Manage mixed conifer communities to maintain and enhance ponderosa, Jeffrey, and sugar pine persistence and structure by removing competing conifers, thinning, and applying prescribed fire, to the extent consistent with management direction for the land use allocation.
- Create new and augment existing populations of ESA-listed, proposed, and candidate plant species and Bureau Sensitive plant and fungi species to meet recovery plan or conservation strategy objectives.

Recreation and Visitor Services

- **Management Objectives**
- Provide a diversity of quality recreational opportunities.
- Meet legal requirements for visitor health and safety and mitigate resource user conflicts.
- Mitigate recreational impacts on natural and cultural resources. In land use allocations where management of other resources is dominant, provide recreational opportunities where they can be managed consistent with the management of these other resources.
- Develop new recreation opportunities (e.g., trails, trailheads, restrooms) to address recreation activity demand created by growing communities, activity groups, or recreation-tourism if—
  - Recreation development is consistent with interdisciplinary land use plan objectives; and
  - The BLM has secured commitments from partners (e.g., a cooperative management agreement, adopt-a-trail agreement, memorandum of understanding).

- **Management Direction**
- Manage Special Recreation Management Areas and Extensive Recreation Management Areas, identified in **Appendix O**, in accordance with their planning frameworks.
- Protect recreation setting characteristics within Special Recreation Management Areas to prohibit activities that would degrade identified characteristics.
- Pursue and prioritize public access to BLM-administered lands that have high recreational potential consistent with BLM designations and allocations.
- Allow the discharge of firearms for recreational target shooting on BLM-administered lands, outside areas with firearm use restrictions described in the RMA frameworks, if the firearm is discharged toward a proper backstop sufficient to stop the projectile's forward progress.
- Issue discretionary Special Recreation Permits for a variety of uses that are consistent with resource and program objectives.
- Issue vending permits that complement visitor use or contribute to resource protection.
- Monitor activity participation and recreation setting characteristics annually during the primary use season of June through October.
- Use recreation management tools such as establishing an allocation system, applying group size limits for private and commercial recreation use, or implementing seasonal closures, if monitoring indicates

that social recreation setting characteristics are not being protected, resource damage is occurring, or user conflicts need to be addressed.

- Develop and maintain partnerships with recreation-based organizations and service providers. These partnerships should engage partners in the planning, implementation and monitoring of recreation opportunities and facilities on BLM-administered public lands.

Recreation and Visitor Services – Significant Caves[36]

- **Management Objective**
- Manage significant caves to allow for appropriate access while protecting pristine and fragile resources, wildlife values, scientific and research values, and visitor safety.

- **Management Direction**
- Manage significant caves to maintain the current level of remoteness from motorized and mechanized vehicles and to preserve the natural appearance of the cave. Prohibit construction of new facilities, roads, or trails to access the caves. Allow minor modifications (e.g., use of tape and signage, and placing rescue caches) only for scientific purposes and to accommodate safe use. Maintain low evidence of use and other people.
- Manage visitor frequency, visitor numbers, and season of use through monitoring and subsequent implementation decisions described through cave management plans for each significant cave, group of caves, or complex of caves.
- Focus all management actions on specific activity outcomes for caving and research. Outcomes will be for participants to enjoy and learn about cave and karst resources. Specific benefit outcomes will be for environmental benefits, such as increased environmental stewardship, and the preservation and protection of unique biological, paleontological, archaeological, and mineralogical aspects. Social benefits will be to provide environmental education and appreciation of cave and karst systems.
- Provide appropriate access while addressing issues and concerns relating to visitor safety and preservation of the caves' values. If issues or concerns arise, apply necessary managerial controls, such as closures, permits, trip requirements, and gating. Administer and authorize research, inventory, work projects, and digging trips. Provide informational and educational materials to authorized visitors. Do not market or promote cave and karst resources.

Recreation and Visitor Services – Formerly Used Defense Sites

- **Management Objective**
- Prevent and reduce risks to public health and the environment where hazards may exist resulting from military defense activities.

- **Management Direction**
- Manage the portion of the Modoc Aerial Gunnery and Bombing Range located within the Klamath Falls Field Office to avoid or limit exposure to areas that may contain hazards associated with munitions and explosives of concern. Munitions and explosives of concern may include unexploded ordnance, discarded military munitions, and munitions constituents when munitions constituents are

[36] The Federal Cave Resources Protection Act of 1988 describes significant caves.

present in high enough concentrations to pose an explosive hazard. The site may also be contaminated with munitions constituents that are not present in high enough concentrations to represent an explosive hazard, but in high enough concentrations to be a toxicity hazard in soil, groundwater, surface water, or air.

- Coordinate uses on BLM-administered lands within formerly used defense sites with State and Federal military agencies to prevent and reduce risks to public health and the environment. Develop, as needed, cooperative agreements or Memorandums of Understanding to ensure communication, coordination, and safe use of public lands within formerly used defense sites.
- Take appropriate measures, such as signing, fencing, removal, and remediation, to protect the public from known unexploded ordnance locations on BLM-administered lands.

Soil Resources

- **Management Objectives**
- Maintain or enhance the inherent soil functions (e.g., ability of soil to take in water, store water, regulate outputs for vegetative growth and stream flow, and resist erosion or compaction) of managed ecosystems.
- Provide landscapes that stay within natural soil stability failure rates during and after management activities.

- **Management Direction**
- Apply BMPs (**Appendix J**) as needed to maintain or restore soil functions and soil quality, and limit detrimental soil disturbance.
- Limit detrimental soil disturbance from forest management operations to a total of < 20 percent of the harvest unit area. Where the combined detrimental soil disturbance from implementation of current forest management operations and detrimental soil disturbance from past management operations exceeds 20 percent of the unit area, apply mitigation or amelioration to reduce the total detrimental soil disturbance to < 20 percent of the harvest unit area. Detrimental soil disturbance can occur from erosion, loss of organic matter, severe heating to seeds or microbes, soil displacement, or compaction.
- Avoid road construction and timber harvest on unstable slopes where there is a high probability to cause a shallow, rapidly moving landslide that would likely damage infrastructure (e.g., BLM or privately owned roads, State highways, or residences) or threaten public safety.
- Do not till soils where tillage will cause soils to become unstable due to increasing the soil moisture content.

Sustainable Energy

- **Management Objectives**
- Develop sustainable energy resources to the maximum extent possible without precluding other land uses.

- **Management Direction**
- Exclude from sustainable energy development areas that are part of the National Landscape Conservation System (e.g., Wilderness Areas, Wilderness Study Areas, Wild and Scenic Rivers, and

National Historic and Scenic Trails), Areas of Critical Environmental Concern, and District-Designated Reserve – Lands Managed for their Wilderness Characteristics.

- Site development will include practices as needed to reduce or avoid impacts to other resource uses. Appropriate practices will be applied based on site-specific conditions and include, but are not limited to, the following:
  - Control outdoor lighting with motion or heat sensors to the maximum extent practicable.
  - Use hooded outdoor lighting directed downward to minimize horizontal and skyward illumination to the maximum extent practicable.
  - Minimize the use of high-intensity lighting.
  - Establish non-disturbance buffer zones to protect sensitive habitats or areas of high risk for species of concern.
  - Control any pets of operations staff kept on-site to avoid harassment and disturbance of wildlife.
  - Use existing roads and utility corridors to the maximum extent feasible; minimize the number and length/size of new roads, lay-down areas, and borrow areas.
  - Minimize traffic volumes to the maximum extent practicable; maintain roads adequately to minimize associated impacts.
  - Install and maintain permanent fencing around electrical substations, emergency generators, and other areas potentially hazardous to human health.
  - Consolidate necessary infrastructure requirements wherever possible, including electric power transmission lines, pipelines and market access corridors, and support utility infrastructure.
  - Keep energy conversion sites clean of debris, garbage, fugitive trash or waste, and graffiti; minimize the accumulation of scrap heaps, dumps, and storage yards.
  - Design facilities used for sustainable energy harvesting, conversion, and transmission to discourage the perching or nesting by birds.
  - Integrate facilities used for sustainable energy harvesting, conversion and transmission with the surrounding landscape including minimizing the profile of ancillary structures, burial of cables, prohibition of commercial symbols, and lighting.
  - Provide secondary containment for all on-site hazardous materials and waste storage, including fuel.

Sustainable Energy – Biomass Energy Development

- **Management Objectives**
- *See Sustainable Energy management objectives.*

- **Management Direction**
- Offer slash in excess of soil stabilization needs as biomass energy feedstock.

Sustainable Energy – Wind Energy Development

- **Management Objectives**
- *See Sustainable Energy management objectives*

- **Management Direction**
- Site development will include practices as needed to reduce or avoid impacts to other resource uses. Appropriate practices will be applied based on site-specific conditions and include, but are not limited to, the following:
  - Lock turbine tower access doors to limit public access.
  - Locate turbines away from landscape features known to attract raptors.

- Locate turbines away from colonies where bats hibernate, breed, and raise their young; locate turbines outside of bat migration corridors or flight paths between colonies and feeding areas
- Encompass specific design elements for turbine arrays and turbine design including visual uniformity, use of tubular towers, proportion and color of turbines, non-reflective paints, and prohibition of commercial messages on turbines.
- Repair, replace, or remove inoperative turbines in a timely manner.
- Exclude designated areas that are part of the National Landscape Conservation System (e.g., Wilderness Areas, Wilderness Study Areas, Wild and Scenic Rivers, and National Historic and Scenic Trails) and Areas of Critical Environmental Concern from wind energy site monitoring and testing and development.
- Incorporate wildlife-compatible design standards when fencing is necessary.
- Avoid the use of guy wires on communication towers and meteorological towers at wind energy project sites.
- Keep the installation of meteorological towers on a project site to a minimum; do not locate these towers in sensitive habitats or in areas where ecological resources known to be sensitive to human are present.
- Light only a portion of the turbines within a wind project; fix all pilot warning lights to fire synchronously.
- Do not add any wildlife habitat enhancements or improvements (e.g., ponds, guzzlers, rock piles, brush piles, bird nest boxes, nesting platforms, wildlife food plots) that would attract small mammals to wind energy facilities.
- Use only shielded, separated, or insulated electrical conductors that minimize electrocution risk to avian wildlife.

Sustainable Energy – Geothermal Energy Development

- **Management Objectives**
- *See Sustainable Energy management objectives.*

- **Management Direction**
- Site development will include practices as needed to reduce or avoid impacts to other resource uses. Appropriate practices will be applied based on site-specific conditions and include, but are not limited to, the following:
  - Minimize impacts to livestock operations from geothermal energy drilling and development.
  - Incorporate certified weed-free mulch into the reclamation of the land disturbed during the development of geothermal resources.
  - Raise above-ground piping on-site for sufficient wildlife passage.
  - Isolate any liquid that is at elevated temperatures or contains contaminants that are toxic or harmful to fur or feathers from wildlife access with fencing, netting or complete enclosure.

Sustainable Energy – Sustainable Energy Transmission Corridors

- **Management Objectives**
- *See Sustainable Energy management objectives.*

- **Management Direction**
- Site development will include practices as needed to reduce or avoid impacts to other resource uses. Appropriate practices will be applied based on site-specific conditions and include, but are not limited to, the following:

- Site overhead lines away from areas where bird crossings are frequent.
- Mark overhead lines in accordance with Avian Power Line Interaction Committee collision guidelines.
- Install overhead lines such that the conductors parallel tree lines, employ bird flight diverters, or are otherwise screened so that bat and bird collision risk is reduced.
- Where pipeline right-of-way clearings can be incorporated into a strategic system of fire breaks, make clearings sufficiently wide to be effective as fire breaks.
- Raise pipelines constructed above ground sufficiently high enough to allow wildlife passage where needed and avoid potential alterations to predator/prey dynamics.

Trails and Travel Management

- **Management Objectives**
- Maintain a comprehensive travel network that best meets the full range of public use, resource management, and administrative access needs.
- Protect fragile and unique resource values from damage by public motorized vehicle use.
- Provide public motorized vehicle use opportunities where appropriate.

- **Management Direction**
- Develop public motorized and non-motorized travel routes and trails in a manner designed to minimize conflicts between public motorized vehicle use and other existing (or proposed) recreational uses of the same, or neighboring, public lands. Design in a manner to ensure the compatibility of such uses with existing conditions in populated areas, taking into account noise and other factors.
- Manage public motorized vehicle use in Recreation Management Areas (Special Recreation Management Area/Extensive Recreation Management Area) according to interim management guidelines until subsequent comprehensive implementation-level travel management plans are completed.
- Develop closed or abandoned roads to provide additional public motorized and non-motorized trail opportunities, where feasible and compatible with other resource objectives.
- Prohibit public motor vehicle travel within areas designated as *closed* for public motorized access. Where the BLM has public access, allow public access by means other than motorized vehicle, such as mechanized or non-motorized use. Allow travel required for valid existing rights.
- Restrict public motorized vehicle travel within areas designated as *limited* for public motorized access. Until completion of implementation-level travel management planning, limit public motorized vehicle travel to existing routes where the BLM has public access. After completion of implementation-level travel management planning, limit public motorized vehicle travel in conformance with the resultant Travel Management Plan. Allow travel required for valid existing rights.

Visual Resource Management

- **Management Objectives**
- Protect scenic values on public lands where visual resources are an issue or where high-value visual resources exist.
- Prohibit activities that would disrupt the existing character of the landscape in Visual Resource Management Class I areas.

- Retain the existing character of the landscape in Visual Resource Management Class II areas.
- Partially retain the existing character of the landscape in Visual Resource Management Class III areas.
- Allow for major modification of the existing character of the landscape in Visual Resource Management Class IV areas.

- **Management Direction**
- Only allow activities that are found to meet visual management objectives using the Visual Resource Contrast Rating system.
- Visual Resource Management Class I includes—
  - Wilderness Areas;
  - Wilderness Study Areas; and
  - Designated and suitable Wild and Scenic Rivers that are classified as Wild.

  Manage Visual Resource Management Class I areas in accordance with natural ecological changes. Prohibit activities that would lower the Visual Resources Inventory class of Visual Resource Management Class I areas. The level of change to the characteristic landscape will be very low and will not attract attention. Changes will repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape.
- Visual Resource Management Class II includes—
  - Designated and suitable Wild and Scenic Rivers that are classified as Scenic;
  - Eligible Wild and Scenic Rivers that are classified as Scenic outside of the Harvest Land Base;
  - National Trail management corridors;
  - District-Designated Reserve – Lands Managed for their Wilderness Characteristics;
  - Special Recreation Management Areas that fall within the Primitive and Backcountry category of the Recreation Opportunity Spectrum; and
  - Areas of Critical Environmental Concern in Visual Resource Inventory Class II outside of the Harvest Land Base.

  Manage Visual Resource Management Class II areas for low levels of change to the characteristic landscape. Management activities will be seen but will not attract the attention of the casual observer. Changes will repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape.
- Visual Resource Management Class III includes—
  - Designated, suitable, and eligible Wild and Scenic Rivers that are classified as Recreational;
  - Eligible Wild and Scenic Rivers that are classified as Scenic within the Harvest Land Base;
  - Special Recreation Management Areas and Extensive Recreation Management Areas that fall within the Middle country category of the Recreation Opportunity Spectrum; and
  - Areas of Critical Environmental Concern in Visual Resource Inventory Class III, and in Visual Resource Inventory Class II inside the Harvest Land Base.

  Manage Visual Resource Management Class III areas for moderate levels of change to the characteristic landscape. Management activities will attract attention but will not dominate the view of the casual observer. Changes will repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape.
- Visual Resource Management Class IV includes all lands that are not designated as Visual Resource Management Class I, II, or III. Manage Visual Resource Management Class IV areas for high levels of change to the characteristic landscape. Management activities may dominate the view and will be the major focus of viewer attention.

Wildlife

- **Management Objectives**
- Conserve and recover species that are ESA-listed, proposed, or candidates, and the ecosystems on which they depend.
- Implement conservation measures that reduce or eliminate threats to Bureau Sensitive species to minimize the likelihood of and need for the ESA-listing of these species.
- Conserve or create habitat for species addressed by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act and the ecosystems on which they depend.

- **Management Direction**
- Manage habitat for species that are ESA-listed, or are candidates for listing, consistent with recovery plans, conservation agreements, and designated critical habitat.
  - Existing conservation agreements include:
    - Conservation Agreement for the Oregon Spotted Frog (*Rana pretiosa*) in the Klamath Basin of Oregon (May 7, 2010).
- Implement conservation measures to mitigate specific threats to Bureau Sensitive species during the planning of activities and projects. Conservation measures include altering the type, timing, location, and intensity of management actions.
- Manage naturally occurring special habitats to maintain their ecological function including seeps, springs, wetlands, natural ponds, vernal pools/ponds, natural meadows, rock outcrops, caves, cliffs, talus slopes, mineral licks, oak savannah/woodlands, sand dunes, and marine habitats.
- Manage human-made special habitats as wildlife habitat when compatible with their engineered function, including bridges, buildings, quarries, pump chances/heliponds, abandoned mines, and reservoirs, to the extent possible consistent with safety and legal requirements.
- Klamath Falls Field Office and Medford District: maintain or enhance Bureau Special Status Species wildlife habitat on rangelands.
- Prior to implementing actions that could result in habitat modification or species disturbance in habitat for the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, conduct surveys to determine species presence.
- Do not approve, fund, or implement actions that would adversely affect the Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.
- Do not approve, fund, or implement actions that would adversely affect the designated critical habitats of the vernal pool fairy shrimp, Oregon spotted frog, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.

Wildlife – Bald and Golden Eagles

- Protect known bald eagle or golden eagle nests (including active nests and alternate nests) and bald eagle winter roosting areas. Prohibit activities that will disrupt bald eagles or golden eagles that are actively nesting.

- Continue routine use and maintenance of existing roads and other facilities to where such use pre-dates the eagles' successful nesting activity.
- Do not remove overstory trees within 330 feet of bald eagle or golden eagle nests.
- Do not conduct timber harvest operations (including road construction, tree felling, and yarding) during the breeding season within 660 feet of bald eagle or golden eagle nests. Decrease the distance to 330 feet around alternate nests within a particular territory, including nests that were attended during the current breeding season but not used to raise young, or after eggs laid in another nest within the territory have hatched.
- Prohibit operation of off-highway vehicles within 330 feet of bald eagle or golden eagle nests during the breeding season. In areas without forest cover or topographic relief to provide visual and auditory screening, prohibit operation of off-highway vehicles within 660 feet of bald eagle or golden eagle nests during the breeding season.
- Prohibit activities that will disrupt roosting bald eagles or golden eagles at communal winter roosts.

Wildlife – Bats

- Protect known maternity colonies and hibernacula for Bureau Sensitive bat species within caves, abandoned mines, bridges, and buildings with a 250-foot buffer:
  - Maintain existing habitat conditions and protect the site from destruction or species disturbance, to the extent possible consistent with safety and legal requirements.
  - Prohibit blasting
  - Implement hazard fuel reduction treatments to protect the site from wildfire or to maintain site conditions conducive to the colony.
- Prohibit blasting during periods of reproduction and hibernation within 1 mile of known maternity colonies and hibernacula for Bureau Sensitive bat species within caves, abandoned mines, bridges, and buildings.
- Where white-nose syndrome is found in the bats residing within caves and abandoned mines, bridges, and buildings, prohibit human access except for monitoring, education, or research purposes.

Wildlife – Deer or Elk Management Areas (Klamath Falls Field Office, Medford District, and Salem District)

- For the Medford and Salem Districts, restrict motor vehicle use within designated deer or elk management areas between November 1 and April 15. For the Klamath Falls Field Office, restrict motor vehicle use within the Pokegama management area between November 20 and April 1. Use techniques such as gating or signing to impose the restrictions. Allow administrative use of roads, as needed, on a year-round basis.
- Plant native forage species along roadsides, skid trails, and on disturbed areas, or create forage plots where forage for deer or elk is limited within designated deer or elk management areas.
- For the Klamath Falls Field Office and Medford District:
  - Cut encroaching juniper that hinders attainment of desired forage conditions to maintain and improve forage for big game. Remove, utilize, or pile and burn cut juniper.
  - Retain old-growth 'legacy' juniper when it meets the following definition: Individual trees that likely originated in the pre-settlement period, before 1870. These trees are commonly found in rocky areas where vegetation is sparse and fire frequency is naturally low. Characteristics of old-growth juniper include some or all of the following:

- Crown is flat, rounded, broad at top, or irregular crown (as opposed to the more pointed tops of younger trees) or dead "spike" top
- Numerous dead branches
- Branches covered with coarse, bright yellow-green lichen (*Letharia* or wolf lichen)
- Large diameter lower branches
- Large diameter trunk relative to height
- Spirally twisted bark and deep furrows on the trunk
- Hollow trunk

Wildlife – Fisher

- Do not approve, fund, or carry out actions that would disrupt normal fisher behaviors (e.g., foraging, resting, or denning) associated with known natal or maternal denning sites, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species.
- Within stands where fisher natal or maternal denning or dens are documented, do the following:
    - Maintain ≥ 80 percent canopy cover within at least 50 feet of documented fisher natal and maternal dens.
    - Maintain sufficient canopy cover on the remainder of the stand to support fisher denning post-project.
    - Protect fisher denning structures ≥ 24" diameter (snags, down woody material, and live trees with cavities) within the stand. In this context, **protect fisher denning structures** means to retain the structure in the stand and if, for safety concerns, it is necessary to fall snags or live trees with cavities then those structures would remain on-site as additional down woody material.
    - Retain untreated portions within the stand.
- Within 5th field-watersheds (HUC 10) where fisher are documented to occur, favor retaining trees that have structures (e.g., cavities, mistletoe, rust brooms) that are typically used as denning or resting sites by fisher.
- The above management direction may be modified in conference or consultation with the U.S. Fish and Wildlife Service based on new information.

Wildlife – Gray Wolf

- Restrict activities that create noise or visual disturbance(s) above ambient conditions within one mile of known active gray wolf dens from April 1 to July 15.
- In accordance with 43 CFR 4110, modify grazing leases, as appropriate, to include the following measures when the U.S. Fish and Wildlife Service (1) determines gray wolf occupancy of a BLM grazing allotment, and (2) recommends the implementation of these measures as part of its wolf conservation strategy:
    - Remove, bury, or otherwise dispose of livestock carcasses found on areas of the allotment where they would attract wolves to a potential conflict situation with other livestock (such as a salting ground, water source, or holding corral) such that the carcass will not attract wolves.
    - Move sick or injured livestock from the allotment so they are not targeted by wolves.
    - Limit allotment management activities by humans near active wolf den sites during the denning period (April 1 to July 15) to avoid human disturbance of the site. Determine the distance on a site-specific basis, depending primarily on topography around the den site.
    - Do not place salt or other livestock attractants near known wolf dens or rendezvous sites to minimize livestock use of these sites. If a new den or rendezvous site is discovered, relocate any

previously established salt or attractant location as necessary to minimize livestock use of these sites.

Wildlife – Marbled Murrelet

- Except as stated under Option 3, below, and except when needed to protect human safety and property, prohibit activities that disrupt[37] marbled murrelet nesting at occupied sites within 35 miles of the Pacific Coast within all land use allocations and between 35–50 miles of the Pacific Coast within reserved land use allocations.
- Before modifying nesting habitat or removing nesting structure in (1) all land use allocations within 35 miles of the Pacific Coast, and (2) Late-Successional Reserve and Riparian Reserve between 35–50 miles from the Pacific Coast and outside of exclusion Areas C and D (shown in **Figure 3-166**),—
  - Assess the analysis area for **marbled murrelet nesting structure.**[38] The analysis area consists of the proposed project and lands within 726 feet of the project boundary. This area includes all habitat that would be examined by a 5-acre moving circle (526 feet in diameter) whose inner edge (i.e., the edge closest to the center of the project area) is within 200 feet of the project area boundary. The analysis area includes all nesting structures that could be affected by habitat modification.
  - If the analysis area contains no nesting structure, no further consideration of marbled murrelet habitat is required.

- Before modifying forest stands in any 5-acre portion of the analysis area that contains at least 6 trees with nesting structure, implement Option 1, 2, or 3.

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[37] Disruption is a type of disturbance that that creates the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering (see 50 § CFR 17.3). An action that would disrupt the normal behavior of a listed species may affect, and would be likely to adversely affect, the species and would cause the taking of affected individual(s). In contrast, disturbance is a human action that may affect a federally-listed animal species by the addition, above ambient condition, of noise or human intrusion, or the mechanical movement of habitat (e.g., the shaking of the forest canopy from helicopter rotor wash). Disturbance is temporary/short term (minutes to days) and does not modify habitat structure, or water/air flow or quality. (Disturbance should not be confused with "surface disturbance," which refers to an action that modifies soil, water or vegetation). Disturbance requires the presence of a listed animal. Disruption is a subset of disturbance.

[38] **Marbled murrelet nesting structure** is a conifer tree with all of the following characteristics (which are not always visible from the ground):

- A DBH of at least 19.1" and a height greater than 107'.
- A nest platform at least 32.5' above the ground. A nest platform is a relatively flat surface at least 4" wide, with nesting substrate (e.g., moss, epiphytes, duff), and an access route through the canopy that a murrelet could use to approach and land on that platform.
- A tree branch or foliage, either on the tree with potential structure or on an adjacent tree, which provides protective cover over the platform.

Note: Nesting structure does not have to be occupied by nesting marbled murrelets.

Option 1. Survey for the marbled murrelet using a protocol with a defined methodology and a resultant probability of detection.

- If no occupancy is determined, no further consideration of marbled murrelet habitat is required.
- If occupancy is determined, do not conduct activities within the **occupied stand**[39] and all forest within 300 feet of the occupied stand.
- The following are exceptions that may be implemented as long as the stand continues to support nesting:
  - Felling of hazard trees and trees for instream restoration projects.
  - Construction of linear and nonlinear rights-of-way, spur roads, yarding corridors, or other facilities.
- As needed to protect the overall health of the **occupied stand**, the following activities would be implemented as long as the stand continues to support nesting:
  - Wildfire suppression.
  - Fuels reduction.
  - Insect and disease control.
  - Other activities to improve the health of the stand or adjacent stands.

Option 2. Exclude nesting structure from the project area by doing all of the following:

- Do not remove or damage nesting structure. This includes trees with nesting structure and adjacent trees with branches that interlock the branches of any tree with nesting structure.
- Do not conduct timber harvest and associated ground disturbing activities during the murrelet nesting period (April 1 – September 15) unless the U.S. Fish and Wildlife Service concurs that disturbances would not adversely affect nesting marbled murrelets.
- Maintain a 150-foot un-thinned buffer around all trees with nesting structure. Within this buffer, do not remove trees for any reason associated with timber harvest, including the placement of roads, landings, or yarding corridors. Other activities are permitted if the U.S. Fish and Wildlife Service concurs that such activities would not adversely affect nesting marbled murrelet.
- Maintain an average canopy cover of at least 60 percent post-project (averaged over each 40-acre area) in the zone between 150 feet and 300 feet of all trees with nesting structure.
- Include additional, site-specific prescriptive measures to maintain or enhance habitat conditions, as needed, in the zone between 150 feet and 300 feet from all trees with nesting structure. In this context, **maintain marbled murrelet habitat** means to maintain stand structural characteristics such that, following habitat modification, the stand could support marbled murrelet nesting.
- Maintain an average canopy cover of at least 40 percent post-project (averaged over each 40-acre area) within the project area beyond 300 feet from all trees with nesting structure.

[39] Marbled murrelet occupied stand refers to all forest stands, regardless of age or structure, within ¼ mile (1,320 feet) of the location of marbled murrelet behavior indicating occupancy and not separated from the location of marbled murrelet behavior indicating occupancy by more than 328 feet of non-forest.

Option 3. With concurrence from the U.S. Fish and Wildlife Service, manage nesting structure in a manner that would not adversely affect nesting marbled murrelets, except when taking actions that are necessary to treat or protect stands from sudden oak death. Take actions necessary to treat or protect stands from sudden oak death, including actions that may adversely affect nesting marbled murrelets.

- Before modifying forest stands in any 5-acre portion of the analysis area that contain 1–5 trees with nesting structure, implement Options 1, 2, 3, or 4.

Option 4. Protect nesting structure within the project area by doing all of the following:

- If the nesting structure is within 20 miles of the coast—
  - Between April 1 and August 5, stand modification would not occur;
  - Between August 6 and September 15, stand modification activities would not begin until 2 hours after sunrise and would conclude 2 hours before sunset.
- Design projects in accordance with Late-Successional Reserve management direction.
- Do not remove or damage nesting structure.
- Design habitat modifications that occur within one site-potential tree height of nesting structure to protect and improve future habitat conditions. Examples include—
  - Protecting the roots of trees with nesting structure;
  - Removing suppressed trees;
  - Removing trees that might damage nesting structure during wind storms;
  - Removing trees that compete with key adjacent trees that are, or will be, providing cover to potential nest platforms.
- Implement management actions that aid development of limbs and adjacent cover.
- Prohibit the creation of any opening (i.e., a gap ≥ 0.25 acre in size) within a distance equal to one site-potential tree height of nesting structure.

Wildlife – Northern Spotted Owl

- Manage habitat conditions for northern spotted owl movement and survival between and through large blocks of northern spotted owl nesting-roosting habitat.
- Do not authorize timber sales that would cause the incidental take of northern spotted owl territorial pairs or resident singles from timber harvest until implementation of a barred owl management program consistent with the assumptions contained in the Biological Opinion on the RMP has begun.

Wildlife – North Oregon Coast Distinct Population Segment of the Red Tree Vole

- Survey proposed projects within the range of the North Oregon Coast Distinct Population Segment of the red tree vole north of Highway 20 that could degrade or remove habitat using a protocol with a defined methodology that includes detection probabilities. Habitat that requires surveys prior to modification includes stands containing Douglas-fir, grand fir, Sitka spruce, or western hemlock and meet the following:
  - Stands with a QMD ≥ 16” based on the Survey Protocol for the Red Tree Vole, Version 3.0 (Huff *et al.* 2012, p. 9); and are

- **Either** (a) conifer-dominated stands that are ≥ 80 years old **<u>or</u>** (b) conifer-dominated stands that have ≥ 60 percent canopy cover and have ≥ 2 superdominant conifer trees[40] per acre.

- The following types of projects are exempt from the above direction to survey for red tree voles prior to project implementation:
  - Projects in stands < 80 years old.
  - Culvert replacements on roads that are in use and part of the road system; culvert removals if the road is temporary or to be decommissioned.
  - Riparian and stream improvement projects where the work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the stream improvement work is the placement of large wood, channel and flood plain reconstruction, or removal of channel diversions.
  - Portions of hazardous fuels treatments where prescribed fire is applied. Any portion of a hazardous fuels treatment project involving commercial logging will remain subject to survey requirements except for projects in stands < 80 years old.
- If surveys north of Highway 20 indicate that habitat is occupied by red tree voles from the North Oregon Coast Distinct Population Segment, establish a 'habitat area' for each cluster of nests that are not isolated from one another by more than 330 feet and includes at least one active nest.
  - Establish habitat areas at least 10 acres in size and include 1.0 acre per nest if there are more than 10 red tree vole nests (e.g., establish a 15-acre habitat area for a cluster with 15 red tree vole nests).
  - Within habitat areas, do not remove or modify nest trees.
  - Within habitat areas, do not create barriers or strong filters to red tree vole movement through the canopy by—
    - Maintaining at least 75 percent canopy cover within habitat areas;
    - Retaining all nest trees (including active and inactive nest trees); and
    - Retaining trees with crowns directly interlocking the crowns of nest trees.

    Allow routine maintenance of existing infrastructure and facilities in habitat areas (including the felling of hazard trees) that does not meet the above criteria.
- South of Highway 20 within the North Oregon Coast Distinct Population Segment, establish and manage habitat areas as described above for known sites of red tree voles in the Late-Successional Reserve and Riparian Reserve.

<u>Wildlife – Oregon Spotted Frog</u>

- Manage livestock grazing at sites occupied by Oregon spotted frogs to prevent direct impacts to eggs, tadpoles, or adults.

<u>Wildlife – Siskiyou Mountains Salamander</u>

- Manage the Siskiyou Mountains salamander consistent with the Conservation Agreement for the Siskiyou Mountains Salamander (*Plethodon stormi*) in Jackson and Josephine Counties of Southwest Oregon; and in Siskiyou County of Northern California (Aug. 17, 2007), as amended and as long as in effect.

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[40] **Superdominant conifer trees** typically have crowns that extend above the general stand canopy and have large branches in the upper canopy of the dominant trees in the stand. Superdominant trees may be remnant trees from an earlier cohort, or they may be trees from the dominant cohort that were more open grown and have become much larger than the rest of the trees in the stand.

Wildlife – Vernal Pool Fairy Shrimp

- Do not authorize or construct additional discretionary roads and trails within designated critical habitat for the vernal pool fairy shrimp or within vernal pool fairy shrimp habitat.

Wildlife – Pacific Coast Distinct Population Segment of the Western Snowy Plover

- Do not authorize or construct additional discretionary roads and trails within designated critical habitat or within western snowy plover habitat.
- Restore snowy plover nesting habitat.
- Restrict the timing and location of beach access or activities to avoid disruption of normal snowy plover nesting and nesting behaviors.

Wild Horses

- **Management Objective**
  - Manage and maintain a healthy population of wild and free-roaming horses in the Pokegama Herd Management Area of the Klamath Falls Field Office.

- **Management Direction**
- Gather horses to maintain the appropriate management level of 30–50 head. During gathers, the number of horses will normally be reduced to the low end of the appropriate management level, and then allowed to increase to the top end of the appropriate management level before another gather occurs. Horses will be removed from private land per private landowner request. Horses straying outside the herd management area will be removed or returned to the herd management area.
- Maintain existing water developments to provide season-long water for wild horses within the herd management area. Consider new developments to assist in meeting the herd management objectives.
- Provide periodic repair and maintenance of fences to protect riparian areas from concentrated use by wild horses.
- Protect Bureau Sensitive plant habitat from concentrated use by wild horses, including constructing and maintaining fences as necessary.
- Adjust the appropriate management level if monitoring data identifies a change in long-term forage availability or rangeland health assessments and evaluations determine that wild horse numbers or patterns of grazing use are a contributing factor toward not meeting one or more of the Standards for Rangeland Health and Guidelines for Grazing Management for Public Lands in Oregon and Washington.
- Introduce wild horses from other herd areas periodically to maintain the viable genetic diversity of the herd.

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Appendix B. Monitoring Plan

Monitoring Plan for the Proposed Resource Management Plan

Monitoring is an essential component of an RMP. Monitoring provides information to determine whether the BLM is following the RMP management direction (implementation monitoring) and to verify if the implementation of the RMP is achieving plan-level desired results (effectiveness monitoring).

The monitoring plan for the Proposed RMP focuses specifically on monitoring the implementation and effectiveness of the RMP and is not intended as an all-encompassing strategy that addresses all ongoing monitoring and research efforts. This monitoring plan does not attempt to address research-based questions. There are many ongoing research-based efforts in which the BLM participates that address evaluating whether the RMP is based on correct assumptions (validation monitoring).

The use of this monitoring plan by all BLM offices in the decision area would provide a basis for consistent and coordinated monitoring, and allow district information to be compiled and considered at the scale of the entire decision area. The BLM would evaluate the monitoring questions at each monitoring interval to ascertain if the questions, reporting, methods, sample size, or intervals need to be changed. The BLM would make such changes to the monitoring plan through plan maintenance.

Effectiveness Monitoring

The BLM would continue to rely on the existing interagency effectiveness monitoring modules to address key questions about whether the RMP is effectively meeting its objectives. The existing interagency effectiveness modules are aquatic and riparian ecosystems, late-successional and old growth, marbled murrelet, northern spotted owl, socioeconomic, and tribal. Although there are differences in the objectives in the 1995 RMP and this Proposed RMP, the key questions that the existing interagency effectiveness modules are designed to answer are still relevant to the objectives of the Proposed RMP, as detailed below. These key questions address fundamental conditions and processes that underlie the objectives of both the 1995 RMP and this Proposed RMP. As such, answering these key questions through effectiveness monitoring will continue to provide a basis for the BLM to determine whether the RMP is effectively meeting its objectives.

The aquatic and riparian ecosystems effectiveness monitoring program assesses status and trends in watershed condition to answer the basic question:

- Is implementation of the RMP maintaining and restoring aquatic and riparian ecosystems to desired conditions on Federal lands in the planning area?

This monitoring effort determines riparian watershed condition status for every 6th field watershed (with > 5 percent Federal ownership along the stream length) based on upslope and riparian data derived from GIS layers and satellite imagery. In-channel attributes are also measured using a statistically valid survey design to assess aquatic watershed condition. Changes in riparian and aquatic conditions provide information for tracking status and trend based on management activities, natural disturbance and wildfire. More information on the aquatic and riparian ecosystems effectiveness monitoring is contained in the 20-year Monitoring Report (Miller *et al*. 2015), which is incorporated here by reference.

The late-successional and old growth (LSOG) ecosystems effectiveness monitoring program characterizes the status and trend of older forests to answer the basic question:

- Is implementation of the RMP maintaining and restoring late-successional and old growth forest ecosystems to desired conditions on Federal lands in the planning area?

This monitoring effort determines the current status of forest vegetation from classification of satellite imagery and analysis of inventory and other available data. Remote sensing change detection and trend analysis provide information for tracking losses and gains in forest conditions from management activities, natural succession, and wildfire. More information on the late-successional and old growth ecosystems effectiveness monitoring is contained in the 20-year Monitoring Report (Davis *et al*. in press), which is incorporated here by reference.

The marbled murrelet effectiveness monitoring program assesses status and trends in marbled murrelet populations and nesting habitat to answer the basic questions:

- Are the marbled murrelet populations associated with the planning area stable, increasing, or decreasing?
- Is implementation of the RMP maintaining and restoring marbled murrelet nesting habitat?

This monitoring effort determines marbled murrelet population size and trends by sampling of populations in near-shore waters, using standardized and consistent methodology. Trends in the amount, quality, and distribution of nesting habitat in the planning area are evaluated periodically using a model approach that applies current vegetation maps along with other data derived from GIS layers and other available sources. More information on the marbled murrelet effectiveness monitoring is contained in the 20-year Monitoring Report (Falxa *et al*. 2015), which is incorporated here by reference.

The northern spotted owl effectiveness monitoring program assesses status and trends in northern spotted owl populations and habitat to answer the basic questions:

- Will implementing the RMP reverse the downward trend in spotted owl populations?
- Is implementation of the RMP maintaining and restoring owl habitat necessary to support viable owl populations?

Population monitoring documents survival, reproductive success, and annual rate of population change in northern spotted owl demographic study areas. Maps depicting habitat suitability are produced using habitat models applied to current vegetation maps developed by the LSOG monitoring program along with other available data sources. More information on the northern spotted owl effectiveness monitoring is contained in the draft 20-year Monitoring Report (Davis *et al*. 2015), which is incorporated here by reference.

The socio-economic effectiveness monitoring program assesses social and economic impacts of Federal forest management, framed as two questions:

- Are predictable levels of timber and non-timber resources available and being produced?
- Are communities and economies experiencing positive or negative changes that may be associated with Federal forest management?

The key objectives of the socio-economic effectiveness monitoring program are to identify communities experiencing significant positive or negative conditions or trends, as well as those that are not, and to improve understanding of the relationship between Federal forest management and social and economic change. To address the objectives above, the monitoring program analyzes trends in data for timber and non-timber resources. The monitoring program considers social and economic indicators derived from U.S. census data, analysis of quantitative data from agency databases, along with other available data. More information on the socioeconomic effectiveness monitoring is contained in the 20-year Monitoring Report (Grinspoon *et al*. 2015), which is incorporated here by reference.

The tribal effectiveness monitoring program addresses conditions, trends, and access to resources protected by treaty or of interest to American Indian tribes, the condition of and access to religious and cultural heritage sites, and the quality of the government-to-government relationship. The basic effectiveness monitoring questions are:

- How well and to what degree is government-to-government consultation being conducted under the RMP?
- Have the goals and objectives of the consultation been achieved?
- Is the consultation occurring because of effects on resources of tribal interest on Federal lands or trust resources on tribal lands?

Effectiveness monitoring data are collected during interviews using a standardized questionnaire developed by Federal agency officials. All federally recognized Tribes with Tribal lands and/or territories within the RMP area will be invited to participate in interviews. More information on the tribal effectiveness monitoring is contained in the 20-year Monitoring Report (Vinyeta and Lynn 2015), which is incorporated here by reference.

The interagency effectiveness monitoring modules would continue to report every 5 years. The BLM would continue to use these reports to state the findings and conclusions made through monitoring, and to serve as a report to managers and the public. Effectiveness monitoring reports would also include analysis of whether the BLM is achieving desired conditions based on effectiveness monitoring questions and, where possible, inform adaptive management.

In addition to the six interagency effectiveness monitoring modules, the BLM would conduct effectiveness monitoring of hazardous fuels treatments through the Fuels Treatment Effectiveness Monitoring (FTEM) system. The FTEM is a centralized interagency web-based hub for recording on-the-ground documentation describing the effect of hazardous fuel reduction treatments on the wildland fire environment, framed around two key questions:

- Did the fire behavior change as a result of the treatment (as planned in the treatment objectives)?
- Did the treatment contribute to control of the fire?

The FTEM system is intended to identify the extent which hazardous fuels treatments are affecting the wildland fire environment. Field personnel from each field office will fill out an online form for every hazardous fuel reduction treatment intersected by a wildfire, within 90 days of the wildfire burning in the treated area.

The BLM will conduct monitoring of employment effects on low-income populations in Coos and Curry Counties.[41] The Proposed RMP/Final EIS identified that the RMP will have disproportionately negative employment effects on low-income populations in Coos and Curry counties. Although the BLM will monitor the level and type of timber harvest, payments to counties, and changes in resource conditions, these measurements will not tell the BLM how low-income populations are being affected. The BLM will conduct monitoring, that will identify and track appropriate indicators of social and economic conditions. The BLM will conduct primary research, such as focus groups or interviews with community residents, leaders, and others, to supplement and interpret the secondary data. The results of the monitoring will allow the BLM and its partners to identify environmental justice impacts that have not been mitigated through the RMP as implemented or by other means, pointing the way toward potential mitigation actions.

[41] This monitoring component is not effectiveness monitoring in the same sense as the other components described in this section, in that it would not be directly evaluating whether the RMP is effectively meeting its objectives. Instead, this monitoring would evaluate whether the employment effects in Coos and Curry Counties identified in the Proposed RMP/Final EIS are occurring as analyzed and would identify any potential mitigation measures that would be revealed by the monitoring of effects.

Implementation Monitoring

The implementation monitoring plan for the Proposed RMP would assess the level of management activity and would examine if the BLM is implementing actions in accordance with management direction of the RMP.

The BLM would employ sampling or evaluation of a subset of implementation actions. The BLM has designed the monitoring plan for the Proposed RMP to avoid prohibitive costs and effectively answer monitoring questions and reporting levels of activities. It is not necessary or desirable for the BLM to monitor every implementation action of an RMP. The BLM would select projects to be monitored based on those that would yield a greater amount of information or be more beneficial. For example, a random sample may result in monitoring of a relatively small straightforward project that would yield limited information, whereas a more sophisticated or complex project might be available for monitoring that would yield more information or be more effective. As much as possible, project implementation monitoring would be integrated among resources and programs. This integration saves time and costs, and helps build common information and understanding between various resources and programs.

The BLM would conduct sampling at the level of the entire administrative unit to which the resource management applies (e.g., Medford District or Klamath Falls Field Office).

The BLM would report implementation monitoring results annually in a monitoring report, which may be combined with other documents, such as an annual program summary. The monitoring report would report, track, and assess the progress of plan implementation, state the findings and conclusions made through monitoring, and serve as a report to managers and the public. Monitoring reports would also include any discussions and analysis of non-compliance and recommendations for corrective action.

Some management direction in the Proposed RMP is not measurable or quantifiable, or does not have a standard or threshold of acceptability, and therefore would not lend itself to being addressed through monitoring questions that are almost always dependent on a quantifiable basis of measurement. The level of activity for certain management direction that does not have standards or thresholds of acceptability would be monitored in the form of a program reporting item. The BLM will use the information in the program reporting items, to assess the level of management activity and examine if the BLM is implementing actions consistent with the analytical assumptions in the Proposed RMP/Final EIS.

In some cases, where monitoring indicates very high compliance with the plan, the BLM would subsequently adjust the frequency or interval of monitoring for cost and time efficiency.

Monitoring of certain questions would not take place in the early years of implementation, because the BLM would not yet have completed projects and, therefore, would not be ready for monitoring. Although incomplete projects may be informally examined by managers to assess progress towards implementing management actions and achieving objectives, the evaluation of incomplete projects would not be part of formal plan monitoring. Not all programs or resources have monitoring questions.

Monitoring Questions

Late-Successional Reserve

M1. Monitoring Question: Have the number of snags been created in the appropriate size classes as described in the management direction (**Appendix B**, **Table B-3**)?

Monitoring Requirement: Evaluate at least one completed timber sale in a Late-Successional Reserve per field office. Report the number of snags created > 20” DBH and > 10” DBH per project.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

M2. Monitoring Question: Has the amount of down woody material described in the management direction been retained when implementing fuels or prescribed fire treatments (**Appendix B**, **Table B-4**)?

Monitoring Requirement: Evaluate at least one fuels or prescribed fire treatment in the Late-Successional Reserve per field office. Report the percent cover of down woody material and the method used to measure percent cover.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

Late-Successional Reserve - Dry

M3. Monitoring Question: Have the Medford District and the South River Field Office of the Roseburg District applied selection harvest or commercial thinning to meet decadal acreage targets set forth in the RMP? Note that acreage in untreated skips counts towards total treatment acreage for this calculation.

Monitoring Requirement: Report acres of thinning and selection harvest sold and the cumulative total since approval of the plan. Also report as an annual average and compare with the annual average required to meet decadal acreage targets.

Monitoring Interval: Annual.

Riparian Reserve

***Note*:** Monitoring questions M4–M9 do not apply to Eastside Management Area – Riparian Reserve.

M4. Monitoring Question: Is the width of the Riparian Reserve established adjacent to regeneration harvests in the Moderate Intensity Timber Area or Low Intensity Timber Area in accordance with the RMP?

Monitoring Requirement: Evaluate all streams within at least one completed timber sale per field office.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

M5. Monitoring Question: When thinning treatments are applied in the Riparian Reserve along fish-bearing streams and perennial streams, is a minimum of 30 percent canopy closure and 60 trees per acre retained? Are thinning treatments excluded from the inner zone of the Riparian Reserve along perennial and intermittent fish-bearing streams?

Monitoring Requirement: Evaluate all fish-bearing streams and perennial streams treated within at least one completed thinning timber sale per field office.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

M6. Monitoring Question: When thinning treatments are applied in the Riparian Reserve along intermittent non-fish-bearing streams, is a minimum of 30 percent canopy closure and 60 trees per acre retained? Are thinning treatments excluded within inner zone of the Riparian Reserve along intermittent non-fish bearing streams?

Monitoring Requirement: Evaluate 0.25 mile of streams within thinning projects completed within the past year per field office.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

M7. Monitoring Question: Were Best Management Practices that were identified as applicable (as indicated through NEPA decision record or contract stipulations) applied during project implementation?

Monitoring Requirement: Evaluate at least one project with identified Best Management Practices per field office. Projects from any land use allocation may be selected for evaluation.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

M8. Monitoring Question: Have the number of snags been created in the appropriate size classes as described in the management direction (**Appendix B**, **Table B-3**)?

Monitoring Requirement: Evaluate at least one completed timber sale that includes Riparian Reserve per field office. Report the number of snags created > 20” DBH and > 10” DBH per project.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

M9. Monitoring Question: Has the amount of down woody material described in the management direction been retained when implementing fuels or prescribed fire treatments (**Appendix B**, **Table B-4**)?

Monitoring Requirement: Evaluate at least one fuels or prescribed fire treatment in the Riparian Reserve per field office. Report the percent cover of down woody material and the method used to measure percent cover.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

Note: Monitoring question M10 applies only to Eastside Management Area – Riparian Reserve.

M10. Monitoring Question: Has the amount of streams in proper functioning condition been maintained or increased? (Eastside Management Area – Riparian Reserve only)

Monitoring Requirement and Monitoring Interval: Monitoring and reporting would be through the use of the statewide report, Table 1 from USDI TR-1737-9 1993 (or similar), of lotic and lentic water bodies in properly functioning; functioning at risk with trend up, down or not apparent; and not properly functioning. (*Note*: Table 1 is available online, with instructions, at http://www.blm.gov/nstc/library/pdf/Final%20TR%201737-9.pdf and is also provided below (**Table V-256** for reference purposes.)

State: _____

Table V-256. Example of Table 1–Functioning Condition Status from USDI TR-1737-9 (1993).

Habitat Types	Proper Functioning Condition	Functional – At Risk			Non-functional	Unknown	Totals
		Trend Up	Trend Not Apparent	Trend Down			
Riverine Miles (Lotic)							
Nonriverine Acres (Lentic)*							

* Report only acres associated with lentic riparian-wetland areas. Do not include acres associated with lotic riparian-wetland areas.

Eastside Management Area

M11. Monitoring Question: Are snags and coarse woody debris retained in accordance with RMP requirements?

Monitoring Requirement: Evaluate at least one completed timber sale.

Monitoring Interval: Annual, or each year in which there is an completed timber sale.

M12. Monitoring Question: Is a stand average relative density of 15–55 maintained after commercial harvest conducted for the removal and sale of timber and biomass?

Monitoring Requirement: Evaluate at least one completed timber sale.

Monitoring Interval: Annual, or each year in which there is an completed timber sale.

Harvest Land Base

M13. Monitoring Question: Has the allowable sale quantity been offered for sale within the variation provided for in the plan?

Monitoring Requirement: Report annual sale quantity offered for sale by sustained-yield unit and the cumulative total since approval of the plan. Also report as volume offered by harvest type (selection harvest, commercial thinning, regeneration harvest, and timber salvage) by sustained-yield unit.

Monitoring Interval: Annual.

M14. Monitoring Question: Have the number of snags been created in the appropriate size classes as described in the management direction (**Appendix B**, **Table B-2**)?

Monitoring Requirement: Evaluate at least one completed timber sale per field office. Report the number of snags created > 20" DBH and > 10" DBH per project.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

M15. Monitoring Question: Are regeneration harvest areas, salvage harvest areas, and group selection openings being reforested in accordance with the RMP?

Monitoring Requirement: Evaluate at least one completed timber sale per field office.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

Harvest Land Base – Uneven-Aged Timber Area

M16. Monitoring Question: Is a stand average relative density of 20–45 percent maintained after commercial harvest?

Monitoring Requirement: Evaluate at least one completed timber sale per field office. Report the stand average relative density per stand treated within each timber sale evaluated.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

Harvest Land Base – Moderate Intensity Timber Area and Low Intensity Timber Area

M17. Monitoring Question: Is a stand average relative density of 25–45 percent maintained after commercial thinning?

Monitoring Requirement: Evaluate at least one completed timber sale per field office. Report the stand average relative density per stand treated within each timber sale evaluated.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

M18. Monitoring Question: Are trees retained after regeneration harvest in accordance with targets set forth in the RMP?

Monitoring Requirement: Evaluate at least one completed timber sale per field office.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

Air Quality

M19. Monitoring Question: Have smoke intrusions occurred in areas designated as Class I for air quality and non-attainment occurred as a result of BLM prescribed fire?

Monitoring Requirement: Report intrusions through Oregon Department of Forestry asrequired under the Oregon Smoke Management Plan.

Monitoring Interval: Annual.

Areas of Critical Environmental Concern

M20. Monitoring Question: Are important and relevant values being maintained or restored?

Monitoring Requirement: Evaluate 20 percent of the Areas of Critical Environmental Concern.

Monitoring Interval: Rotate the monitoring of Areas of Critical Environmental Concern, so that all of the areas would be monitored over a 5-year period.

Rare Plants and Fungi

M21. Monitoring Question: Is management of plant species that are listed under the Endangered Species Act consistent with recovery plans and designated critical habitat?

Monitoring Requirement: Evaluate at least two completed projects per field office that 'may affect' listed species.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

M22. Monitoring Question: Have protection measures maintained populations of BLM special status plant and fungi species?

Monitoring Requirement: Evaluate at least two completed projects per field office in which the BLM implemented protection measures for BLM Special Status plant and fungi species.

Monitoring Interval: Annual.

Cultural and Paleontological Resources Including American Indian Traditional Uses

M23. Monitoring Question: Were sites located within project areas after the commencement of ground-disturbing activities?

Monitoring Requirement: Evaluate at least 20 percent of management activities per field office that involve ground disturbance that have been completed within the past year.

Monitoring Interval: Annual.

M24. Monitoring Question: Have ground-disturbing actions avoided recorded sites that are listed (or eligible for listing) on the National Register of Historic Places?

Monitoring Requirement: Evaluate 100 percent of recorded listed or eligible sites that lie within the boundaries of a ground-disturbing project after the project is completed.

Monitoring Interval: Annually when listed or eligible sites are present and avoidance prescribed.

M25. Monitoring Question: Are sites with scientific value salvaged prior to disturbance (when disturbance cannot be practically avoided) through practices such as data recovery, including excavation, relocation, or documentation?

Monitoring Requirement: Evaluate 100 percent of data recovery actions undertaken to salvage site data at risk of loss from ground disturbing management activities that have been completed within the past year.

Monitoring Interval: Annual.

M26: Monitoring Question: Are cultural and paleontological resources that are threatened by natural processes or human activity (other than Federal undertakings) stabilized and protected or excavated and the data recovered where warranted by the scientific importance of the site?

Monitoring Requirement: Evaluate 100 percent of threatening events that have happened within the past year.

Monitoring Interval: Annual.

Energy and Minerals

M27. Monitoring Question: Has the level of opportunities for the exploration and development of locatable, leasable, and salable mineral resources been maintained?

Monitoring Requirement: Identify new closures and withdrawals.

Monitoring Interval: Five years.

Fire and Fuels Management

M28. Monitoring Question: Were fuels managed to reduce wildfire hazard, risk to communities, and negative impacts to ecosystems, and highly valued resources?

Monitoring Requirement: Summarize the primary and secondary reason for treatments and the primary and secondary initiative for all treatments, based on spatial inventory treatment data.

Monitoring Interval: Annual.

M29. Monitoring Question: Have fuels treatments created fuel beds and fuel breaks intended to reduce potential fire behavior, reduce potential wildfire severity, or improve fire management opportunities?

Monitoring Requirement: Evaluate at least one treatment per field office.

Monitoring Interval: Annual.

M30. Monitoring Question: Did risk-based wildfire management decisions implemented in response to natural ignitions include an examination of the full range of fire management options?

Monitoring Requirement: Evaluate 100 percent of Wildland Fire Decision Support System decisions completed.

Monitoring Interval: Annual.

M31. Monitoring Question: Did land management treatments intersected by wildfires change fire behavior, minimize negative wildfire effects and damage to resource values, or positively contribute toward fire management opportunities?

Monitoring Requirement: Complete a treatment effectiveness assessment of 100 percent of treatments intersected by wildfire.

Monitoring Interval: Annual.

Hazardous Materials

M32. Monitoring Question: Has the response to hazardous material incidents included cleanup, proper notifications, criminal investigations, and site assessments as applicable?

Monitoring Requirement: Evaluate 100 percent of hazardous material incidents.

Monitoring Interval: Annual.

M33. Monitoring Question: Are hazardous materials stored, treated, and disposed of in accordance with applicable laws and regulations?

Monitoring Requirement: Evaluate 100 percent of district-stored, treated and disposed hazardous materials.

Monitoring Interval: Annual.

Invasive Species – Port-Orford-cedar Root Disease (Phytophthora lateralis)

M34. Monitoring Question: Are General Direction requirements from the Record of Decision and Resource Management Plan Amendment for Management of Port-Orford-cedar in Southwest Oregon, Coos Bay, Medford, and Roseburg Districts (USDI BLM 2004) for maintaining and reducing the risk of *Phytophthora lateralis* infections being implemented?

Monitoring Requirement: Describe the general activities accomplished for maintaining and reducing the risk of *Phytophthora lateralis* infections, which may include modifying Port-Orford-cedar bough collection permits to include prevention practices, applying adaptive management, community outreach, and eradication activities.

Monitoring Interval: Annual.

M35. Monitoring Question: Are project-specific management actions applied as required in the Record of Decision and Resource Management Plan Amendment for Management of Port-Orford-cedar in Southwest Oregon, Coos Bay, Medford, and Roseburg Districts (USDI BLM 2004) when a need is indicated by using the Port-Orford-cedar Risk Key on page 32?

Monitoring Requirement: Describe where Port-Orford-cedar root disease management actions have been incorporated into project-specific implementation monitoring programs. Port-Orford-cedar root disease management actions could include seasonal restrictions, using uninfested water, unit scheduling, designating access routes, and public education through signage in site-specific project design and implementation.

Monitoring Interval: Annual.

Lands, Realty, Access, and Transportation

M36. Monitoring Question: Have the acres of O&C lands of all classifications and the acres of O&C and public domain lands that are available for harvesting been reduced through disposal, exchange, or purchase?

Monitoring Requirement: Review O&C lands records through the Oregon State Office. Evaluate total net change in land tenure of O&C lands in the decision area. Evaluate changes at 10-year intervals keyed from 1998, the date of the legislation that provides for no net loss of O&C lands.

Monitoring Interval: Three years.

Livestock Grazing

Note: Monitoring questions **M37** through **M39** apply only to the Medford District and the Klamath Falls Field Office of the Lakeview District.

M37. Monitoring Question: Has the condition of public rangelands been maintained or improved compared to the baseline year of 2015?

Monitoring Requirement and Monitoring Interval: In 'I' category allotments, examine trend plots every five years, determine condition every 10 years, and record utilization data every other year. In 'M' allotments, determine trend and condition every ten years and utilization every five years. Monitoring in 'C' allotments is limited to periodic inventories and observations to measure long-term resource condition changes.[42]

M38. Monitoring Question: Are areas disturbed by natural and human-induced events (including wildland fire, prescribed burns, timber-management treatments, and juniper reduction treatments) rested from livestock grazing? Is livestock grazing resumed only after a determination that soil and vegetation has recovered sufficient to support livestock grazing (except where livestock grazing would either not impede site recovery, or where livestock grazing could be used as a tool to aid in achieving recovery objectives)?

Monitoring Requirement: Evaluate 10 percent of disturbance events.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

M39. Monitoring Question: For streams with ESA-listed or anadromous fish species, is livestock restricted from riparian areas during spawning, incubation, and until 30 days following the emergence of juveniles from spawning beds?

Monitoring Requirement: Evaluate 20 percent of streams with ESA-listed or anadromous fish species within active grazing allotments.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

Recreation

M40. Monitoring Question: Are Special Recreation Management Areas managed in accordance with their planning frameworks?

Monitoring Requirement: Evaluate 20 percent of the Special Recreation Management Areas.

[42] Grazing allotments are assigned to one of three management categories: (I) Improve (M) Maintain, and (C) Custodial.

Monitoring Interval: Annual. The monitoring of Special Recreation Management Areas would be rotated so that over a five-year period 100 percent of the areas would be monitored.

Visual Resource Management

M41. Monitoring Question: Is the level of change in character for the areas designated to be managed as VRM Class I, II, and III consistent with RMP requirements?

Monitoring Requirements: Evaluate 20 percent of activities that have the potential to affect the existing character in VRM Class I, II, and III.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

Wild Horses

M42. Monitoring Question: Is the population of wild horses in the Pokegama Herd Management Area maintained at the appropriate management level of 30–50 head?

Monitoring Requirement: Report on population surveys or censuses.

Monitoring Interval: Five years.

M43. Monitoring Question: Are horses from other herd areas periodically introduced to the Pokegama herd to maintain the genetic diversity of the herd?

Monitoring Requirement: Report all introductions.

Monitoring Interval: Five years.

M44. Monitoring Question: Are water developments maintained or established to provide season-long water for wild horses within the herd management area?

Monitoring Requirement: Evalutate 100 percent of water developments.

Monitoring Interval: Annual. Every three years if three consecutive years of monitoring show 100 percent compliance.

Wilderness Characteristics

M45. Monitoring Question: Are wilderness characteristics maintained in accordance with RMP requirements?

Monitoring Requirements: Report all management activities that would adversely affect wilderness characteristics in Wilderness Study Areas and Wilderness Areas and District-Designated Reserve – Lands Managed for their Wilderness Characteristics. Monitor for amount of degradation or loss of inventoried

wilderness characteristics resulting from undue or unnecessary degradation as a result of human or natural causes.

Monitoring Interval: Five years.

Wild and Scenic Rivers

M46. Monitoring Question: Are the outstandingly remarkable values of designated Wild and Scenic river corridors (including those classified as Wild, Scenic, or Recreational) being maintained?

Monitoring Requirements: Evaluate 100 percent of BLM-authorized activities that have the potential to affect the Outstandingly Remarkable Values of Wild and Scenic Rivers.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

Wildlife

M47. Monitoring Question: Is management of species that are listed under the Endangered Species Act consistent with recovery plans and designated critical habitat?

Monitoring Requirement: Evaluate at least two completed projects per field office that 'may affect' listed species.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

M48. Monitoring Question: Have BLM actions in the Harvest Land Base caused the abandonment (i.e., caused a site to not be occupied during the year following the BLM action) of more than 10 percent of northern spotted owl occupied sites in the Harvest Land Base during the first decade of RMP implementation, more than an additional 15 percent of northern spotted owl occupied sites in the Harvest Land Base during the second decade of RMP implementation, and more than an additional 20 percent of northern spotted owl occupied sites in the Harvest Land Base per decade beginning with the third decade of RMP implementation?

Monitoring Requirements: The BLM State Office wildlife program lead will coordinate this monitoring requirement. BLM wildlife biologists in each district will estimate the number of sites in the Harvest Land Base occupied by a northern spotted owl territorial pair or resident single. Biologists will base their estimates on the most recent year of protocol surveys supplemented by the previous four years of protocol surveys and, if no protocol surveys of a site has been completed during the previous five years, by the most recent ten years of protocol surveys. BLM wildlife biologists in each district will examine all actions in the Harvest Land Base implemented under the RMP and estimate the number of northern spotted owl occupied sites in the Harvest Land Base that have been abandoned by northern spotted owls due to BLM actions in the Harvest Land Base. Although the behaviors of individual northern spotted owl pairs and singles vary, in general, the following are evidence that BLM actions caused site abandonment:

- The BLM modified or removed habitat in the nest patch, which commonly extends 300 meters from the occupied site.
- Following a BLM action in the 500-acre core use area surrounding the occupied site, less than 250 acres of the core use area supported nesting-roosting habitat, when all land ownerships are

considered, regardless of the amount of nesting-roosting habitat in this area before the BLM action.

- Following a BLM action in the median provincial home range areas surrounding the occupied site, less than 40 percent of the home range area supported nesting-roosting habitat, when all land ownerships are considered, regardless of the amount of nesting-roosting habitat in this area before the BLM action.

If, following a BLM action, survey indicates that a site is occupied by a territorial pair or resident single, the biologist will determine that the BLM action did not cause site abandonment.

The State Office wildlife program leader will collect results from all BLM districts, make the plan-wide monitoring calculations and report the results to the U.S. Fish and Wildlife Service.

Monitoring Interval: Biologists will annually document all BLM actions associated with northern spotted owl occupied sites in the Harvest Land Base, and every 5 years will estimate the percent of occupied sites in the Harvest Land Base that were abandoned due to BLM actions implemented under the RMP.

M49. Monitoring Question: Have BLM actions avoided adverse effects to Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River Distinct Population Segment of Columbian white-tailed deer, or western snowy plover, except when done in accordance with an approved recovery plan, conservation agreement, species management plan, survey and monitoring protocol, or critical habitat rule, and when the action is necessary for the conservation of the species?

Monitoring Requirements: Evaluate at least 20 percent of actions that 'may affect' Fender's blue butterfly, Oregon silverspot butterfly, Taylor's checkerspot butterfly, streaked horned lark, vernal pool fairy shrimp, Oregon spotted frog, Lower Columbia River distinct population segment of Columbian white-tailed deer, or western snowy plover.

Monitoring Interval: Annual. Change interval to once every 3 years if 3 consecutive years of monitoring show 100 percent compliance.

Program Reporting Items

Program reporting items involve activities that are related to: (1) certain analytical assumptions that are pertinent to non-specific management actions; or (2) analytical assumptions pertinent to the analysis of environmental consequences in the Proposed RMP/Final EIS. Not all programs or resources have reporting items.

Late-Successional Reserve

R1. Program Reporting Item: Report the volume of non-ASQ timber offered for sale from the Late-Successional Reserve. Reporting would be annual.

Riparian Reserve

***Note*:** Program Reporting Item R2 *does not* apply to Eastside Management Area – Riparian Reserve**.**

R2. Program Reporting Item: Report the volume of non-ASQ timber offered for sale from the Riparian Reserve. Reporting would be annual.

R3. Program Reporting Item: Report the number of fish-passage blockages that have been corrected and the number of resulting miles of stream habitat that are newly accessible. Reporting would be annual.

R4. Program Reporting Item: Report the miles of permanent road construction, road renovation, road improvement, and road decommissioning within the Riparian Reserve. Reporting would be annual.

R5. Program Reporting Item: Report the overall level of stream and riparian restoration activities (e.g, placement of large wood and boulders in streams, planting, and thinning). Report the level of stream restoration activities in high intrinsic potential streams, or streams with high priority fish populations. Reporting would be annual.

Eastside Management Area

R6. Program Reporting Item: Report the acres of group selection, commercial thinning, density management, and regeneration harvest. Reporting would be annual, or each year in which there is an completed timber sale.

Harvest Land Base

R7. Program Reporting Item: Report acres by treatment type for silvicultural treatments listed in the following table by Harvest Land Base sub-allocation. Compare against modeling results for the appropriate decade of implementation; see **Table V-257** and **Table V-258** for decade one and two values. See the Proposed RMP/Final EIS for subsequent decades. Report commercial thinning, selection harvest, regeneration harvest, and timber salvage harvest as acres sold, and report other treatment type categories as acres treated. Reporting would be annual.

Table V-257. Decade 1 modeled acres by treatment type by Harvest Land Base sub-allocation.

Decade 1 Treatment Type‡	Coos Bay			Eugene			Klamath Falls				Medford				Roseburg				Salem			Grand Total (Acres)
	MITA (Acres)	LITA (Acres)	Total (Acres)	MITA (Acres)	LITA (Acres)	Total (Acres)	UTA (Acres)	MITA (Acres)	LITA (Acres)	Total (Acres)	UTA (Acres)	MITA (Acres)	LITA (Acres)	Total (Acres)	UTA (Acres)	MITA (Acres)	LITA (Acres)	Total (Acres)	MITA (Acres)	LITA (Acres)	Total (Acres)	
Commercial Thinning*	840	430	1,270	3,000	420	3,420	-	-	-	-	-	200	1,410	1,610	-	4,200	4,580	8,780	6,310	910	7,220	**22,300**
Selection Harvest*	-	-	-	-	-	-	5,750	-	-	5,750	28,170	-	-	28,170	1,810	-	-	1,810	-	-	-	**35,730**
Regeneration Harvest*	2,620	510	3,130	9,460	980	10,440	-	110	340	450	-	420	2,590	3,010	-	3,110	3,020	6,130	11,120	1,100	12,230	**35,380**
Timber Salvage Harvest*	-	-	-	-	-	-	-	-	-	-	1,940	-	-	1,940	80	220	-	300	-	-	-	**2,240**
Reforestation†	3,320	650	3,970	12,580	1,300	13,890	1,150	140	430	1,710	6,670	480	2,980	10,130	380	4,160	3,780	8,310	13,350	1,320	14,670	**52,690**
Manual Cutting	4,450	870	5,320	8,510	880	9,400	580	60	180	810	7,880	500	3,110	11,490	300	2,590	2,360	5,250	11,790	1,170	12,960	**45,230**
Mulching	-	-	-	-	-	-	350	30	100	480	980	60	360	1,400	260	2,260	2,050	4,580	-	-	-	**6,450**
Tubing	1,810	350	2,160	9,460	980	10,440	120	10	30	160	340	30	180	550	260	2,300	2,080	4,640	5,560	550	6,110	**24,060**
Shading	-	-	-	950	100	1,040	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1,050**
Trapping	-	-	-	-	-	-	-	-	-	-	650	40	230	920	-	-	-	-	1,670	170	1,830	**2,760**
Scalping	-	-	-	-	-	-	-	-	-	-	660	40	260	960	-	-	-	-	-	-	-	**960**
Pre-commercial Thinning	3,110	810	3,920	10,900	1,200	12,100	810	160	790	1,760	4,810	460	4,070	9,330	260	3,700	3,640	7,610	12,870	1,150	14,010	**48,740**
Pruning	260	50	310	1,890	200	2,090	230	20	70	320	330	20	130	480	20	200	180	400	560	60	610	**4,220**
Stand Conversion	100	20	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**120**

* Acreage includes untreated portion of stand (i.e., skips, aggregate retention areas)

† Natural and artificial reforestation

‡ These estimates represent analytical results based on the vegetation modeling assumptions described in **Appendix C**. The BLM has made these assumptions and estimations solely for analytical purposes. These acreages of silvicultural treatments by district office and by Harvest Land Base sub-allocation for each decade do not represent management direction or restrictions on silvicultural treatments under the RMP. Silvicultural treatments would be implemented consistent with the management direction for the Harvest Land Base sub-allocation and consistent with project-level analysis and decision-making.

Table V-258. Decade 2 modeled acres by treatment type by Harvest Land Base sub-allocation.

Decade 2 Treatment Type‡	Coos Bay			Eugene			Klamath Falls				Medford				Roseburg				Salem			Grand Total (Acres)
	MITA (Acres)	LITA (Acres)	Total (Acres)	MITA (Acres)	LITA (Acres)	Total (Acres)	UTA (Acres)	MITA (Acres)	LITA (Acres)	Total (Acres)	UTA (Acres)	MITA (Acres)	LITA (Acres)	Total (Acres)	UTA (Acres)	MITA (Acres)	LITA (Acres)	Total (Acres)	MITA (Acres)	LITA (Acres)	Total (Acres)	
Commercial Thinning*	2,350	520	2,870	11,300	1,100	12,400	-	-	20	20	-	50	640	690	-	2,510	5,710	8,220	13,590	1,590	15,180	**39,380**
Selection Harvest*	-	-	-	-	-	-	7,360	-	-	7,360	27,840	-	-	27,840	2,210	-	-	2,210	-	-	-	**37,410**
Regeneration Harvest*	1,680	500	2,180	4,450	770	5,220	-	90	350	440	-	200	2,610	2,810	-	3,090	3,380	6,470	8,750	980	9,730	**26,850**
Timber Salvage Harvest*	-	-	-	-	-	-	-	-	-	-	1,610	-	-	1,610	-	80	580	660	-	-	-	**2,270**
Reforestation†	2,140	630	2,770	5,920	1,020	6,940	1,470	110	440	2,020	6,450	230	3,010	9,680	440	3,960	4,950	9,350	10,500	1,170	11,680	**42,440**
Manual Cutting	2,860	850	3,710	4,010	690	4,700	740	50	180	960	7,640	240	3,140	11,010	350	2,470	3,090	5,920	9,280	1,040	10,310	**36,630**
Mulching	-	-	-	-	-	-	440	30	110	570	950	30	370	1,340	310	2,150	2,700	5,160	-	-	-	**7,090**
Tubing	1,160	340	1,510	4,450	770	5,220	150	10	40	190	330	10	180	530	310	2,180	2,730	5,230	4,380	490	4,870	**17,530**
Shading	-	-	-	450	80	520	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**530**
Trapping	-	-	-	-	-	-	-	-	-	-	630	20	240	880	-	-	-	-	1,310	150	1,460	**2,350**
Scalping	-	-	-	-	-	-	-	-	-	-	640	20	260	920	-	-	-	-	-	-	-	**920**
Pre-commercial Thinning	1,680	500	2,180	4,450	770	5,220	1,030	90	350	1,470	4,630	200	2,610	7,440	310	3,170	3,960	7,440	8,750	980	9,730	**33,480**
Pruning	170	50	220	890	150	1,040	290	20	70	380	320	10	130	460	20	190	240	450	440	50	490	**3,040**
Stand Conversion	70	20	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**90**

* Acreage includes untreated portion of stand (i.e., skips, aggregate retention areas).

† Natural and artificial reforestation

‡ These estimates represent analytical results based on the vegetation modeling assumptions described in **Appendix C**. The BLM has made these assumptions and estimations solely for analytical purposes. These acreages of silvicultural treatments by district office and by Harvest Land Base sub-allocation for each decade do not represent management direction or restrictions on silvicultural treatments under the RMP. Silvicultural treatments would be implemented consistent with the management direction for the Harvest Land Base sub-allocation and consistent with project-level analysis and decision-making.

Rare Plants and Fungi

R8. Program Reporting Item: Report the acres of activities designed to maintain or restore natural plant communities on non-forest and non-commercial lands. Reporting would be annual.

Energy and Minerals

R9. Program Reporting Item: Report the number of biomass utilization projects. Reporting would be annual.

Fire and Fuels Management

R10. Program Reporting Item: Report the number of acres of hazardous fuels treatments by treatment type and by land use allocation (i.e., under burning, broadcast burning, hand pile and burn, landing pile and burn, machine pile and burn, slash and scatter, and mastication). Reporting would be annual.

Forest Management

R11. Program Reporting Item: Report the number of acres of silvicultural treatments by treatment type and by land use allocation, including commercial thinning, selection harvest, regeneration harvest, timber salvage harvest, reforestation (natural and artificial), manual cutting, mulching, tubing, shading, trapping, scalping, pre-commercial thinning, non-commercial thinning, pruning, and stand conversion. Report acres of commercial thinning, selection harvest, regeneration harvest, and timber salvage harvest as acres sold; report all other treatment types as acres treated. Reporting would be annual.

Invasive Species

R12. Program Reporting Item: Report the number of acres of manual, mechanical, cultural, chemical, and biological treatments used to manage invasive species infestations. Reporting would be annual.

R13. Program Reporting Item: Report the number of acres of invasive species inventories. Reporting would be annual.

R14. Program Reporting Item: Report the number of acres of inventory, manual, mechanical, cultural, and chemical treatments used to manage sudden oak death (*Phytophthora ramorum*) infections. Reporting would be annual.

Livestock Grazing

R15. Program Reporting Item: Report the findings of livestock grazing allotments towards meeting the Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the States of Oregon and Washington. Reporting would be annual.

R16. Program Reporting Item: Report the number of acres of prescribed livestock grazing used to control invasive plants, reduce fire danger, or accomplish other management objectives. Reporting would be annual.

R17. Program Reporting Item: Report the acres or number of range improvements. Reporting would be annual.

Socioeconomic

R18. Program Reporting Item: Report the payments to counties associated with BLM-administered lands including O&C, Coos Bay Wagon Roads, and Public Domain lands. Reporting would be annual.

R19. Program Reporting Item: Report receipts from timber sales, special forest products, recreation and permits. Reporting would be annual.

R20. Program Reporting Item: Report appropriations; number of full time and temporary employees; and major new facility developments or improvements. Reporting would be annual.

Recreation

R21. Program Reporting Item: Report the number of service-oriented and outreach programs, including interpretation and education provided to visitors. Reporting would be annual.

R22. Program Reporting Item: Report the status of development of comprehensive travel management plans for off-highway vehicle management areas and travel management areas. Reporting would be annual.

R23. Program Reporting Item: Within Special Recreation Management Areas (SRMAs), conduct visitor studies or on-site monitoring to assess recreation outcome attainment, targeted recreation activity participation, and protection of recreation setting characteristics during the primary recreation use season. Reporting would be conducted along a rotating schedule, focusing on a cross section of SRMAs within one district each year. Monitoring cycle would run every six years between districts.

Special Forest Products

R24. Program Reporting Item: Report the number of permits for harvest and collection of special forest products. Reporting would be annual.

Soils

R25. Program Reporting Item: Report the number of unit treatment areas in which there was greater than 20 percent detrimental soil disturbance resulting from forest management operations. Reporting would be based on evaluation of at least 10 percent of the total number of completed forest management units and 10 percent of completed fuel reduction treatment units. Reporting would be annual.

Wildlife

R26. Program Reporting Item: Report the survey effort for marbled murrelet and the outcomes of that survey effort. For each survey polygon, report: acres of survey, years surveys were conducted, age of stand at time of survey, presence/absence of platform trees, protocol used for the survey, and occupied or presence detections of marbled murrelet. For consistency, an example table format is presented below (**Table V-259**). Reporting would be annual.

Table V-259. Marbled murrelet survey reporting.

Survey Polygon (Name)	Survey Area (Acres)	Survey Date(s) (Years)	Stand Age (Years)	Protocol Used	Marbled Murrelet Detections		
					Occupied	Presence	None
Sample Project	*000*	*20XX-20XX*	*000*	*Citation*	*X*	*X*	*X*

R27. Program Reporting Item: Report the number of newly discovered occupied marbled murrelet sites. For each newly discovered occupied marbled murrelet site, report: name of site (master site number), associated survey that discovered the site, survey dates (years of survey), and acreage included in the occupied site designation. For consistency, an example table format is presented below (**Table V-260**). The table should present a running list of all occupied sites designated and the cumulative number and acreage of occupied sites. Reporting would be annual.

Table V-260. Marbled murrelet occupied site.

Survey Dates (Years)	Occupied Site Name	Associated Survey (Name)	Area Designated (Acres)
20XX, 20XX	*Sample Project (MSNO XXXX)*	*Sample Project*	*000*
Cumulative Total	***000 sites***	**-**	***000***

R28. Program Reporting Item: Report the amount of marbled murrelet nesting habitat that was modified or removed within the Harvest Land Base *without* pre-disturbance surveys (i.e., 35–50 miles from the Pacific Ocean except within exclusion Areas C and D as described in Chapter 3 of the Proposed RMP/Final EIS). For stands of marbled murrelet nesting habitat modified or removed without surveys, report: harvest type, acres, date of treatment, and age at time of treatment. For consistency, an example table format is presented below (**Table V-261**). Reporting would be annual.

Table V-261. Marbled murrelet nesting habitat modified or removed *without* surveys.

Project (Name)	Harvest Type	Area (Acres)	Date Modified/ Removed (Year)	Stand Age at the Time of Modification/Removal (Years)
Sample Project	*Harvest Type*	*000*	*20XX*	*000*

R29. Program Reporting Item: Report the survey effort for the red tree vole north of Highway 20 within the North Oregon Coast DPS and the outcomes of that survey effort. For each survey polygon,

report: acres of survey, year surveys were conducted, age of stand at time of survey, protocol used for the survey, number of active or inactive red tree vole sites discovered, and the total acreage of habitat areas established associated with the discoveries. For consistency, an example table format is presented below (**Table V-262**). Reporting would be annual.

Table V-262. Survey reporting for the North Oregon Coast DPS of the red tree vole.

Survey Polygon (Name)	**Survey Area (Acres)**	**Survey Date (Years)**	**Stand Age (Years)**	**Protocol Used**	**Red Tree Vole Discoveries**			
					Active Sites (Number)	***Inactive Sites (Number)***	***None (Number)***	***Total Habitat Area (Acres)***
Sample Project	*000*	*20XX*	*000*	*Citation*	*000*	*000*	*000*	*000*

R30. Program Reporting Item (Coos Bay District only)**:** Report number, type, and acres (as appropriate) of restoration actions for the western snowy plover. Reporting would be annual.

R31. Program Reporting Item: Report number and acres of deer and elk forage planting projects. Reporting would be annual.

R32. Program Reporting Item (applies to Eastside Management Area only)**:** Report acres of thinning or removal of encroaching western juniper. Reporting would be annual.

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Appendix C. Best Management Practices

Best Management Practices

Introduction

A Best Management Practice (BMP) is a practice or combination of practices that have been determined to be the most effective and practicable in preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals (40 CFR 130.2 [m]). Using of BMPs is required by the Clean Water Act (33 U.S.C 1251 *et seq*.) to reduce nonpoint source pollution to the maximum extent practicable. Nonpoint source pollution is defined as pollutants detected in water bodies, such as a streams or lakes, which come from the landscape in a dispersed manner. The BMPs are the primary controls for achieving Oregon's water quality standards pertaining to nonpoint source pollution. Oregon's narrative and numeric criteria within water quality standards are designed to protect designated beneficial uses such as salmonid spawning and rearing, resident fish and aquatic life, domestic water supplies, and water-contact recreation.

The BLM is responsible for implementing BMPs on the lands it administers.[43] The BMPs provide compliance with the Clean Water Act of 1972, as amended, State of Oregon water quality legislation (Chapter 340), and the O&C Act. For proposed management actions, the BLM would design and implement BMPs in a manner that is consistent with the ODEQ Memorandum of Understanding (ODEQ and USDI BLM 2011), and with the Clean Water Act.

The BLM's and ODEQ's strategy for managing and controlling nonpoint source water pollution from BLM-administered lands in the State of Oregon is managed through a Memorandum of Understanding between the two agencies (ODEQ and USDI BLM 2011). This MOU defines the process by which the BLM and ODEQ will cooperatively meet State and Federal water quality rules and regulations. The physical, chemical, and biological conditions of 'waters of the State' that support beneficial uses[44] would be protected, restored, and maintained by working in a proactive, collaborative, and adaptive manner. The MOU specifies that the BLM would implement site-specific BMPs as specified in management objectives, standards, guidelines, design features, and mitigation developed in RMPs, RMP amendments, project-level plans, and Water Quality Restoration Plans to meet applicable water quality standards. The MOU requires monitoring to ensure that practices are properly designed and applied, to determine the effectiveness of practices in meeting water quality standards, and to provide for adjustment of BMPs when it is found that water quality standards are not being protected.

The RMP contains measures in both management direction and BMPs to prevent and reduce the amount of pollution generated by non-point sources to a level compatible with water quality goals. Where a specific measure would apply to all actions on all sites (either in a specific land use allocation or across the decision area), the BLM presents the measure as management direction.[45] Where the applicability of a specific measure would depend upon site-specific conditions, technical feasibility, resource availability, and the water quality of those water bodies potentially affected, the BLM presents the

[43] The ODEQ has granted Designated Management Agency status to the BLM through a Memorandum of Understanding (ODEQ and USDI BLM 2011).

[44] Beneficial uses are defined in Oregon Revised Statute (ORS), Chapter 468B Water Quality, and Oregon Administrative Rules (OAR), Division 41.

[45] Management direction identifies where future actions may or may not be allowed and what restrictions or requirements may be placed on those future actions to achieve the objectives set for the BLM-administered lands and resources (see **Appendix B**).

measure as a BMP. This appendix only lists the BMPs, which must be considered together with the management direction (see **Appendix B**).

The BMPs described in this appendix are methods, measures, or practices selected based on site-specific conditions to ensure that the BLM would maintain water quality at its highest practicable level to meet water quality standards and TMDL load allocations as set by the State of Oregon's Department of Environmental Quality. These site-specific BMPs are a compilation of commonly employed practices developed through professional experience or research, and designed to minimize water quality degradation and loss of soil productivity. The BMPs include, but are not limited to, avoidance, structural and nonstructural treatments, operations, and maintenance procedures. Although normally preventative, BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR 130.2, EPA Water Quality Standards Regulation). The implementation of these BMPs would be the beginning of an iterative process that includes the monitoring and modification of BMPs, where needed, to achieve water quality goals. This cyclic process would be the primary mechanism to achieve Oregon's water quality standards.

For vegetation treatments using herbicides on BLM-administered lands in the decision area, BMPs are included in Vegetation Treatments Using Herbicides on BLM Lands in Oregon Record of Decision (USDI BLM 2010) as mitigation measures and standard operating practices, and are incorporated here by reference. Briefly, mitigation and standard operating procedures in Attachment A; General, Soil, Water Resources, Wetlands and Riparian Areas, Fish and Other Aquatic Organisms, Recreation and other beneficial uses and values (pp. 33-45), and additional mitigation measures (pp. 13-15) are considered BMPs for herbicide treatments. For other management activities, including minerals exploration and development, linear transmission projects, and most hazardous materials, the mechanism to achieve Oregon State Water Quality Standards would be guided by RMP management direction, regulations, or project-level design features, and not necessarily be covered by the BMPs contained in this RMP. For example, management of locatable minerals is governed by regulations found in 43 CFR 3809. The BMPs for locatable minerals include language from 43 CFR 3809 that requires operators to prevent unnecessary and undue degradation from mining operations, as defined in 43 CFR 3809.5 and 43 CFR 3809.415.

Selection and Application of BMPs

For implementation actions under this RMP, BLM decision-makers will select the appropriate and applicable BMPs, using input from BLM staff. The BLM will select BMPs based upon site-specific conditions, technical feasibility, resource availability, and the water quality of those water bodies potentially impacted. Not all of the BMPs listed will be selected for any specific management action. The BMPs below do not provide an exhaustive list of nonpoint source control measures. The BLM may identify additional nonpoint source control measures during project-level planning and analysis. The BLM will apply the selected BMPs in a manner that would be in conformance with all RMP management direction.

The BMPs that relate to instream activities may coincidently be similar to applicable practices specified in applicable permits, such as Army Corps of Engineers, Department of State Lands, and ODFW joint removal/fill permits, ODEQ water quality permits and 401 certifications, or project design criteria contained in biological assessments. The BMPs in the following tables are not specific permit requirements, but rather demonstrate the process by which the BLM would control nonpoint source pollution from instream activities.

Monitoring and Adjustment

The BLM will monitor the application of BMPs through implementation and effectiveness monitoring. Post-project implementation monitoring of selected BMPs will evaluate whether the BLM carries forward BMPs from the project-level plans. Effectiveness monitoring will evaluate whether selected BMPs meet water quality standards and criteria and assure protection of beneficial uses. The BLM would modify BMPs if monitoring demonstrates that water quality standards are not being protected. The BLM would make changes to individual BMPs, or additions or deletions to the BMP lists below, through plan maintenance, consistent with 43 CFR 1610.5-4.

BMP Lists

Table J-263 through **Table J-276** are organized by core activities on BLM-administered lands in the decision area. For each core activity, the table displays the sequential number and BMP in the left columns, the source or reference in the center column, and the applicable ODEQ narrative or numeric water quality standards in the right column. The table identifies the ODEQ Oregon Administrative Rules (OAR) number(s) in the right column and provides OAR references within the roads and landings section, to compare these BMPs to similar Oregon Department of Forestry OARs. See Oregon Administrative Rules on water pollution (ODEQ OARs, Division 41 2015) for additional details about the standards and regulations that are associated with the BMPs.

Core activities with BMPs include:

- Road and landing maintenance and construction
- Timber harvest activities
- Silvicultural activities
- Fire and fuels management
- Surface source water for drinking water
- Recreation management
- Range management
- Minerals (salable) development
- Spill prevention and abatement
- Restoration activities
- Dry forest-specific BMPs

The following lists of BMPs are not intended to be all-inclusive nor replace site-specific project planning, which may require the use of different or additional BMP practices.

Roads and Landings

Table J-263. Best management practices for roads and landings.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
General Construction			
R 01	Locate temporary and permanent roads and landings on stable locations, e.g., ridge tops, stable benches, or flats, and gentle-to-moderate side slopes. Minimize road construction on steep slopes (> 60%) consult TPCC for FP and FM classifications.	USDI BLM 2008, Appendix I – Water, R 1, p. 270. OAR 629-625-0200 (3)	OAR 629-625-0200–ODF, Road Location ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 02	Locate temporary and permanent road construction or improvement to minimize the number of stream crossings.	USDI BLM 2008, Appendix I – Water, R 2, p. 270. OAR 629-625-0200 (3-4)	OAR 629-625-0200–ODF, Road Location ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 03	Locate roads and landings away from wetlands, Riparian Reserve, floodplains, and waters of the State, unless there is no practicable alternative. Avoid locating landings in areas that contribute runoff to channels.	USDI BLM 2008, Appendix I – Water, R 4, p. 270. OAR 629-625-0200 (2)	OAR 629-625-0200–ODF, Road Location ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 04	Locate roads and landings to reduce total transportation system mileage. Renovate or improve existing roads or landings when it would cause less adverse environmental impact. Where roads traverse land in another ownership, investigate options for using those roads before constructing new roads.	USDI BLM 2008, Appendix I – Water, R 2, p. 270. EPA 2005, p. 3-12, Bullet 1 OAR 629-625-0200 (5) EPA 2005, p. 3-10, Bullet 1	OAR 629-625-0200–ODF, Road Location ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 05	Design roads to the minimum width needed for the intended use as referenced in BLM Manual 9113.	USDI BLM 2008, Appendix I – Water, R 8, p. 271. OAR 629-625-0310 (3)	OAR 629-625-0310-ODF, Road Prism ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 06	Confine pioneer roads to the construction limits of the permanent roadway to reduce the amount of area disturbed and avoid deposition in wetlands, Riparian Reserve, floodplains, and waters of the State. Install temporary drainage, erosion, and sediment control structures. Storm proof or close pioneer roads prior to the onset of the wet season.	USDI BLM 2008, Appendix I – Water, R 11, p. 271. EPA 2005, p. 3-41, Bullet 2	OAR 629-625-0410-ODF, Disposal of Waste Materials ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 07	Design road cut and fill slopes with stable angles, to reduce erosion and prevent slope failure.	USDI BLM 2008, Appendix I – Water, R 3, p. 270. EPA 2005	OAR 629-625-0310-ODF, Road Prism ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 08	End-haul material excavated during construction, renovation, or maintenance where side slopes generally exceed 60% and any slope where side-cast material may enter wetlands, floodplains, and waters of the State.	USDI BLM 2008, Appendix I – Water, R 10, p. 271. EPA 2005, p. 3-12, Bullet 5	OAR 629-625-0310-ODF, Road Prism ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 09	Construct road fills to prevent fill failure using inorganic material, compaction, buttressing, sub-surface drainage, rock facing, or other effective means.	USDI BLM 2008, Appendix I – Water, R 13, p. 271. OAR 629-625-0310-5	OAR 629-625-0310-ODF, Road Prism ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 10	Design and construct sub-surface drainage (e.g., trench drains using geo-textile fabrics and drain pipes) in landslide-prone areas and saturated soils. Minimize or eliminate new road construction in these areas.	USDI BLM 2008, Appendix I – Water, R 19, p. 272. ODEQ 2005, RC-1, RC-6, pp.4-5, 4-6	OAR 629-625-0300-ODF, Road Design ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 11	Locate waste disposal areas outside wetlands, Riparian Reserve, floodplains, and unstable areas to minimize risk of sediment delivery to waters of the State. Apply surface erosion control prior to the wet season. Prevent overloading areas, which may become unstable.	USDI BLM 2008, Appendix I – Water, R 80, p. 281. OAR 629-625-0340	OAR 629-625-0340-ODF, Waste Disposal Areas ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 12	Use controlled blasting techniques to minimize loss of material on steep slopes or into wetlands, Riparian Reserve, floodplains, and waters of the State.	USDI BLM 2008, Appendix I – Water, R 12, p. 271.	OAR 629-625-0410-ODF, Disposal of Waste Materials ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 13	Use temporary sediment control measures (e.g., check dams, silt fencing, bark bags, filter strips, and mulch) to slow runoff and contain sediment from road construction areas. Remove any accumulated sediment and the control measures when work or haul is complete. When long-term structural sediment control measures are incorporated into the final erosion control plan, remove any accumulated sediment to retain capacity of the control measure.	USDI BLM 2008, Appendix I – Water, R 14, p. 271. ODEQ 2005, RC-11	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 14	Avoid use of road fills for water impoundment dams unless specifically designed for that purpose. Impoundments over 9.2-acre feet or 10 feet in depth will require a dam safety assessment by a registered engineer. Upgrade existing road fill impoundments to pass 100-year flood events.	OAR 629-625-0310-5	OAR 629-625-0310-ODF, Road Prism ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Permanent Stream Crossings			

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 15	Minimize fill volumes at permanent and temporary stream crossings by restricting width and height of fill to amounts needed for safe travel and adequate cover for culverts. For deep fills (generally greater than 15 feet deep), incorporate additional design criteria (e.g., rock blankets, buttressing, bioengineering techniques) to reduce the susceptibility of fill failures.	USDI BLM 2008, Appendix I – Water, R 47, p. 276. OAR 629-625-0320 (1b)	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 16	Locate stream-crossing culverts on well-defined, unobstructed, and straight reaches of stream. Locate these crossings as close to perpendicular to the streamflow as stream allows. When structure cannot be aligned perpendicular, provide inlet and outlet structures that protect fill, and minimize bank erosion. Choose crossings that have well-defined stream channels with erosion-resistant bed and banks.	USDI BLM 2008, Appendix I – Water, R 48, p. 276. EPA 2005, p. 3-14 Gesford and Anderson 2006, pp. 5–30	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 17	On new construction, install culverts at the natural stream grade, unless a lessor gradient is required for fish passage. Stream crossings with listed fish must meet ARBO II (NMFS 2013 and USFWS 2013) fish passage design criteria.	USDI BLM 2008, Appendix I – Water, R 49, p. 276.	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 18	Design stream crossings to minimize diversion potential in the event that the crossing is blocked by debris during storm events. This protection could include hardening crossings, armoring fills, dipping grades, oversizing culverts, hardening inlets and outlets, and lowering the fill height.	USDI BLM 2008, Appendix I – Water, R 53, p. 277.	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 19	Design stream crossings to prevent diversion of water from streams into downgrade road ditches or down road surfaces.	USDI BLM 2008, Appendix I – Water, R 31, p. 274. OAR 629-625-0330 (3)	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 20	Place instream grade control structures above or below the crossing structure, if necessary, to prevent stream headcutting, culvert undermining and downstream sedimentation. Employ bioengineering measures to protect the stability of the streambed and banks.	ODEQ 2005 , RC - 2 Gesford and Anderson 2006, pp 5–31. USDA FS 2002 Chapter 20	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 21	Prevent culvert plugging and failure in areas of active debris movement with measures such as beveled culvert inlets, flared inlets, wingwalls, over-sized culverts, trash racks, or slotted risers.	USDI BLM 2008, Appendix I – Water, R 59, p. 278.	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 22	To reduce the risk of loss of the road crossing structure and fill causing excessive sedimentation, use bridges or low-water fords when crossing debris-flow susceptible streams. Avoid using culverts when crossing debris-flow susceptible streams when practicable.	USDI BLM 2008, Appendix I – Water, R 59, p. 280.	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 23	Utilize stream diversion and isolation techniques when installing stream crossings. Evaluate the physical characteristics of the site, volume of water flowing through the project area and the risk of erosion and sedimentation when selecting the proper techniques.	USDI BLM 2008, Appendix I – Water, R 50, R 51, p. 277.	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 24	Limit activities and access points of mechanized equipment to streambank areas or temporary platforms when installing or removing structures. Keep equipment activity in the stream channel to an absolute minimum.	USDI BLM 2008, Appendix I – Water, R 52, p. 277. OAR 629-625-0430 (2)	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 25	Install stream crossing structures before heavy equipment moves beyond the crossing area.	USDI BLM 2008, Appendix I – Water, R 60, p. 278.	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 26	Disconnect road runoff to the stream channel by outsloping the road approach. If outsloping is not possible, use runoff control, erosion control and sediment containment measures. These may include using additional cross drain culverts, ditch lining, and catchment basins. Prevent or reduce ditch flow conveyance to the stream through cross drain placement above the stream crossing.	USDI BLM 2008, Appendix I – Water, R 26, p. 273, R 33 p. 274. Gesford and Anderson 2006, pp. 5-22. OAR 629-625-0330 (4)	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Temporary Stream Crossings for Roads and Skid Trails			
R 27	When installing temporary culverts, use washed rock as a backfill material. Use geotextile fabric as necessary where washed rock will spread with traffic and cannot be practicably retrieved.	USDI BLM 2008, Appendix I – Water, R 63, p. 279. ODEQ 2005, NS-3	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 28	Use no-fill structures (e.g., portable mats, temporary bridges, or improved hardened crossings) for temporary stream crossings. When not practicable, design temporary stream crossings with the least amount of fill and construct with coarse material to facilitate removal upon completion.	OAR 629-625-0320 (2)	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 29	Remove temporary crossing structures promptly after use. Follow practices under the Closure/Decommissioning section for removing stream crossing drainage structures and reestablishing the natural drainage.	USDI BLM 2008, Appendix I – Water, R 65, p. 279. OAR 629-625-0430 (5)	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Surface Drainage			
R 30	Effectively drain the road surface by using crowning, insloping or outsloping, grade reversals (rolling dips), and waterbars or a combination of these methods. Avoid concentrated discharge onto fill slopes unless the fill slopes are stable and erosion-proofed.	USDI BLM 2008, Appendix I – Water, R 22, p. 272. EPA 2005, p. 3-41	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 31	Outslope temporary and permanent low volume roads to provide surface drainage on road gradients up to 6% unless there is a traffic hazard from the road shape.	USDI BLM 2008, Appendix I – Water, R 23, R 24, p. 273. EPA 2005, p. 3-42 USDA FS 2002 Chapter 13	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 32	Consider using broad-based drainage dips or lead-off ditches in lieu of cross drains for low volume roads. Locate these surface water drainage measures where they will not drain into wetlands, floodplains, and waters of the State.	USDI BLM 2008, Appendix I – Water, R 25, R 26, p. 273. EPA 2005, pp. 3-41–3-45 USDA FS 2002 Chapter 13	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 33	Avoid use of outside road berms unless designed to protect road fills from runoff. If road berms are used, breach to accommodate drainage where fill slopes are stable.	USDI BLM 2008, Appendix I – Water, R 27, p. 273. Gesford and Anderson 2006, pp. 3-7.	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 34	Construct variable road grades and alignments (e.g., roll the grade, grade breaks) which limit water concentration, velocity, flow distance, and associated stream power.	USDI BLM 2008, Appendix I – Water, R 28, p. 273. Gesford and Anderson 2006, pp. 5–20. OAR 629-625-0310 (1)	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 35	Install underdrain structures when roads cross or expose springs, seeps, or wet areas rather than allowing intercepted water to flow downgradient in ditchlines.	USDI BLM 2008, Appendix I – Water, R 29, p. 273. OAR 629-625-0330 (5)	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 36	Design roads crossing low-lying areas so that water does not pond on the upslope side of the road. Provide cross drains at short intervals to ensure free drainage.	USDI BLM 2008, Appendix I – Water, R 19, p. 272. EPA 2005, p. 3-14, Bullet 1	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 37	Divert road and landing runoff water away from headwalls, slide areas, high landslide hazard locations, or steep erodible fill slopes.	USDI BLM 2008, Appendix I – Water, R 29, p. 273. OAR 629-625-0330 (2)	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 38	Design landings to disperse surface water to vegetated stable areas.	USDI BLM 2008, Appendix I – Water, R 30, p. 274.	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Cross Drains			
R 39	Locate cross drains to prevent or minimize runoff and sediment conveyance to waters of the State. Implement sediment reduction techniques such as settling basins, brush filters, sediment fences, and check dams to prevent or minimize sediment conveyance. Locate cross drains to route ditch flow onto vegetated and undisturbed slopes.	USDI BLM 2008, Appendix I – Water, R 33, p. 274. OAR 629-625-0330 (4)	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 40	Space cross drain culverts at intervals sufficient to prevent water volume concentration and accelerated ditch erosion. At a minimum, space cross drains at intervals referred to in the BLM Road Design Handbook 9113-1 (USDI BLM 2011), Illustration 11 –'Spacing for Drainage Lateral.' Increase cross drain frequency through erodible soils, steep grades, and unstable areas.	USDI BLM 2008, Appendix I – Water, R 34, p. 274.	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 41	Choose cross drain culvert diameter and type according to predicted ditch flow, debris and bedload passage expected from the ditch. Minimum diameter is 18 inches.	USDI BLM 2008, Appendix I – Water, R 35, p. 274. Johansen *et al*. 1997, p. 3.	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 42	Locate surface water drainage measures (e.g., cross drain culverts, rolling dips, water bars) where water flow will be released on convex slopes or other stable and non-erosive areas that will absorb road drainage and prevent sediment flows from reaching wetlands, floodplains, and waters of the State. Where possible locate surface water drainage structures above road segments with steeper downhill grade. Locate cross drains at least 50 feet from the nearest stream crossing and allow for a sufficient non-compacted soil and vegetative filter.	USDI BLM 2008, Appendix I – Water, R 26, p. 273. Johansen *et al*. 1997, p. 3.	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 43	Armor surface drainage structures (e.g., broad based dips, leadoff ditches) to maintain functionality in areas of erosive and low-strength soils.	USDI BLM 2008, Appendix I – Water, R 38, p. 275.	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 44	Discharge cross drain culverts at ground level on non-erodible material. Install downspout structures or energy dissipaters at cross drain outlets or drivable dips where alternatives to discharging water onto loose material, erodible soils, fills, or steep slopes are not available.	USDI BLM 2008, Appendix I – Water, R 39, R 40, p. 275. ODEQ 2005, RC-2 Gesford and Anderson 2006, pp. 5–31.	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 45	Cut protruding 'shotgun' culverts at the fill surface or existing ground. Install downspout or energy dissipaters to prevent erosion.	USDI BLM 2008, Appendix I – Water, R 41, p. 275.	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 46	Skew cross drain culverts 45–60 degrees from the ditchline as referenced in BLM Road Design Handbook 9113-1 and provide pipe gradient slightly greater than ditch gradient to reduce erosion at cross drain inlet.	BLM Road Design Handbook H9113-1 2009	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 47	Provide for unobstructed flow at culvert inlets and within ditch lines during and upon completion of road construction prior to the wet season.	OAR 629-625-0420	OAR 629-625-0330-ODF, Drainage ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Timing of In-water Work			

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 48	Conduct all nonemergency in-water work during the ODFW instream work window. Avoid winter sediment and turbidity entering streams during in-water work to the extent practicable.	USDI BLM 2008, Appendix I – Water, R 44, p. 276, R 65, p. 279. Oregon guidelines for timing of in-water work to protect fish and wildlife resources. ODFW 2008 OAR 629-625-0430	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 49	Remove stream crossing culverts and entire in-channel fill material during ODFW instream work period.	USDI BLM 2008, Appendix I – Water, R 93, p. 283. Oregon guidelines for timing of in-water work to protect fish and wildlife resources. ODFW 2008	OAR 629-625-0650-ODF,Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Low-water Ford Stream Crossings			
R 50	Harden low-water ford approaches with durable materials. Provide cross drainage on approaches. Limit ford crossings to the ODFW instream work period.	USDI BLM 2008, Appendix I – Water, R 67, p. 279. EPA 2005, p. 3-50.	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 51	Restrict access to unimproved low-water stream crossings.	USDI BLM 2008, Appendix I – Water, R 69, p. 280. OAR 629-625-0430 (5)	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 52	Use permanent low-water fords (e.g., concrete and well-anchored concrete mats) in debris-flow susceptible streams.	USDI BLM 2008, Appendix I – Water, R 70, p. 280. EPA 2005, p. 3-50.	OAR 629-625-0320-ODF, Stream Crossing Structures ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Maintaining Water Quality - Noxious Weeds			
R 53	Locate equipment-washing sites in areas with no potential for runoff into wetlands, Riparian Reserve, floodplains, and waters of the State. Do not use solvents or detergents to clean equipment on site.	USDI BLM 2008, Appendix I – Water, R 75, p. 280. ODEQ 2005, NS-5	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Water Source Development and Use			

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 54	Limit disturbance to vegetation and modification of streambanks when locating road approaches to in-stream water source developments. Surface these approaches with durable material. Employ erosion and runoff control measures.	USDI BLM 2008, Appendix I – Water, R 102, p. 285.	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 55	Direct pass-through flow or overflow from in-channel and any connected off-channel water developments back into the stream.	USDI BLM 2008, Appendix I – Water, R 104, p. 285.	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 56	Direct overflow from water harvesting ponds to a safe non-eroding dissipation area, and not into a stream channel.	USDI BLM 2008, Appendix I – Water, R 105, p. 285.	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 57	Limit the construction of temporary in-channel water drafting sites. Develop permanent water sources outside of stream channels and wetlands.	USDI BLM 2008, Appendix I – Water, R 106, p. 286. ODEQ 2005, NS-1	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 58	Do not place pump intakes on the substrate or edges of the stream channel. When placing intakes instream, place on hard surfaces (e.g., shovel, rocks) to minimize turbidity. Use a temporary liner to create intake site. After completion of use, remove liner and restore channel to natural condition.	USDI BLM 2008, Appendix I – Water, R 107, p. 286. ODEQ 2005, NS-1	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 59	Do not locate placement of road fill in the proximity of a public water supply intake (404(f) exemption criteria xi) in waters of the State.	USACOE (1972) 404(f) exemption criteria xi	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 60	Avoid water withdrawals from fish-bearing streams whenever possible. Limit water withdrawals in listed fish habitat and within 1,500 feet of listed fish habitat to 10% of stream flow or less at the point of withdrawal, and in non-listed fish habitat to 50% or less at the point of withdrawal, based on a visual assessment by a fish biologist or hydrologist. The channel must not be dewatered to the point of isolating fish.	USDC NMFS 2013 ARBO II, p. 43 (NWR-2013-9664) USDA FS 2012, p. 146	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011
Erosion Control Measures			

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 61	During roadside brushing, remove vegetation by cutting rather than uprooting.	OAR 629-625-0430 (4)	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 62	Limit road and landing construction, reconstruction, or renovation activities to the dry season. Keep erosion control measures concurrent with ground disturbance to allow immediate stormproofing.	USDI BLM 2008, Appendix I – Water, R 9, p. 271.	OAR 629-625-0440-ODF, Stabilization ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 63	Apply native seed and certified weed-free mulch to cut and fill slopes, ditchlines, and waste disposal sites with the potential for sediment delivery to wetlands, Riparian Reserve, floodplains and waters of the State. If needed to promote a rapid ground cover and prevent aggressive invasive plants, use interim erosion control non-native sterile annuals before attempting to restore natives. Apply seed upon completion of construction and as early as possible to increase germination and growth. Reseed if necessary to accomplish erosion control. Select seed species that are fast-growing, have adequate provide ample ground cover and soil-binding properties. Apply mulch that will stay in place and at site-specific rates to prevent erosion.	USDI BLM 2008, Appendix I – Water, R 17, p. 272.	OAR 629-625-0440-ODF, Stabilization ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 64	Place sediment-trapping materials or structures such as straw bales, jute netting, or sediment basins at the base of newly constructed fill or side slopes where sediment could be transported to waters of the State. Keep materials away from culvert inlets or outlets.	USDI BLM 2008, Appendix I – Water, R 14, p. 271, R 21, p. 272. USDA FS 2002 Chapter 18	OAR 629-625-0440-ODF, Stabilization ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 65	Use biotechnical stabilization and soil bioengineering techniques to control bank erosion (e.g., commercially produced matting and blankets, live plants or cuttings, dead plant material, rock, or other inert structure).	USDI BLM 2008, Appendix I – Water, R 54, p. 277. USDA FS 2002, Chapters 18 and 20	OAR 629-625-0440-ODF, Stabilization ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 66	Suspend ground-disturbing activity if projected forecasted rain will saturate soils to the extent that there is potential for movement of sediment from the road to wetlands, floodplains, and waters of the State. Cover or temporarily stabilize exposed soils during work suspension. Upon completion of ground-disturbing activities, immediately stabilize fill material over stream crossing structures. Measures could include but not limited to erosion control blankets and mats, soil binders, soil tackifiers, or placement of slash.	USDI BLM 2008, Appendix I – Water, R 57, p. 278, R 88, p. 282.	OAR 629-625-0440-ODF, Stabilization ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 67	Apply fertilizer in a manner to prevent direct fertilizer entry to wetlands, Riparian Reserve, floodplains, and waters of the State.	OAR 629-625-0440 Aquatic Resources Biological Opinion NMFS-ARBO 2013.	OAR 629-625-0440-ODF, Stabilization ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Road Use and Dust Abatement			
R 68	Apply water or approved road surface stabilizers/dust control additives to reduce surfacing material loss and buildup of fine sediment that can enter into wetlands, floodplains and waters of the State. Prevent entry of road surface stabilizers/dust control additives into waters of the State during application. For dust abatement, limit applications of lignin sulfonate to a maximum rate of 0.5 gal/yd^2 of road surface, assuming a 50:50 (lignin sulfonate to water) solution.	USDI BLM 2008, Appendix I – Water, R 76, p. 281. ODEQ 2005, EP-13 Western Oregon Programmatic 2011	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Road Maintenance			
R 69	Prior to the wet season, provide effective road surface drainage maintenance. Clear ditch lines in sections where there is lowered capacity or obstructed by dry ravel, sediment wedges, small failures, or fluvial sediment deposition. Remove accumulated sediment and blockages at cross-drain inlets and outlets. Grade natural surface and aggregate roads where the surface is uneven from surface erosion or vehicle rutting. Restore crowning, outsloping or insloping for the road type for effective runoff. Remove or provide outlets through berms on the road shoulder. After ditch cleaning prior to hauling, allow vegetation to reestablish or use sediment entrapment measures (e.g., sediment trapping blankets or silt fences).	USDI BLM 2008, Appendix I – Water, R 81, R 84, R 85, p. 281. OAR 629-625 0600 (2-4) EPA 2005, pp. 3-61–3-62.	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 70	Retain ground cover in ditch lines, except where sediment deposition or obstructions require maintenance.	USDI BLM 2008, Appendix I – Water, R 86, p. 282.	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 71	Maintain water flow conveyance, sediment filtering and ditch line integrity by limiting ditch line disturbance and groundcover destruction when machine cleaning within 200 feet of road stream crossings.	USDA FS 2012, pp. 113–114. EPA 2005, p. 3-62.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 72	Avoid undercutting of cut-slopes when cleaning ditch lines.	USDI BLM 2008, Appendix I – Water, R 78, p. 281. EPA 2005, p. 3-62.	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 73	Remove and dispose of slide material when it is obstructing road surface and ditch line drainage. Place material on stable ground outside of wetlands, Riparian Reserve, floodplains, and waters of the State. Seed with native seed and weed-free mulch.	USDI BLM 2008, Appendix I – Water, R 79, p. 281. OAR 629-625-0600 (6)	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 74	Do not sidecast loose ditch or surface material where it can enter wetlands, Riparian Reserve, floodplains, and waters of the State.	USDI BLM 2008, Appendix I – Water, R 80, p. 281. OAR 629-625-0600 (7)	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 75	Retain low-growing vegetation on cut-and-fill slopes.	USDI BLM 2008, Appendix I – Water, R 86, p. 282. EPA 2005, EP-6	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 76	Seed and mulch cleaned ditch lines and bare soils that drain directly to wetlands, floodplains, and waters of the State, with native species and weed-free mulch.	USDI BLM 2008, Appendix I – Water, R 78, p. 281.	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Road Stormproofing			
R 77	Inspect and maintain culvert inlets and outlets, drainage structures and ditches before and during the wet season to diminish the likelihood of plugged culverts and the possibility of washouts.	USDI BLM 2008, Appendix I – Water, R 81, R 82, p. 281. OAR 629-625-0600 (3)	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 78	Repair damaged culvert inlets and downspouts to maintain drainage design capacity.	USDI BLM 2008, Appendix I – Water, R 82, p. 281. OAR 629-625-0600 (3)	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 79	Blade and shape roads to conserve existing aggregate surface material retain or restore the original cross section, remove berms and other irregularities that impede effective runoff or cause erosion, and ensure that surface runoff is directed into vegetated, stable areas.	USDI BLM 2008, Appendix I – Water, R 84, p. 281. OAR 629-625-0600 (4)	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 80	Stormproof open resource roads receiving infrequent maintenance to reduce road erosion and reduce the risk of washouts by concentrated water flows. Stormproof temporary roads if retained over-winter.	USDI BLM 2008, Appendix I – Water, R 87, p. 282. OAR 629-625-0600 (2)	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 81	Suspend stormproofing/ decommissioning operations and cover or otherwise temporarily stabilize all exposed soil if conditions develop that cause a potential for sediment-laden runoff to enter a wetland, floodplain, or waters of the State. Resume operations when conditions allow turbidity standards to be met.	USDI BLM 2008, Appendix I – Water, R 88, p. 282.	OAR 629-625-0600-ODF, Road Maintenance ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Road Closure and Decommissioning			
R 82	Inspect closed roads to ensure that vegetation stabilization measures are operating as planned, drainage structures are operational, and noxious weeds are not providing erosion control. Conduct vegetation treatments and drainage structure maintenance as needed.	OAR 629-625-0650 (2)	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 83	Decommission temporary roads upon completion of use.	USDI BLM 2008, Appendix I – Water, R 90, p. 283.	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 84	Prevent use of vehicular traffic utilizing methods such as gates, guard rails, earth/log barricades, to reduce or eliminate erosion and sedimentation due to traffic on roads.	USDI BLM 2008, Appendix I – Water, R 91, p. 283. OAR 629-625-0650 (2)	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 85	Convert existing drainage structures such as ditches and cross drain culverts to a long-term maintenance free drainage configuration such as an outsloped road surface and waterbars.	USDI BLM 2008, Appendix I – Water, R 92, p. 283. OAR 629-625-0650 (3)	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 86	Place and remove temporary stream crossings during the dry season, without overwintering, unless designed to accommodate the 100-year theoretical flood. See also R 49.	OAR 629-625-0430 (5)	OAR 629-625-0430-ODF, Stream Protection ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
R 87	Place excavated material from removed stream crossings on stable ground outside of wetlands, Riparian Reserve, floodplains, and waters of the State. In some cases, the material could be used for recontouring old road cuts or be spread across roadbed and treated to prevent erosion.	USDI BLM 2008, Appendix I – Water, R 94, p. 284.	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 88	Reestablish stream crossings to the natural stream gradient. Excavate sideslopes back to the natural bank profile. Reestablish natural channel width and floodplain.	USDI BLM 2008, Appendix I – Water, R 95, p. 284.	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 89	Install cross ditches or waterbars upslope from stream crossing to direct runoff and potential sediment to the hillslope rather than deliver it to the stream	USDI BLM 2008, Appendix I – Water, R 96, p. 284. OAR 629-625-0650 (3)	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 90	Following culvert removal and prior to the wet season, apply erosion control and sediment trapping measures (e.g., seeding, mulching, straw bales, jute netting, and native vegetative cuttings) where sediment can be delivered into wetlands, Riparian Reserve, floodplains, and waters of the State.	USDI BLM 2008, Appendix I – Water, R 97, p. 284. OAR 629-625-0650 (3)	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 91	Implement tillage measures, including ripping or subsoiling to an effective depth. Treat compacted areas including the roadbed, landings, construction areas, and spoils sites.	USDI BLM 2008, Appendix I – Water, R 98, p. 285.	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 92	After tilling the road surface, pull back unstable road fill and end-haul or contour to the natural slopes.	USDI BLM 2008, Appendix I – Water, R 99, p. 285.	OAR 629-625-0650-ODF, Vacating Forest Roads ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Wet-season Road Use			
R 93	On active haul roads, during the wet season, use durable rock surfacing and sufficient rock depth to resist rutting or development of sediment on road surfaces that drain directly to wetlands, floodplains, and waters of the State.	USDI BLM 2008, Appendix I – Water, R 71, p. 280. OAR 629-625-0700 (2)	OAR 629-625-0700-ODF, Wet Weather Road Use ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 94	Prior to winter hauling activities, implement structural road treatments such as: increasing the frequency of cross drains, installing sediment barriers or catch basins, applying gravel lifts or asphalt road surfacing at stream crossing approaches, and armoring ditch lines.	USDI BLM 2008, Appendix I – Water, R 72, p. 280. OAR 629-625-0700 (2)	OAR 629-625-0700-ODF, Wet Weather Road Use ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 95	Remove snow on surfaced roads in a manner that will protect the road and adjacent resources. Retain a minimum layer (4 inches) of compacted snow on the road surface. Provide drainage through the snow bank at periodic intervals to allow snowmelt to drain off the road surface.	USDI BLM 2008, Appendix I – Water, R 74, p. 280. BLM snow removal letter.	OAR 629-625-0700-ODF, Wet Weather Road Use ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
R 96	Avoid removing snow from unsurfaced roads where runoff drains to waters of the State.	USDA FS 2012, pp. 120–123 EPA 2005, p. 3-80	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 97	Maintain road surface by applying appropriate gradation of aggregate and suitable particle hardness to protect road surfaces from rutting and erosion under active haul where runoff drains to wetlands, Riparian Reserve, floodplains, and waters of the State.	USDI BLM 2008, Appendix I – Water, R 71, p. 280. OAR 629-625-0700 (2)	OAR 629-625-0700-ODF, Wet Weather Road Use ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 98	To reduce sediment tracking from natural surface roads during active haul, provide a gravel approach before entrance onto surfaced roads.	EPA 2005, pp. 3-57–3-58	OAR 629-625-0700-ODF, Wet Weather Road Use ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
R 99	Install temporary culverts and washed rock on top of low-water ford to reduce vehicle contact with water during active haul. Remove culverts promptly after use.	USDA FS 2012, pp. 119–120	OAR 629-625-0700-ODF, Wet Weather Road Use ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

Timber Harvest Activities

Table J-264. Best management practices for timber harvest activities.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Cable Yarding			
TH 01	Design yarding corridors in Riparian Reserve to limit the number of such corridors, using narrow widths, and using the most perpendicular orientation to the stream feasible. Yarding corridors shall be set at 12 foot maximum widths and no less than 200 feet apart.	USDI BLM 2008, Appendix I – Water, TH 2, p. 287.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
TH 02	Trees felled for yarding corridors in the Riparian Reserve within a site-potential tree height distance of a stream channel would be directed toward the stream and left on site.		ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 03	Require full suspension over flowing streams, non-flowing streams with highly erodible bed and banks, and jurisdictional wetlands.	USDI BLM 2008, Appendix I – Water, TH 3, p. 287.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 04	When logging downhill into Riparian Reserve, design the logging system to prevent converging yarding trails from intersecting the stream network.	USDI BLM 2008, Appendix I – Water, TH 4, p. 287.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
TH 05	Prevent streambank and hillslope disturbance on steep slopes (generally >60%) by requiring full-suspension within 50 feet of definable stream channels. Yard the remaining areas across the Riparian Reserve using at least one-end suspension.	USDI BLM 2008, Appendix I – Water, TH 5, p. 287.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 06	Implement erosion control measures such as waterbars, slash placement, and seeding in cable yarding corridors where the potential for erosion and delivery to water bodies, floodplains and wetlands exists.	USDI BLM 2008, Appendix I – Water, TH 6, p. 288.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Ground-based Harvesting			
TH 07	Exclude ground-based equipment on hydric soils, defined by the Natural Resources Conservation Service.	USDI BLM 2008, Appendix I – Water, TH 8, p. 288.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 08	Limit designated skid trails for thinning or regeneration harvesting to ≤ 15% of the harvest unit area to reduce displacement or compaction to acceptable limits.	Soil Quality Standards USDA FS 1998	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 09	Limit width of skid roads to single width of what is operationally necessary for the approved equipment. Where multiple machines are used, provide a minimum-sized pullout for passing.	USDI BLM 2008, Appendix I – Water, TH 10, p. 288.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 10	Ensure leading-end of logs is suspended when skidding.	USDI BLM 2008, Appendix I – Water, TH 11, p. 288.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 11	Restrict ground-based harvesting operations (cutting or transporting logs) to periods of low soil moisture; generally from May 15 to Oct 15. Low soil moisture varies by texture, e.g., <25% for clay/clay loam, <20% for loam/silt loam, and <15% for sand/sandy loam.[46]	USDI BLM 2008, Appendix I – Water, TH 12, p. 288.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 12	Incorporate existing skid trails and landings as a priority over creating new trails where feasible, into a designated trail network for ground-based harvesting equipment, consider proper spacing, skid trail direction and location relative to terrain and stream channel features.	USDI BLM 2008, Appendix I – Water, TH 13, p. 289.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 13	Limit conventional skidders and tracked equipment to slopes less than 35%, except when using legacy trails or accessing isolated ground based harvest areas requiring short trails (up to 100 feet) over steeper pitches without causing adverse effects to soils.	USDI BLM 2008, Appendix I – Water, TH 14, p. 289.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036

[46] Soil moisture is the ratio of the weight of the water in the soil to the weight of the solids, expressed as a percentage.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
TH 14	Limit the use of specialized ground-based mechanized equipment (designed to operate on slopes greater than 35%) where excessive surface displacement creates trenches or depressions that would channel water and sediment as overland flow.	USDI BLM 2008, Appendix I – Water, TH 15, p. 289.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 15	Designate skid trails in locations that channel water from the trail surface away from water bodies, floodplains, and wetlands, or unstable areas adjacent to them.	USDI BLM 2008, Appendix I – Water, TH 16, p. 289.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 16	Directionally fall trees to lead for skidding and skyline yarding to minimize ground disturbance when moving logs to skid trails and skyline corridors.	USDI BLM 2008, Appendix I – Water, TH 17, p. 289.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 17	Apply erosion control measures to skid trails and other disturbed areas with potential for erosion and subsequent sediment delivery to water bodies, floodplains, or wetlands. These practices may include seeding, mulching, water barring, tillage, and woody debris placement. Use guidelines from the road decommissioning section.	USDI BLM 2008, Appendix I – Water, TH 18, p. 289.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 18	Construct waterbars on skid trails using guidelines in **Table J-268** where potential for soil erosion or delivery to water bodies, floodplains, and wetlands exists.	USDI BLM 2008, Appendix I – Water, TH 19, p. 289.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 19	Subsoil skid trails, landings, or temporary roads where needed to achieve 20% detrimental soil conditions, minimize surface runoff, improve soil structure and water movement through the roadbed. See also R 92-93	USDI BLM 2008, Appendix I – Water, R 98, p. 285.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 20	Block skid trails to prevent public motorized travel and other unauthorized use at the end of seasonal use.	USDI BLM 2008, Appendix I – Water, TH 21, p. 290.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 21	Allow harvesting operations (cutting and transporting logs) when ground is frozen or adequate snow cover exists to prevent soil compaction and displacement.	USDI BLM 2008, Appendix I – Water, TH 12, p. 288.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 22	Minimize the area where more than half of the depth of the organically-enriched upper horizon (topsoil) is removed when conducting forest management operations	Soil Quality Standards USDA FS 1998	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 23	Maintain the minimum percent of effective ground cover needed to control surface erosion, as shown in **Table J-265**, following forest management operations. Ground cover may be provided by vegetation, slash, duff, medium to large gravels, cobbles, or biological crusts.	Soil Quality Standards USDA FS 1998	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Helicopter			

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
TH 24	Consider the use of helicopter or aerial logging systems to prevent water quality impacts from road construction or ground-based timber yarding, where other BMPs would be more costly or have limited effectiveness.	USDI BLM 2008, Appendix I – Water, TH 23, p. 290.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
Horse			
TH 25	Within Riparian Reserve, limit horse logging to slopes less than 20%.	USDI BLM 2008, Appendix I – Water, TH 24, p. 290.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
TH 26	Construct waterbars on horse skid trails when there is potential for soil erosion and delivery to water bodies, floodplains, and wetlands.	USDI BLM 2008, Appendix I – Water, TH 25, p. 290.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036

Table J-265. Soil cover based on erosion hazard ratings.

NRCS Erosion Hazard Rating*	Minimum Percent Effective Ground Cover – Year 1	Minimum Percent Effective Ground Cover – Year 2
Very Severe	60%	75%
Severe	45%	60%
Moderate	30%	40%
Slight	20%	30%

* Rating obtained from Natural Resources Conservation Services County Soil Survey information by map unit.

Silvicultural Activities

Table J-266. Best management practices for planting, pre-commercial thinning, and fertilization.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Planting and Pre-commercial Thinning			
S 01	Limit the crossing of stream channels with motorized support vehicles (e.g., public motorized travel) and mechanized equipment to existing road crossings or temporary ford crossings to the ODFW instream work period.	USDI BLM 2008, Appendix I – Water, S 1, p. 291.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
S 02	Scatter treatment debris on disturbed soils and water bar any equipment access trails that could erode and deposit sediment in water bodies, floodplains, and wetlands.	USDI BLM 2008, Appendix I – Water, S 4, p. 291.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Fertilization			
S 03	For streams and water bodies that support domestic use, apply fertilizer further than 100 feet from the edge of the active channel or shoreline.	USDI BLM 2008, Appendix I – Water, S 5, p. 291.	EPA 440/5-86-001,-10 mg/L nitrate nitrogen for domestic water supply. ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
S 04	Locate storage, transfer, and loading sites outside Riparian Reserve and separated from hydrological connections (e.g., road ditches that are linked to stream channels).	USDI BLM 2008, Appendix I – Water, S 6, p. 291.	EPA 822-R-13-001 2013,-salmonid acute criterion, 17 mg total ammonia nitrogen/L at pH 7 and temperature of 20 °C. ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033

Fire and Fuels Management

Table J-267. Best management practices for fire and fuel management.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Underburn, Jackpot Burn, and Broadcast Burn			
F 01	Keep broadcast burns and jackpot burns out of Riparian Reserve inner zone, unless prescribed for restoration purposes (e.g., sudden oak death sanitation, improve species composition, invigorate deciduous trees). Locate ignition lines above large open meadows associated with stream channels, unless prescribed for restoration.	USDI BLM 2008, Appendix I – Water, F 1, p. 293.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
F 02	Reduce fuel loads by whole tree yarding, and piling material, as necessary, prior to under burning in dry forest types where fuel loads are elevated.	USDI BLM 2008, Appendix I – Water, F 2, p. 293.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
F 03	Avoid direct ignition or ignition by a backing-in fire of large woody material that is touching the high water mark of a water body or that may be affected by high flows.	USDI BLM 2008, Appendix I – Water, F 3, p. 293.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
F 04	Avoid delivery of chemical retardant foam or additives to water bodies, and wetlands. Store and dispose of ignition devices/ materials (e.g., flares, plastic spheres) outside Riparian Reserve or a minimum of 150 feet from water bodies, floodplains, and wetlands. Maintain and refuel equipment (e.g., drip torches, chainsaws) a minimum of 100 feet from water bodies, floodplains, and wetlands. Portable pumps can be refueled on-site within a spill containment system.	USDI BLM 2008, Appendix I – Water, F 4, p. 293.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
F 05	Limit fire lines inside Riparian Reserve. Construct fire lines by hand on all slopes greater than 35% and inside the Riparian Reserve inner zone. Use erosion control techniques such as tilling, waterbarring, or debris placement on fire lines when there is potential for soil erosion and delivery to water bodies, floodplains, and wetlands. Space the waterbars as shown in **Table J-268**. Avoid placement of any fire line where water would be directed into water bodies, floodplains, wetlands, headwalls, or areas of instability.	USDI BLM 2008, Appendix I – Water, F 5, p. 294.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
F 06	In broadcast burning, consume only the upper horizon organic materials and allow no more than 15% of the burned area mineral soil surface to change to a reddish color.	Soil Quality Standards USDA FS 1998	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Pile and Burn			
F 07	Avoid burning piles within 35 feet of a stream channel.	USDI BLM 2008, Appendix I – Water, F 6, p. 294.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
F 08	Avoid creating piles greater than 16 feet in height or diameter. Pile smaller diameter materials and leave larger >12 inch pieces within the unit. Reduce burn time and smoldering of piles by extinguishment with water and tool use.	Soil Quality Standards USDA FS 1998	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
F 09	In pile burning, consume only the upper horizon organic materials and allow no more than 15% of the burned area mineral soil surface to change to a reddish color.	Soil Quality Standards USDA FS 1998	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Mechanical and Manual Fuels Treatments			

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
F 10	Prevent mechanical fuel reduction equipment within the Riparian Reserve inner zone, unless prescribed for restoration. Limit mechanical fuel reduction equipment to slopes less than 35%. Restrict non-track mechanized equipment (e.g., feller bunchers, horizontal bar masticators) to slopes less than 20%.	USDI BLM 2008, Appendix I – Water, F 7, p. 294.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
F 11	Use temporary stream crossings if necessary to access the opposite side with any equipment or vehicles (including public motorized travel). Follow Temporary Stream Crossing practices under Roads section.	USDI BLM 2008, Appendix I – Water, F 8, p. 294.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
F 12	Place residual slash on severely burned areas, where there is potential for sediment delivery into water bodies, floodplains and wetlands.	USDI BLM 2008, Appendix I – Water, F 9, p. 294.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Wildfire Suppression			
F 13	Limit firelines inside Riparian Reserve. Where hand constructed firelines are necessary in Riparian Reserve, angle the approach, where feasible, rather than have it perpendicular to the Riparian Reserve. Limit heavy equipment to slopes less than 35%. Locate fire lines to minimize directing water into water bodies, wetlands, headwalls, or areas of instability. Use erosion control techniques such as tilling, waterbarring, or debris placement on fire lines when there is potential for soil erosion and delivery to water bodies, floodplains, and wetlands. Space waterbars as shown in **Table J-268**. Block dozer lines and roads or landing intersections with an approved barricade or scattered slash to preclude public motorized travel use.	USDI BLM 2008, Appendix I – Water, F 5, p. 294, F 11, p. 295.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
F 14	Prevent cutting of logs or woody material if any portion of that material extends into the stream channel, unless for restoration. Fall snags in the Riparian Reserve towards the stream channel when felling is necessary for safety or fire suppression activities.	USDI BLM 2008, Appendix I – Water, F 12, p. 295.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
F 15	Avoid locating incident bases, camps, helibases, staging areas, constructed helispots, and other centers for incident activities in Riparian Reserve or within 200 feet of any waterbody, floodplain, or wetland. Water drafting sites for engines and tankers would be permitted.	USDI BLM 2008, Appendix I – Water, F 13, p. 295.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1)) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
F 16	Locate and maintain portable sanitation facilities at incident bases, camps (including spike/ remote camps), helibases, staging areas, constructed helispots, and other centers for incident activities in accordance with State and local regulations.	USDI BLM 2008, Appendix I – Water, F 14, p. 295.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009
F 17	Avoid application of chemical retardant, foam, or other chemicals to waterways, maintain a 300 ft. buffer (FA-IM-2008-029), unless the wildfire is deemed a threat to human safety or private property. Apply aerial retardant adjacent to Riparian Reserve by making parallel passes.	USDI BLM 2008, Appendix I – Water, F 15, p. 295.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
Emergency Stabilization or Rehabilitation			

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
F 18	Implement emergency fire stabilization or rehabilitation treatments to accomplish erosion control as quickly as possible and before the wet season. Soil and water conservation practices may include, but are not restricted to: – Seeding or planting native vegetation for short-term cover development and long-term recovery, unless not available in quantities necessary for the emergency response. – Mulching with straw, wood chips, or other suitable material. To avoid introducing noxious weeds when mulching, use certified weed-free straw mulch or rice straw where available. – Placing straw wattles on the contour at adequate spacing between each row to capture eroded material without overflowing. Embed to the surface of the soil in slight trench to prevent undermining. – Placing and anchoring log erosion barriers similarly to straw wattles. – Spreading available cut vegetation or slash on bare soils. – Placing channel sediment retention or stabilization structures. – Placing trash racks for debris above road drainage structures. – Installing drainage structures, such as waterbars or drainage dips, on fire lines, fire roads, and other cleared areas according to guidelines in **Table J-268** (Waterbar spacing by gradient and erosion class). – Repairing damaged road drainage facilities, such as flattened or ripped culvert ends, or burned out plastic pipes, or cleaning ditch lines of materials that impede natural flow. – Blocking or decommissioning roads and trails.	USDI BLM 2008, Appendix I – Water, F 16, p. 296. Interagency Burned Area Emergency Response Guidebook; Interpretation of Department of the Interior 620 DM 3 and USDA Forest Service Manual 2523 For the Emergency Stabilization of Federal and Tribal Trust Lands Version 4.0 February 2006	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Post-Fire Road Repair			

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
F 19	Implement emergency fire rehabilitation treatments to accomplish erosion control as quickly as possible and before the wet season. Soil and water conservation practices may include, but are not restricted to: – Reducing road system hydrologic conductivity though proper grading, culvert spacing, and installing drivable dips. – Replacing culverts to increase peak flow capacity of stream crossing culverts to accommodate the 100-year design flood. – Preventing culvert plugging. – Correcting stream diversions.	USDI BLM 2008, Appendix I – Water, F 17, p. 297. Interagency Burned Area Emergency Response Guidebook; Interpretation of Department of the Interior 620 DM 3 (USDI BLM 2006) and USDA Forest Service Manual 2523 For the Emergency Stabilization of Federal and Tribal Trust Lands Version 4.0 (USDA FS *et al.* 2006)	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Fuel/Retardant Transport			
F 20	If more than 42 gallons of fuel or combined quantity of petroleum product and chemical substances would be transported to a project site, implement the following precautions: 1. Plan a safe route and transfer sites that could contain the transported volume. 2. Plan an active dispatch system that can relay the information to appropriate resources. 3. Ensure a spill containment kit that can absorb and contain 55 gallons of petroleum product and chemical substances is readily available. 4. Provide for immediate notification in the event of a spill. Have a radio equipped vehicle lead the chemical or fuel truck to the project site. 5. Assemble a spill notification list that includes the district hazardous materials coordinator, DEQ, and spill clean-up contractors. 6. Construct a water user contact list with address and phone numbers. 7. When operating within Source Water Watersheds, pre-estimate travel times through the watershed to predict downstream arrival times. 8. Be prepared to sample water and carry sample containers.	USDI BLM 2008, Appendix I – Water, F 18, p. 297.	[40 CFR 112] - Oil Pollution Prevention. Reportable quantity is forty-two U.S. Gallons not involving waterways, a visible sheen where waterways are involved. ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) and (13) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033

Table J-268. Water bar spacing by gradient and erosion class.

Gradient (Percent)	Water Bar Spacing* Per Erosion Class†		
	High (Feet)	Moderate (Feet)	Low (Feet)
2-5%	200	300	400
6-10%	150	200	300
11-15%	100	150	200
16-20%	75	100	150
21-35%	50	75	100
36+%	50	50	50

* Spacing is determined by slope distance and is the maximum allowed for the grade.
† The erosion classes include the following rock types:

High: Granite, sandstone, andesite porphyry, glacial or alluvial deposits, soft matrix conglomerate, volcanic ash, and pyroclastics.
Moderate: Basalt, andesite, quartzite, hard matrix conglomerate, and rhyolite.
Low: Metasediments, metavolcanics, and hard shale.

Surface Source Water for Drinking Water

Table J-269. Best management practices for surface source water for drinking water protection.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
SW 01	Plan, locate, design, construct, operate, inspect, and maintain sanitary facilities to minimize water contamination.	USDI BLM 2008, Appendix I – Water, SW 1, p. 299.	ODEQ–Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 02	Locate contractor camps outside DEQ sensitive zones in drinking water source areas for public water systems. If this is not possible, require self-contained sanitary facilities.	USDI BLM 2008, Appendix I – Water, SW 2, p. 299. ODEQ Drinking Water Protection Program http://www.deq.state.or.us/wq/dwp/swcountymap.htm	ODEQ–Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 03	Require self-contained sanitary facilities in surface source water watersheds, when long-term camping (greater than 14 days) is involved with contract implementation.	USDI BLM 2008, Appendix I – Water, SW 3, p. 299.	ODEQ–Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 04	Provide self-contained sanitary facilities when there is high recreational use (almost continuous occupancy) inside DEQ sensitive zones within drinking water source areas for public water systems, known domestic source water watersheds, or Riparian Reserve inner zone.	USDI BLM 2008, Appendix I – Water, SW 4, p. 299. ODEQ Drinking Water Protection Program http://www.deq.state.or.us/wq/dwp/swcountymap.htm	ODEQ–Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
SW 05	Locate pack and riding, facilities outside DEQ sensitive zones within drinking water source areas for public water systems, known domestic source water watersheds, or Riparian Reserve inner zone.	USDI BLM 2008, Appendix I – Water, SW 5, p. 299. ODEQ Drinking Water Protection Program http://www.deq.state.or.us/wq/dwp/swcountymap.htm	ODEQ–Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 06	Do not allow surface occupancy within 200 feet of a known domestic water source or within DEQ sensitive zones in drinking water source areas for public water systems.	USDI BLM 2008, Appendix I – Water, SW 6, p. 299. ODEQ Drinking Water Protection Program http://www.deq.state.or.us/wq/dwp/swcountymap.htm	ODEQ–Water Pollution: Bacteria OAR 340-041-0009 Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 07	Do not apply sewage sludge as a soil amendment within drinking water source areas for public water systems, known domestic source water watersheds, or Riparian Reserve.	USDI BLM 2008, Appendix I – Water, SW 7, p. 300. ODEQ Drinking Water Protection Program http://www.deq.state.or.us/wq/dwp/swcountymap.htm	ODEQ–Water Pollution: Bacteria OAR 340-041-0009 Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 08	Avoid loading, or storing chemical, fuel, or fertilizer in DEQ sensitive zones within drinking water source areas for public water systems, known domestic source water watersheds, or Riparian Reserve inner zone.	USDI BLM 2008, Appendix I – Water, SW 8, p. 300. ODEQ Drinking Water Protection Program http://www.deq.state.or.us/wq/dwp/swcountymap.htm	ODEQ–Water Pollution: Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 09	Conduct equipment maintenance outside DEQ sensitive zones within drinking water source areas for public water systems, known domestic source water watersheds, or Riparian Reserve inner zone.	USDI BLM 2008, Appendix I – Water, SW 9, p. 300. ODEQ Drinking Water Protection Program http://www.deq.state.or.us/wq/dwp/swcountymap.htm	ODEQ–Water Pollution: Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
SW 10	Use non-oil-based dust suppressants within surface source water watersheds.	USDI BLM 2008, Appendix I – Water, SW 10, p. 300.	ODEQ–Water Pollution: Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)
SW 11	Use fire retardant and surfactants as a last resort in fire suppression activities within surface source water watersheds.	USDI BLM 2008, Appendix I – Water, SW 11, p. 300.	ODEQ–Water Pollution: Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)

Recreation

Table J-270. Best management practices for recreation management.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
All Recreation Facilities			
REC 01	Implement erosion control measures at recreation sites to stabilize exposed soils where water flows or sediment, may reach water bodies.	USDI BLM 2008, Appendix I – Water, REC 1, p. 301.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 02	Minimize development of recreation facilities that are not water-dependent (e.g., boat ramps and docks) in the Riparian Reserve.	USDI BLM 2008, Appendix I – Water, REC 2, p. 301.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
Developed Recreation Sites			
REC 03	Use self-contained sanitary facilities at all developed recreational facilities, unless a sewage system and drain field is approved by the DEQ.	USDI BLM 2008, Appendix I – Water, REC 3, p. 301.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009
REC 04	When conducting recreation site maintenance, do not cut portions of logs or coarse woody debris that fall across the active stream channel. Keep adequate lengths of material on the banks to anchor it in place. If not possible to make the log stable, it may be removed.	USDI BLM 2008, Appendix I – Water, REC 5, p. 301.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Water Dependent Facilities			
REC 05	Construct boat ramps and approaches with hardened surfaces. Minimize riprap to a 4-foot width to protect concrete ramps. Docks must not be wider than 6 feet, and not include any treated wood.	USDI BLM 2008, Appendix I – Water, REC 6, p. 301.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
Public Motorized Travel Trails			
REC 06	Locate new public motorized travel trails on stable locations (e.g., ridge tops, benches, and gentle-to-moderate side slopes). Minimize trail construction on steep slopes where runoff could channel to a waterbody.	USDA FS 2012, pp. 91–92.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
REC 07	Design, construct, and maintain trail width, grades, curves, and switchbacks suitable to the terrain and designated use. Use and maintain surfacing materials suitable to the site and use, to withstand traffic and to minimize runoff and erosion.	USDA FS 2012, pp. 91–92	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 08	Suspend construction or maintenance of trails, where erosion and runoff into water bodies would occur.	USDI BLM 2008, Appendix I – Water, REC 11, p. 302.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 09	Locate staging areas outside Riparian Reserve. Design or upgrade staging areas to prevent sediment/pollutant delivery to wetlands, floodplains, and water bodies, (e.g., rocking or hardening, drainage through grading or shaping).	USDI BLM 2008, Appendix I – Water, REC 12, p. 302.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
REC 10	Designate class of vehicle suitable for the trail location, width, trail surfaces and waterbody crossings, to prevent erosion and potential sediment delivery.	USDA FS 2012, pp. 91–92.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
REC 11	Designate season of use if the trail bed is prone to erosion, rutting, gullying or compaction, due to high soil moisture, standing water or snowmelt.	USDA FS 2012, pp. 91–92.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
REC 12	Use existing road crossings of streams and floodplains on low-volume roads and partially decommissioned roads that tie with the trail system, where safety permits.	USDA FS 2012, pp. 91–92.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Toxic Substances OAR 340-041-0033
REC 13	Minimize low-water stream crossings for constructed or existing trails. Cross stream on stable substrate, e.g., bedrock, cobble, in areas of low streambanks. Block alternate stream-crossing routes where public motorized travel wheel slippage (acceleration/ braking) would tear down banks or deliver sediment.	USDI BLM 2008, Appendix I – Water, REC 7, p. 301.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Toxic Substances OAR 340-041-0033
REC 14	Avoid public motorized travel use in ponds and wetlands, and navigating up or down streams and side-channels. Use suitable barriers where feasible.	USDI BLM 2008, Appendix I – Water, REC 7, pp. 302–303	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Toxic Substances OAR 340-041-0033
REC 15	Design improved stream crossings (culverts and bridges) for the 100-year flood event. Stream crossings with listed fish must meet ARBO II (NMFS 2013 and USFWS 2013) fish passage design criteria (See Roads and Landings section for stream crossing BMPs).	USDI BLM 2008, Appendix I – Water, REC 10, p. 302.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Toxic Substances OAR 340-041-0033
REC 16	In public motorized travel bridge structures, avoid chemically treated materials at water level contact points where leachate or solids may enter waterbodies.	USDI BLM 2008, Appendix I – Water, REC 15, p. 302.	ODEQ–Water Pollution: Toxic Substances OAR 340-041-0033 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (10) Toxic Substances OAR 340-041-0033

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
REC 17	Use a temporary flow diversion bypass to minimize downstream turbidity, when constructing in perennial stream crossings (See Roads and Landings section for Stream Crossing BMPs).	USDI BLM 2008, Appendix I – Water, REC 16, p. 302.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
REC 18	When constructing or maintaining trails within Riparian Reserve, do not cut the portion of logs or down woody material that extend into the active stream channel. Provide for adequate stabilization of the logs if not doing so would create a safety hazard.	USDI BLM 2008, Appendix I – Water, REC 8, p. 302.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
REC 19	Harden trail approaches to stream crossings using materials such as geotextile fabric and rock aggregate.	USDI BLM 2008, Appendix I – Water, REC 13, p. 302.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 20	Hydrologically disconnect trails from waterbodies to the extent practicable. Install drainage features, e.g., drain dips, lead-off ditches, on approaches to stream crossings as needed to divert runoff and reinforce with rock for longevity.	USDI BLM 2008, Appendix I – Water, REC 14, p. 302. USDA FS 2012, pp. 91-92.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 21	Where trails intersect road ditches, provide erosion resistant crossings. Divert water from the trail to keep from reaching wetlands, floodplains, and water bodies.	USDI BLM 2008, Appendix I – Water, REC 18, p. 303.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 22	If trail width is too wide for the designated use (such as old roads converted to trails), consider tilling one side of the trail, covering with brush, and seeding or planting.	USDI BLM 2008, Appendix I – Water, REC 19, p. 303.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 23	Repair rills and gullies to keep sediment from reaching wetlands, floodplains, and water bodies.	USDI BLM 2008, Appendix I – Water, REC 20, p. 303.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 24	Construct and repair water bars, drain dips, and lead-off ditches as needed. These features may need rock reinforcement to promote longevity. Self-maintaining drain dips or lead-off features are the preferred design.	USDI BLM 2008, Appendix I – Water, REC 21, p. 303.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 25	Monitor trail condition to identify surface maintenance and drainage needs to prevent or minimize sediment delivery to waterbodies.	USDA FS 2012, pp. 91–92.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 26	Close and rehabilitate unauthorized trails, where needed, to protect sensitive areas and water quality.	USDA FS 2012, pp. 91–92.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Toxic Substances OAR 340-041-0033
Trails (Hiking)			

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
REC 27	When constructing or maintaining trails within Riparian Reserve, do not cut any portion of logs or coarse woody debris that extend into the active stream channel. Use alternative passage options, such as earthen ramps, small notch steps, or slight trail realignments, to facilitate maintenance of intact logs. Cut and stabilize if necessary for safe passage and safety.	USDI BLM 2008, Appendix I – Water, REC 23, p. 303.	ODEQ–Water Pollution: Antidegradation OAR 340-041-004(1) Biocriteria OAR 340-041-0011 Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Trail Closure			
REC 28	Remove existing stream crossings or bridges (See Road Decommissioning. BMPs).	USDI BLM 2008, Appendix I – Water, REC 24, p. 303.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (8) Turbidity OAR 340-041-0036
REC 29	Position fill or waste material in a location that would avoid direct or indirect sediment discharge to streams or wetlands.	USDI BLM 2008, Appendix I – Water, REC 25, p. 304.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 30	Plant restored stream banks with native vegetation, mulch, and then plant with water-tolerant species where appropriate.	USDI BLM 2008, Appendix I – Water, REC 26, p. 304.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
REC 31	Barricade and allow nearby vegetation to grow into closed trails.	USDI BLM 2008, Appendix I – Water, REC 27, p. 304.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
Dispersed Recreation			
REC 32	Site camps for permitted group overnight camping greater than 150 feet from surface water.	USDI BLM 2008, Appendix I – Water, REC 28, p. 304.	ODEQ–Water Pollution: Bacteria OAR 340-041-0009 Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (13)

Range Management

Table J-271. Best management practices for livestock grazing.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
G 01	Fence water developments, including springs and seeps, unless other methods are available. Pipe overflow away from the developed source area.	USDI BLM 2008, Appendix I – Water, G 1, p. 305.	ODEQ–Water Pollution: Antidegradation OAR 340-04l-0004 Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009 Biocriteria OAR 340-041-0011 Dissolved Oxygen OAR 340-041-0016 Temperature OAR 340-041-0028 Turbidity OAR 340-041-0036
G 02	Do not locate salting areas within 0.25 mile of permanent water sources or Riparian Reserve.	USDI BLM 2008, Appendix I – Water, G 2, p. 305.	ODEQ–Water Pollution: Antidegradation OAR 340-04l-0004 Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009 Biocriteria OAR 340-041-0011 Dissolved Oxygen OAR 340-041-0016 Temperature OAR 340-041-0028 Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
G 03	Locate new permanent livestock handling or management facilities (corrals, pens, or holding pastures) outside Riparian Reserve or 200 feet from water bodies and on level ground where drainage would not enter surface waters. Make changes as necessary to existing facilities within Riparian Reserve to meet water quality standards and regulations.	USDI BLM 2008, Appendix I – Water, G 3, p. 305.	ODEQ–Water Pollution: Antidegradation OAR 340-04l-0004 Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009 Biocriteria OAR 340-041-0011 Dissolved Oxygen OAR 340-041-0016 Temperature OAR 340-041-0028 Turbidity OAR 340-041-0036
G 04	Apply specific grazing strategies for riparian wetland areas, including timing, intensity, or exclusion for maintenance of proper functioning condition. Use one or more of the following features: – Include the water bodies, floodplains, and wetlands within a separate pasture. – Fence or herd livestock out of water bodies, floodplains, and wetlands for as long as necessary to allow vegetation to recover. – Control the timing and intensity of grazing to keep livestock off stream banks when they are most vulnerable to damage and to coincide with the physiological needs of target plant species. – Add more rest to the grazing cycle to increase plant vigor, allow stream banks to revegetate, or encourage more desirable plant species composition. – Limit grazing intensity to a level that will maintain desired species composition and vigor. – Permanently exclude livestock from those water bodies, floodplains, and wetlands areas that are at high risk and have poor recovery potential, and when there is no practical way to protect them while grazing adjacent uplands.	USDI BLM 2008, Appendix I – Water, G 4, p. 306.	ODEQ–Water Pollution: Antidegradation OAR 340-04l-0004 Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009 Biocriteria OAR 340-041-0011 Dissolved Oxygen OAR 340-041-0016 Temperature OAR 340-041-0028 Turbidity OAR 340-041-0036
G 05	Recover degraded water bodies through adjustments to forage utilization levels, improved livestock distribution, and management through fencing, vegetation treatments, water source developments, or changes in season of use or livestock numbers.	USDI BLM 2008, Appendix I – Water, G 5, p. 306.	ODEQ–Water Pollution: Antidegradation OAR 340-04l-0004 Statewide Narrative OAR 340-041-0007(1) Bacteria OAR 340-041-0009 Biocriteria OAR 340-041-0011 Dissolved Oxygen OAR 340-041-0016 Temperature OAR 340-041-0028 Turbidity OAR 340-041-0036

Minerals (Salable) Development

Table J-272. Best management practices for minerals (salable).

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Salable Minerals			
M 01	Locate stockpile sites on stable ground where the material would not move into water bodies, floodplains, and wetlands.	USDI BLM 2008, Appendix I – Water, M 18, p. 309.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
M 02	Locate, design, and construct salable mineral sites to control runoff and prevent or minimize sediment delivery to streams. Prevent overburden, solid wastes, drainage water or petroleum products from entering wetlands, Riparian Reserve, flood plains and waters of the State.	USDI BLM 2008, Appendix I – Water, M 18, p. 309. OAR 629-625-0500 1-5	OAR 629-625-0500-ODF, Rock Pits and Quarries ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
M 03	Locate, design, and maintain settling ponds to contain sediment discharges.	USDI BLM 2008, Appendix I – Water, M 1, p. 309.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
M 04	When a quarry or rock pit is depleted or vacated, stabilize cutbanks, headwalls, and other surfaces to prevent surface erosion and landslides. Close roads, excavations, and crusher pads in accordance with Roads and Landings section. Remove all potential pollutants to prevent their entry into wetlands, Riparian Reserve, floodplains, and waters of the State.	OAR 629-625-0500 ODEQ 2005 NS - 6	OAR 629-625-0500-ODF, Rock Pits and Quarries ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036
M 05	Use erosion-reduction practices, such as seeding, mulching, silt fences, and woody debris placement, to limit erosion and transport of sediment to streams from quarries. Provide drainage from stockpiles and mineral sites, dispersed over stable vegetated areas rather than directly into stream channels. Grade all material sites, where practicable to conform with the surrounding topography prior to closure. Utilized topsoil as a medium to for successful revegetation. Reseed and plant trees, where needed.	USDI BLM 2008, Appendix I – Water, M 22, p. 309.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Turbidity OAR 340-041-0036

Spill Prevention and Abatement

Table J-273. Best management practices for spill prevention and abatement.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Operations Near Water Bodies			
SP 01	Take precautions to prevent leaks or spills of petroleum products (e.g., fuel, motor oil, and hydraulic fluid) from entering the waters of the State.	[40 CFR 112] OAR 629-620-0100(2)	[40 CFR 112] – Oil Pollution Prevention. Reportable quantity is a visible sheen where waterways are involved. OAR 629-620-0100-ODF, Chemical and Other Petroleum Product Rules ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) and (13) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
SP 02	Take immediate action to stop and contain leaks or spills of chemicals and other petroleum products. Notify the Oregon Emergency Response System, through the District Hazard Materials specialist, of any spill that enters the waters of the State.	[40 CFR 112] OAR 629-620-0100(3), (4)	[40 CFR 112] – Oil Pollution Prevention. Reportable quantity is a visible sheen where waterways are involved. OAR 629-620-0100-ODF, Chemical and Other Petroleum Product Rules ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) and (13) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
SP 03	Inspect and clean heavy equipment as necessary prior to moving on to the project site, in order to remove oil and grease, noxious weeds, and excessive soil. Inspect hydraulic fluid and fuel lines on heavy-mechanized equipment for proper working condition. Where possible, maintain and refuel heavy equipment a minimum of 150 feet away from streams and other water bodies. Refuel small equipment (e.g. chainsaws and water pumps) at least 100 feet from water bodies (or as far as possible from the water body where local site conditions do not allow a 100-foot setback) to prevent direct delivery of contaminants into a water body. Refuel small equipment from no more than 5-gallon containers. Use absorbent material or a containment system to prevent spills when re-fueling small equipment within the stream margins or near the edge of water bodies. In the event of a spill or release, take all reasonable and safe actions to contain the material. Specific actions are dependent on the nature of the material spilled. Use spill containment booms or as required by ODEQ. Have access to booms and other absorbent containment materials. Immediately remove waste or spilled hazardous materials (including but not limited to diesel, oil, hydraulic fluid) and contaminated soils near any stream or other water body, and dispose of it/them in accordance with the applicable regulatory standard. Notify Oregon Emergency Response System of any spill over the material reportable quantities, and any spill not totally cleaned up after 24 hours. Store equipment containing reportable quantities of toxic fluids outside of Riparian Reserve.	USDI BLM 2008, Appendix I – Water, SP 1, p. 311.	[40 CFR 112] – Oil Pollution Prevention. Reportable quantity is forty-two U.S. Gallons not involving waterways, a visible sheen where waterways are involved. ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) and (13) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
SP 04	If more than 42 gallons of fuel or combined quantity of petroleum product and chemical substances would be transported to a project site as project materials, implement the following precautions: 1. Plan a safe route and material transfer sites so that all spilled material will be contained easily at that designated location. 2. Plan an active dispatch system that can relay the information to appropriate resources. 3. Ensure a spill containment kit that can absorb and contain 55 gallons of petroleum product and chemical substances is readily available. 4. Provide for immediate notification to OERS in the event of a spill. Have a radio-equipped vehicle lead the chemical or fuel truck to the project site. 5. Assemble a spill notification list that includes the district hazardous materials coordinator, ODEQ, and spill clean-up contractors. 6. Construct a downstream water user contact list with addresses and phone numbers. 7. When operating within source water watersheds, pre-estimate water flow travel times through the watershed to predict downstream arrival times. 8. Be prepared to sample water and carry sample containers. 9. Be prepared to assist OSP and ODFW to assess wildlife impacts of any material spilled.	USDI BLM 2008, Appendix I – Water, SP 2, p. 312.	[40 CFR 112] – Oil Pollution Prevention. Reportable quantity is forty-two U.S. Gallons not involving waterways, a visible sheen where waterways are involved. ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) and (13) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
Spill Abatement			
SP 05	Spill Prevention, Control, and Countermeasure Plan (SPCC): All operators shall develop a modified SPCC plan prior to initiating project work if there is a potential risk of chemical or petroleum spills near water bodies. The SPCC plan will include the appropriate containers and design of the material transfer locations. No interim fuel depot or storage location other than a manned transport vehicle would be used.	USDI BLM 2008, Appendix I – Water, SP 3, p. 312.	[40 CFR 112] – Oil Pollution Prevention. Reportable quantity is forty-two U.S. Gallons not involving waterways, a visible sheen where waterways are involved. OAR-340-142-0030-DEQ, Oil and Hazardous Materials Emergency Response Requirements
SP 06	Spill Containment Kit (SCK): All operators shall have a SCK as described in the SPCC plan on-site during any operation with potential for run-off to adjacent water bodies. The SCK will be appropriate in size and type for the oil or hazardous material carried by the operator.	USDI BLM 2008, Appendix I – Water, SP 4, p. 313.	OAR-340-142-0030-DEQ, Oil and Hazardous Materials Emergency Response Requirements

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
SP 07	Operators shall be responsible for the clean-up, removal, and proper disposal of contaminated materials from the site.	USDI BLM 2008, Appendix I – Water, SP 5, p. 313.	OAR-340-102-DEQ, Standards Applicable to Generators of Hazardous Waste OAR-340-122-DEQ, Hazardous Substance Remedial Action Rules

Restoration Activities

Table J-274. Best management practices for restoration activities.

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
RST 01	Confine work in the stream channels to the ODFW in-water work period unless a waiver is obtained from ODFW, NOAA, and permitting agencies.	USDI BLM 2008, Appendix I – Water, RST 1, p. 314.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
RST 02	In stream channels that are sensitive to disturbance (e.g., meadow streams), do not drive heavy equipment in flowing channels and floodplains.	USDI BLM 2008, Appendix I – Water, RST 2, p. 314.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
RST 03	In well-armored channels that are resistant to damage (e.g., bedrock, small boulder, or cobble-dominated), consider conducting the majority of heavy-equipment work from within the channel, during low streamflow, to minimize damage to sensitive riparian areas.	USDI BLM 2008, Appendix I – Water, RST 3, p. 314.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
RST 04	Design access routes for individual work sites to reduce exposure of bare soil and extensive stream bank shaping.	USDI BLM 2008, Appendix I – Water, RST 4, p. 314.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
RST 05	Limit the number and length of equipment access points through Riparian Reserve.	USDI BLM 2008, Appendix I – Water, RST 5, p. 314.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
RST 06	Limit the amount of stream bank excavation to the minimum necessary to ensure stability of enhancement structures. Provide isolation from flowing water during excavation. Place excavated material above the flood-prone area and cover or place a berm to avoid its reentry into the stream during high-flow events.	USDI BLM 2008, Appendix I – Water, RST 6, p. 314.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036 Temperature OAR 340-041-0028
RST 07	Inspect all mechanized equipment daily for leaks and clean as necessary to ensure that toxic materials, such as fuel and hydraulic fluid, do not enter the stream.	USDI BLM 2008, Appendix I – Water, RST 7, p. 314.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
RST 08	Locate equipment storage areas at least 100 feet from any water feature, including machinery used in stream channels for more than one day.	USDI BLM 2008, Appendix I – Water, RST 8, p. 315.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
RST 09	When using heavy equipment in or adjacent to stream channels during restoration activities, develop and implement an approved spill containment plan that includes having a spill containment kit on-site and at previously identified containment locations.	USDI BLM 2008, Appendix I – Water, RST 9, p. 315.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
RST 10	Refuel equipment, including chainsaws and other hand power tools, at least 100 feet from water bodies (or as far as possible from the water body where local site conditions do not allow a 100-foot setback) to prevent direct delivery of contaminants into a water body.	USDI BLM 2008, Appendix I – Water, RST 10, p. 315.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (12) Biocriteria OAR 340-041-0011 Toxic Substances OAR 340-041-0033
RST 11	Use waterbars, barricades, seeding, and mulching to stabilize bare soil areas along project access routes prior to the wet season.	USDI BLM 2008, Appendix I – Water, RST 11, p. 315.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
RST 12	Prior to the wet season, stabilize disturbed areas where soil will support seed growth, with the potential for sediment delivery to wetlands, and waters of the State. Apply native seed and certified weed-free mulch or erosion control matting in steep or highly erosive areas. If needed to promote a rapid ground cover and prevent aggressive invasive plants, use interim erosion control non-native sterile annuals before attempting to restore native seed or plants.	USDI BLM 2008, Appendix I – Water, RST 12, p. 315.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
RST 13	When replacing culverts design placement location, crossing type, and installation depth to avoid excessive scour through the site, consider using larger culverts and embedding the culvert to 30% bedload. Use bridges on high-gradient stream channels.	USDI BLM 2008, Appendix I – Water, RST 13, p. 315.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036
RST 14	Rehabilitate headcuts and gullies. Use large wood in preference to rock weirs.	USDI BLM 2008, Appendix I – Water, RST 14, p. 315.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
RST 15	Implement measures to control turbidity. Measures may include installation of turbidity control structures (e.g., isolation, diversion, or silt curtains) immediately downstream of in-stream restoration work areas. Remove these structures following completion of turbidity-generating activities.	USDI BLM 2008, Appendix I – Water, RST 15, p. 315.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1) Biocriteria OAR 340-041-0011 Turbidity OAR 340-041-0036

Dry Forest-specific BMPs

Soils of concern in the dry forest area include those with a high potential for severe surface erosion, soil creep, periodic slumping (even when not overly saturated), and low nutrient potential. These soils weathered from granite, schist, and pyroclastic materials. They are predominately located in the Medford District, but are also found in the southern end of the Roseburg District and in the Klamath Falls Field Office. On the Medford District, concentrations of these vulnerable soils occur in Evans, Snow, Sugar, and Meadow Creeks, upper portions of Williams Creek and headwaters of Birdseye Creek. These soils are mapped as fragile soils within the decision area. Limiting disturbance, particularly from ground-based operations, is key to keeping these soils in place.

The Timber Production Capability Classification (TPCC) and Handbook (5251-1, USDI BLM 1986) involves mapping, with discrete mapping units and interpretations of timbered lands. The classification uses geology, landform, topographic position, climate (especially precipitation), soil properties, and vegetation. Lands with the capacity to erode excessively or prone to movement are denoted with either a fragile code of FM (surface erosion potential) or FP (mass movement potential). Sites could have varying severity of either of these conditions. The BLM will scale management activities and restrictions to reflect the differences in erosion or mass movement potential.

Table J-275. Timber Production Capability Classification soil categories of concern.

Category	Description of Soil Categories
Surface Erosion FM	These sites have soil surface horizons that are highly erodible, easily detached and subject to bouncing or sliding downhill (dry ravel), even if partially vegetated. The soils overlay intrusive volcanic bedrock (e.g., granite, diorite, or schist). The Natural Resources Conservation Service (NRCS) provides a Revised Universal Soil Loss Equation soil loss tolerance factor, known as T factor, which ranges from a low of 1 (on shallow soils, 1–10 inches depth), to 5 (on soils deeper than 60 inches). This factor describes the maximum rate of annual soil loss in tons/acre that can be lost and still permit crop productivity to sustain economically and indefinitely. Disturbances from harvesting or burning create increased dry raveling of soil, losses of soil nutrients, and burying of newly planted seedlings. Classification coding may be FMR for suitable lands or FMNW for non-suitable lands.
Mass Movement FP	These sites range from gentle to moderately steep slopes, 10–60 percent, where the rate of sliding is slow enough to permit forest management, but with some loss in wood quality in certain areas. Sites may have an impervious clay pan overlaying pyroclastic bedrock (e.g., volcanic tuffs, breccia, and are subject to movement). Tree roots providing strength and certain landforms act as resisting forces, while gravity and soil moisture may initiate non-uniform spatial and temporal rates of movement. Slow deep seated, slump or earth flow types of mass movements may occur, forming an undulating topography. Classification coding may be FPR for suitable lands or FPNW for non-suitable lands.

Table J-276. Best management practices specific to the dry forest (refer to **Table J-275** for category type).

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Roads and Landings: General Construction, Maintenance **Timber Harvest: Cable Yarding**			
DF 01	Use full log suspension whenever possible on TPCC soils identified as prone to surface erosion, category FM in **Table J-275**. Use one-end suspension on these soils if full suspension is not practicable. Restrict yarding to the dry season, generally from June to end of September. Suspend the leading end over TPCC soils identified as prone to mass movement, category FP in **Table J-275**. Restrict yarding to the dry season.	USDI BLM 2008, Appendix I – Water, MFO 1, p. 317.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Timber Harvest: Ground-based			
DF 02	Limit ground-based yarding equipment to slopes less than 20% on TPCC soils identified as category FM or FP in **Table J-275**, where soils average less than or equal to 20% clay in the top 6 inches of soil as determined by NRCS soil survey data. Otherwise, limit ground-based yarding equipment to slopes less than 35%, on TPCC soils identified as category FM or FP in **Table J-275**where soils average greater than 20% clay in the top 6 inches. Avoid tilling on TPCC soils identified as category FM (when moisture is excessive) or FP in **Table J-275**, unless adequate ground cover is present to arrest potential sediment transport.	USDI BLM 2008, Appendix I – Water, MFO 2, p. 317.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
Fire and Fuels Management			
DF 03	Avoid mechanical piling to limit severe surface disturbance and displacement on TPCC soils identified as category FM or FP in **Table J-275**	USDI BLM 2008, Appendix I – Water, MFO 3, p. 318.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036
DF 04	Implement prescribed burning on FG and FM soils when fuel moisture contents result in 'cool burns.' Post-burn surface soil characteristics may include: litter that is consumed and duff that is deeply charred or consumed, organic matter that is partially charred to a depth >1.0 cm, but mineral soil is not visibly altered.	USDA Forest Service Gen. Tech. Rep. RMRS-GTR-42-vol. 4. 2005 Table 1.4 Part B	None
Wildfire: Suppression			
DF 05	Limit the use of track-driven heavy machinery and other major surface-disturbing activities to slopes equal to 20% or less on TPCC soils identified as category FM or FP in**Table J-275**.	USDI BLM 2008, Appendix I – Water, MFO 5, p. 318.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

BMP Number	Best Management Practices	Source	Water Quality Standards and Regulations
Rights-of-Way			
DF 06	Avoid facility construction on soils identified on TPCC soils identified as the FM category in **Table J-275**, unless water quality would be maintained. Locate rights-of-ways to minimize surface disturbance on TPCC soils identified as category FM or FP in **Table J-275.**	USDI BLM 2008, Appendix I – Water, MFO 6, p. 318.	ODEQ–Water Pollution: Antidegradation OAR 340-041-0004(1) Statewide Narrative OAR 340-041-0007(1), (7) Turbidity OAR 340-041-0036

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